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TFT | CHARACTER | UWVD | FSC | SEGMENT | CUSTOM | REPLACEMENT

TFT Display Module

Part Number

E35RB-FW115-N

Overview:

- 3.5-inch TFT: 480x640 (64x85)
- 3 SPI+16/18- bit RGB
- White LED back-light
- Transflective/ Normally Black
- No Touch Panel
- 115 NITS
- Controller: HX8363-A
- RoHS Compliant

Description

This is a color active matrix TFT (Thin Film Transistor) LCD (Liquid Crystal Display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transflective type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 3.5" TFT-LCD contains 480x640 pixels, and can display up to 65K/262K colors.

Features

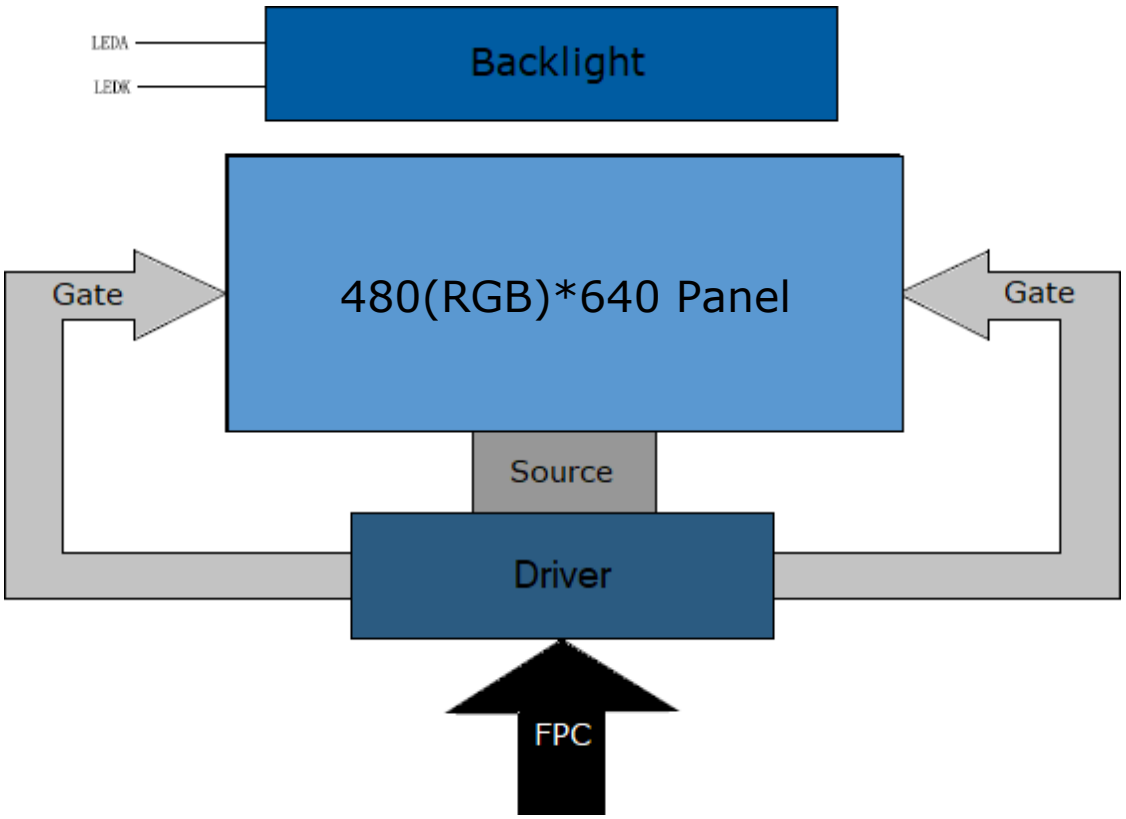
Low Input Voltage: 3.3V (TYP)
Display Colors of TFT LCD: 65K/262K colors
TFT Interface: 3 SPI+16/18Bit RGB

General Information Items	Specification Main Panel	Unit	Note
Display area (AA)	53.57(H) *71.42(V) (3.5 inch)	mm	-
Driver element	TFT active matrix	-	-
Display colors	65K/262K	colors	-
Number of pixels	480(RGB)*640	dots	-
TFT Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.135(H) x 0.135 (V)	mm	-
Viewing angle	Wide angle	o'clock	-
TFT Controller IC	HX8363-A	-	-
Display mode	Transflective/Normally Black	-	-
Operating temperature	-20～+70	℃	-
Storage temperature	-30～+80	℃	-

Mechanical Information

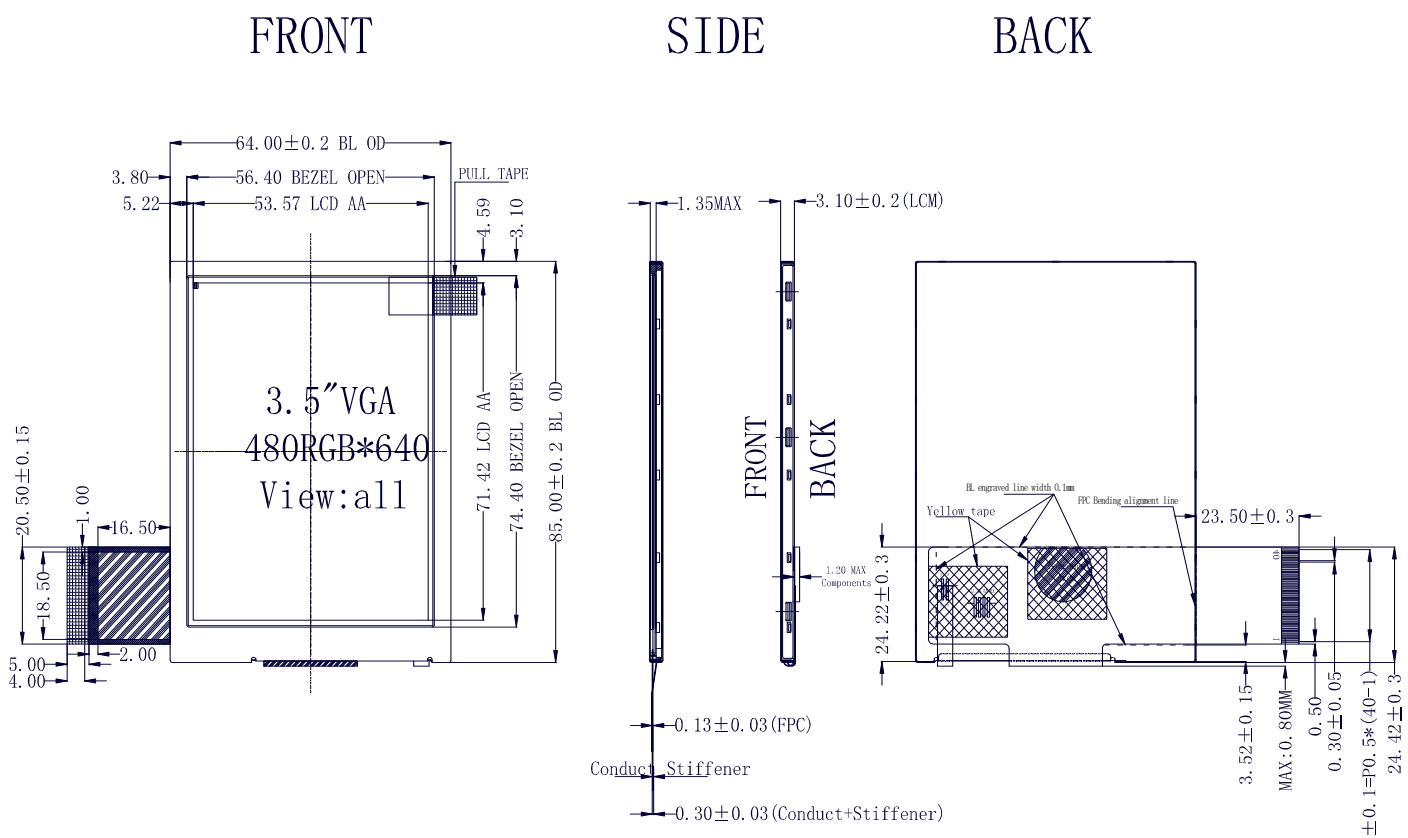
Item		Min	Typ.	Max	Unit	Note
Module size	Horizontal(H)		64.0		mm	-
	Vertical(V)		85.0		mm	-
	Depth(D)		3.10		mm	-
Weight			34		g	-

1. Block Diagram



2. Outline dimensions

ReV.	Revision content description	Date
A	FIRST	2017.10.31
B	modified BL pad adhesive tape	2018.01.19



Pin	Name	Pin	Name
1	DE	21	B3
2	GND	22	B4
3	GND	23	B5
4	GND	24	SCL
5	NC	25	SDA
6	R0	26	/CS
7	R1	27	DOTCLK
8	R2	28	/RESET
9	R3	29	HSYNC
10	R4	30	VSYNC
11	R5	31	VCC
12	G0	32	IOVCC
13	G1	33	GND
14	G2	34	LED_A
15	G3	35	LED_K
16	G4	36	GND
17	G5	37	XR
18	B0	38	YD
19	B1	39	XL
20	B2	40	YU

NOTES:

1. DISPLAY TYPE: 3.5", TFT-LCD, AIFF TRANSFLECTIVE
2. DISPLAY MODE: NORMALLY BLACK
3. VIEWING DIRECTION: WIDE VIEWING
4. DRIVER IC: HX8363-A (COG)
5. INTERFACE: 16/18BIT-RGB
6. VCC 3.3V(TYP), IOVCC=1.65-3.3V
7. OPERATING TEMP: -20° C TO 70° C
   STORAGE TEMP: -30° C TO 80° C
8. BACK LIGHT: LED WHITE, 6 LED, 20mA, 18.6±0.3V
9. RoHS COMPLIANT.

B/L Circuit

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TOLERANCE( )	DRAWING NAME	E35RB-FW115-N	
	PARTS NO.		
TOLERANCE UNLESS OTHERWISE SPECIFIED X.X±0.3 X.XX±0.2	Drawn		Unit
	Checked		mm
Scale 1:1	Approve		Page 1/1

3. Input Terminal Pin Assignment

Recommended Connector: FH19C-40S-0.5SH(10)

NO.	Symbol	Description	I/O
1	DE	Data enable signal in RGB I/F mode. Fixed to GND in MPU interface mode.	I
2	GND	Ground	P
3	GND	Ground	P
4	GND	Ground	P
5	NC		
6-11	R0-R5	Red data bus	I/O
12-17	G0-G5	Green data bus	I/O
18-23	B0-B5	Blue data bus	I/O
24	SCL	Serves as a write signal and writes data at the rising edge. When operate in serial interface, it serves as SCL (Serial Clock). If not used, let it open or connected to VCC	I
25	SDA	Serial data input pin in serial interface operation	I
26	CS	Chip select input pin (“Low” enable). Fix this pin at VCI or GND when not in use.	I
27	DOTCLK	Dot clock signal. Must be connected to GND or VCC if not used.	I
28	RESET	Reset pin. Setting either pin low initializes the LSI. Must be reset after power is supplied (Must be connected to GND or VCC). (Latch type)	I
29	HSYNC	Line synchronizing signal. Must be connected to GND or VCC if not used.	I
30	VSYNC	Frame synchronizing signal. Must be connected to GND or VCC if not used.	I
31	VCC	Supply voltage (3.3V)	I
32	IOVCC	A power supply for the I/O circuit. (1.65-3.3V)	I
33	GND	Ground	O
34	LED_A	Anode pin of backlight	P
35	LED_K	Cathode pin of backlight	P
36	GND	Ground	P
37	XR	Touch panel right glass terminal	A/D
38	YD	Touch panel bottom film terminal	A/D
39	XL	Touch panel left glass terminal	A/D
40	YU	Touch panel top film terminal	A/D

4. LCD Optical Characteristics

4.1 Optical Specifications

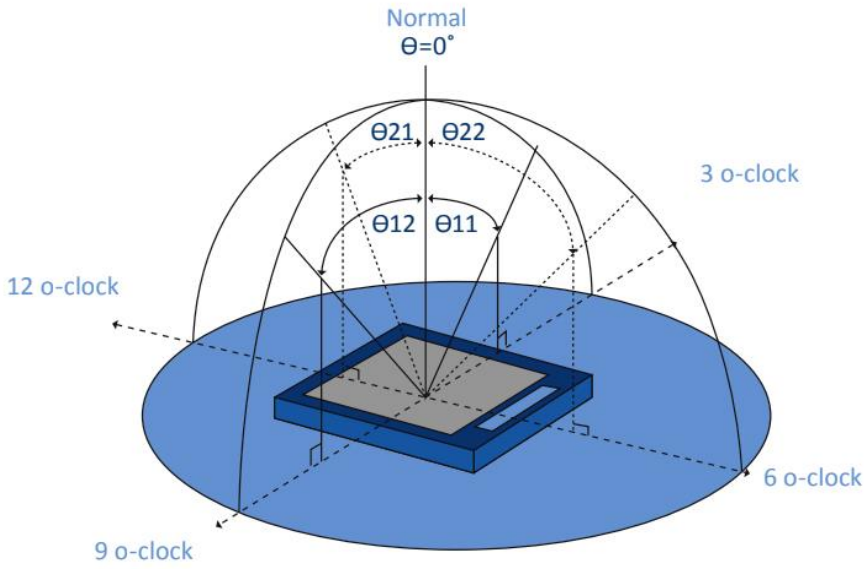
Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	Θ=0 Normal viewing angle	200	300	--		(2)
Reflection Ratio (with polarizer)		R		--	7	--	%	(3)
Response time	Rising+ Falling	TR+TF		--	30	50	msec	(4)
Color gamut		S (%)		--	60	--	%	(5)
Color Filter Chromaticity	White	W_X		0.248	0.288	0.328		(5)(6)
		W_Y		0.272	0.312	0.352		
	Red	R_X		0.425	0.465	0.505		
		R_Y		0.286	0.326	0.366		
	Green	G_X		0.277	0.317	0.357		
		G_Y		0.485	0.498	0.538		
	Blue	B_X		0.135	0.175	0.215		
		B_Y		0.075	0.115	0.115		
Viewing angle	Hor.	ΘL	CR>10	60	80	--		(1)
		ΘR		60	80	--		
	Ver.	ΘU		60	80	--		
		ΘD		60	80	--		
Option View Direction		ALL						

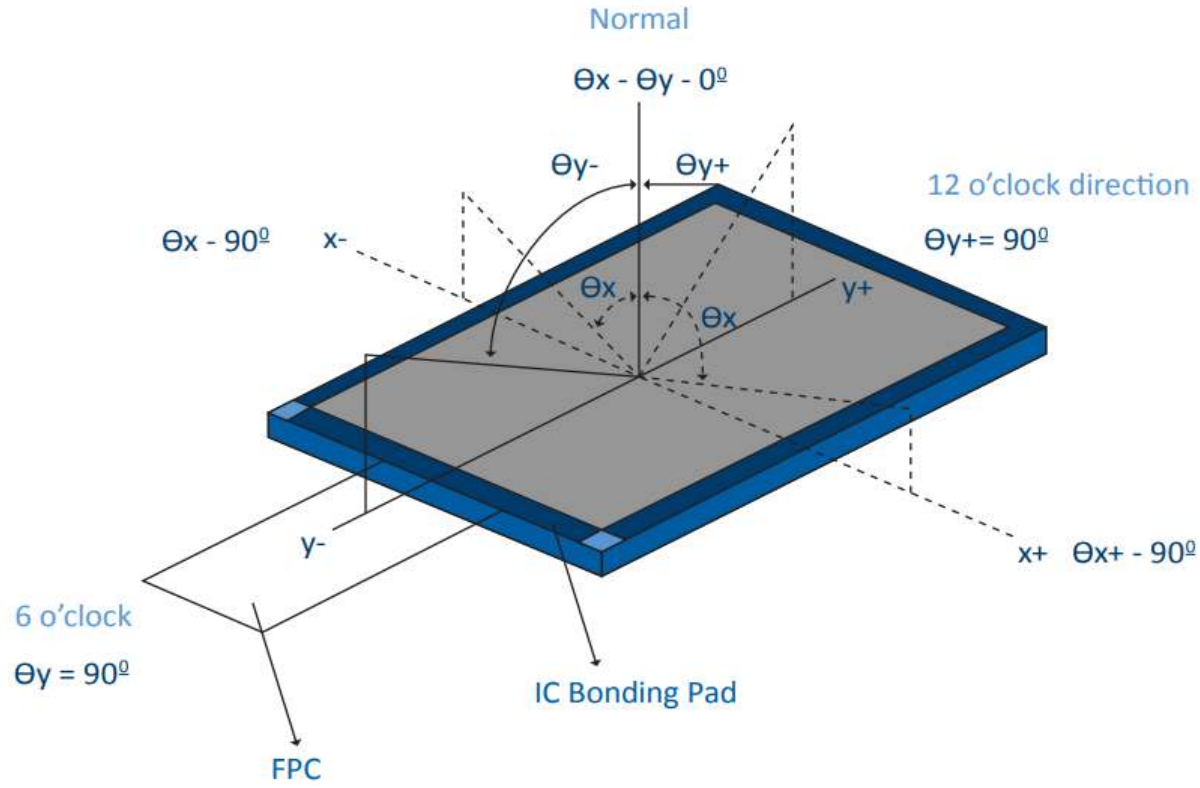
4.2 Measuring Conditions

Measuring surrounding: dark room
Ambient temperature: 25 ± 2℃
15min. warm-up time

Optical Specification Reference Notes:

(1) Definition of Viewing Angle: The viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3,9 o'clock direction and the vertical or 6,12 o'clock direction with respect to the optical axis which is normal to the LCD surface.





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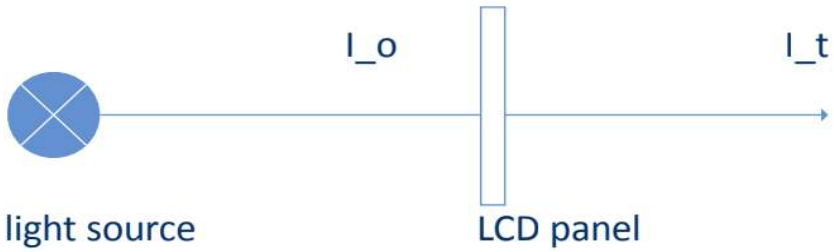
(2) Definition of Contrast Ratio (Cr): measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

$$Cr = \frac{Lw}{Ld}$$

(3) Definition of transmittance (T%): The transmittance of the panel including the polarizers is measured with electrical driving.

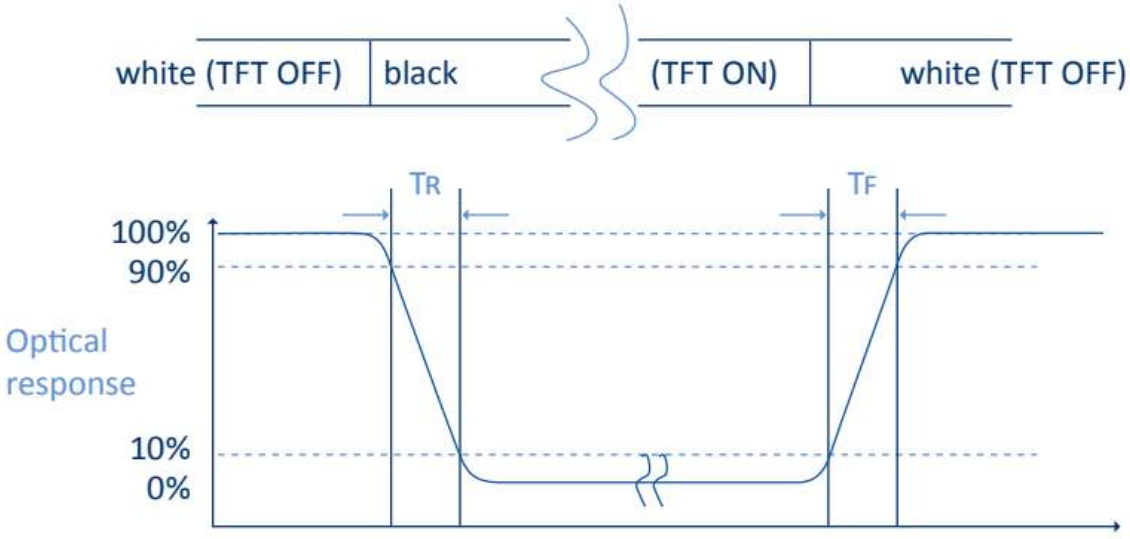


The transmittance is defined as:

$$Tr = \frac{It}{Io}\ x\ 100\%$$

Io = the brightness of the light source.
It = the brightness after panel transmission

(4) Definition of Response Time (Tr, Tf): The rise time 'Tr' is defined as the time for luminance to change from 90% to 10% as a result of a change of the electrical condition. The fall time 'Tf' is defined as the time for luminance to change from 10% to 90% as a result of a change of the electrical condition.



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(5) Definition of Color Gamut: Measuring machine CFT-01. NTSC's Primaries: R(x,y,Y),G(x,y,Y), B(x,y,Y). FPM520 of Westar Display Technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

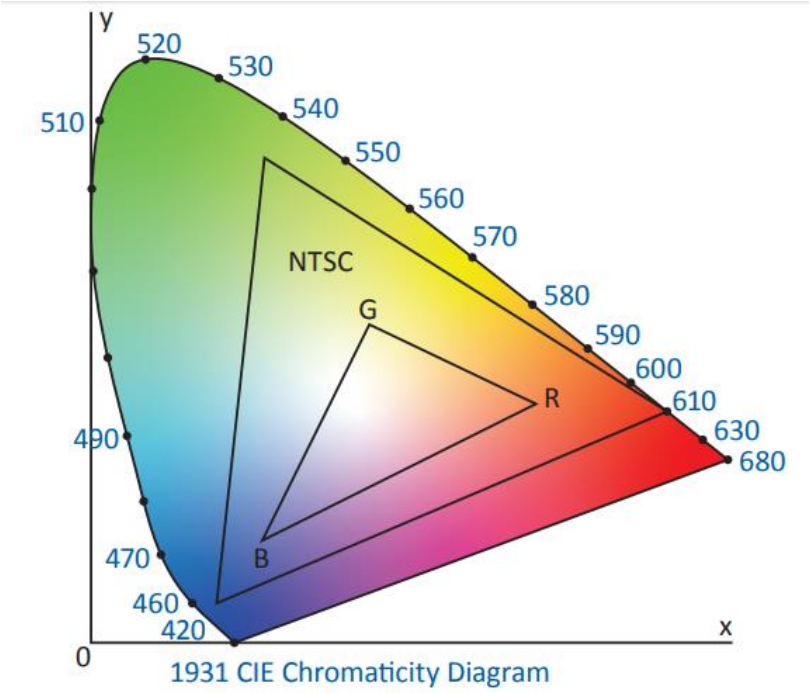
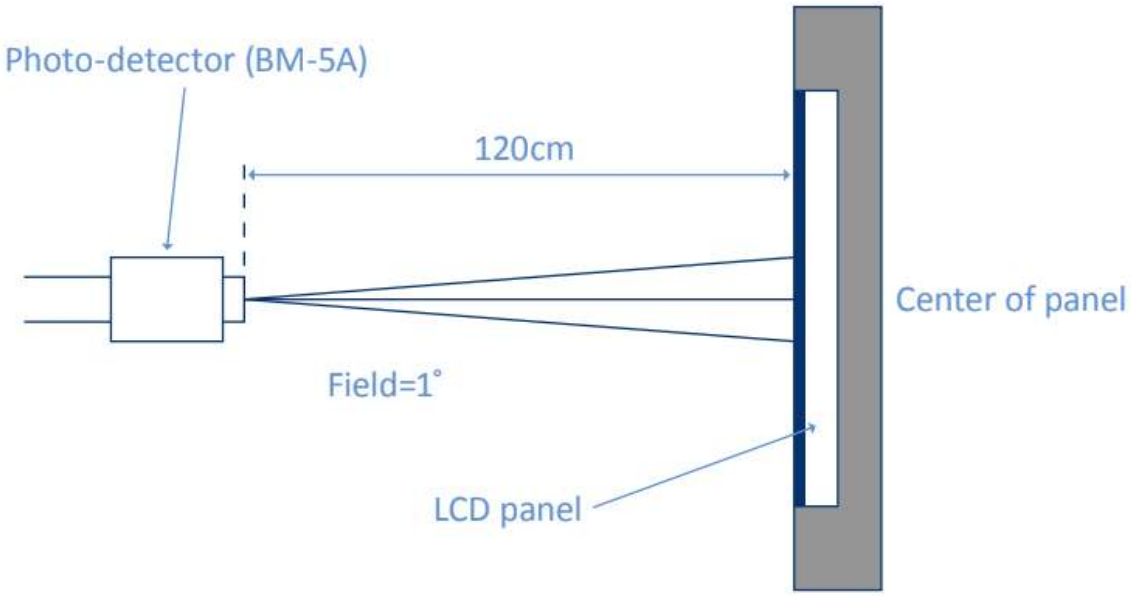


Fig. 1931 CIE chromacity diagram

$$\text{Color gamut: } S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$$

(6) Definition of Optical Measurement Setup:



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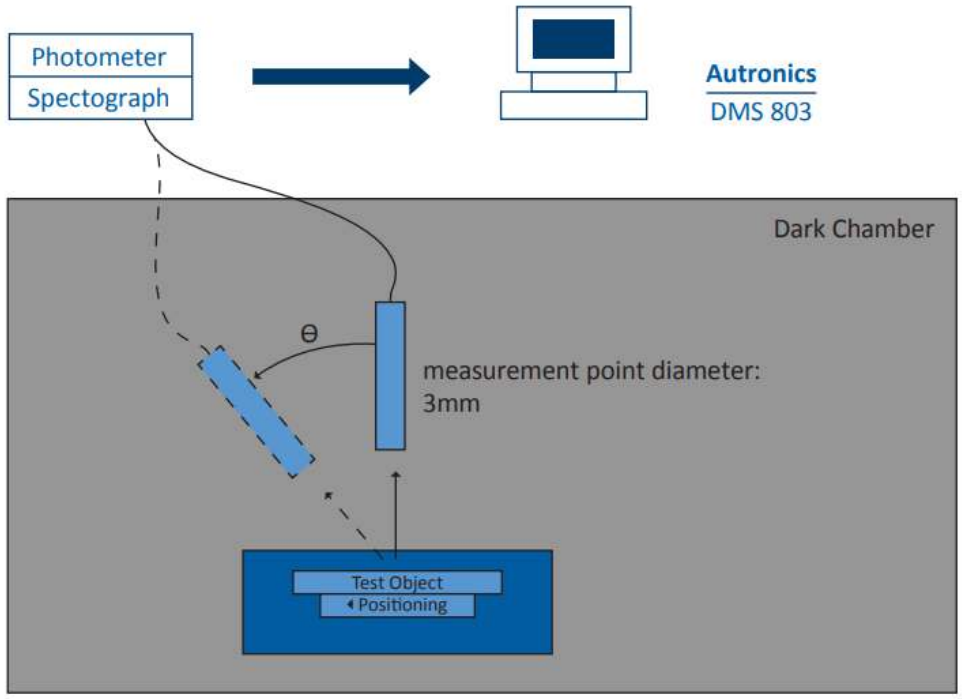
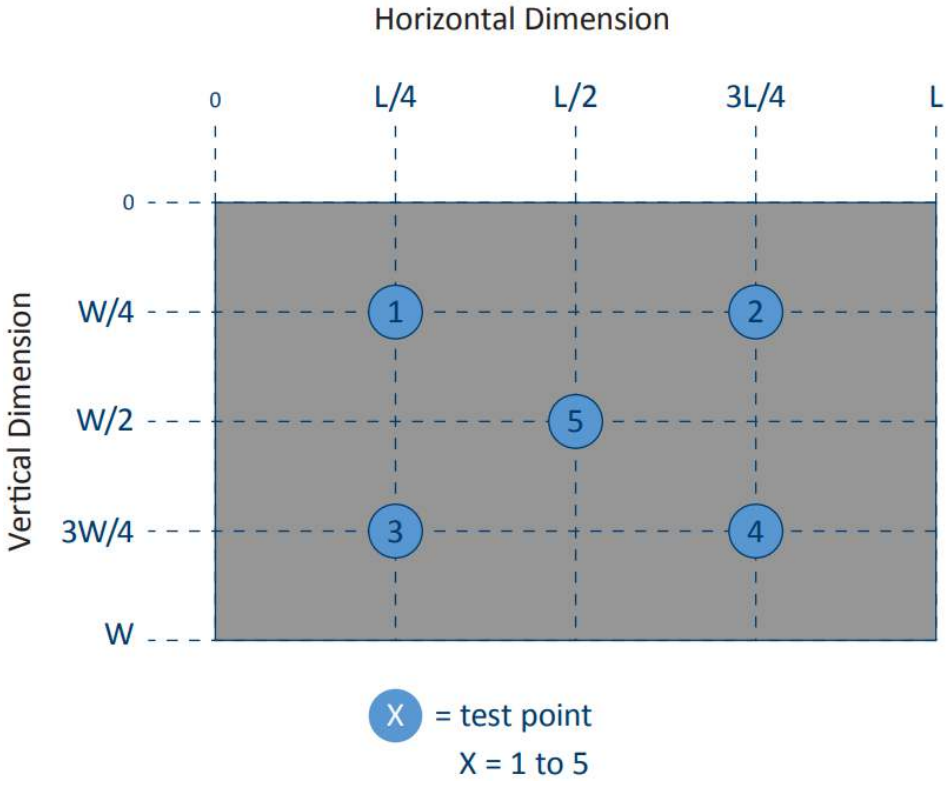
(6) Optical Measurement Setup Continued:
The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 20 minutes.





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5. Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min	Max	Unit
Digital Supply Voltage	VCI	-0.3	4.6	V
Interface Operation Voltage	IOVCC	-0.3	4.6	V
Operating temperature	TOP	-20	+70	℃
Storage temperature	TST	-30	+80	℃

NOTE: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VCI	2.5	3.3	3.6	V	
Interface Operation Voltage	IOVCC	1.65	1.8	3.3	V	
Normal Mode Current Consumption	IVCC+IIOVCC	--	20	40	mA	
Level input voltage	VIH	0.7 IOVCC		IOVCC	V	
	VIL	GND		0.3 IOVCC	V	
Level output voltage	VOH	0.8 IOVCC		IOVCC	V	
	VOL	GND		0.2 IOVCC	V	

5.3 LED Backlight Characteristics

Item	Symbol	Min	Typ.	Max	Unit	Note
Forward Current	IF	15	20	--	mA	
Forward Voltage	VF	--	18.6	--	V	
LCM Luminance	LV	65	115	--	cd/m2	Note 3
LED lifetime	Hr	50000	--	--	hour	Note1 & 2
Uniformity	AVg	80	--	--	%	Note 3

The back-light system is edge-lighting type with 6 chips White LED

Note 1: LED lifetime (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25 ±3 ℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note 2: The “LED lifetime” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=20mA. The LED lifetime could be decreased if operating IL is larger than 20mA. The constant current driving method is suggested.

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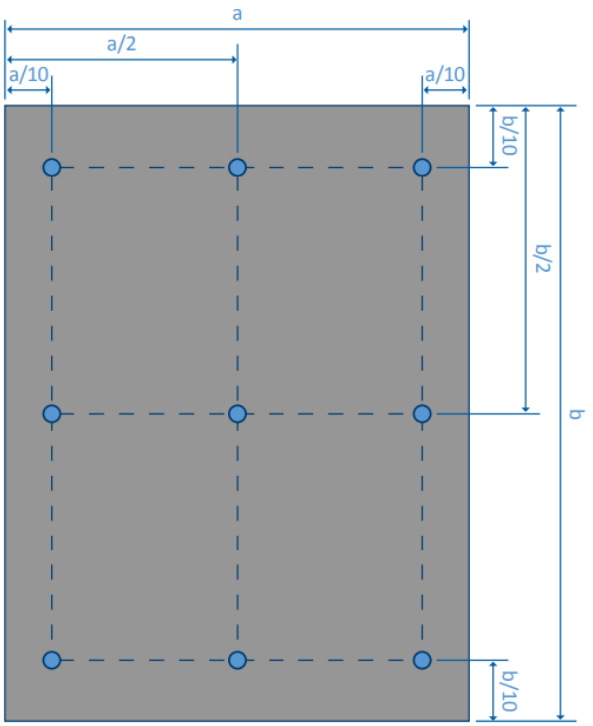
Note 3: Luminance Uniformity of these 9 points is defined as below:



$$\text{Luminance} = \frac{\text{(Total Luminance of 9 points)}}{9}$$

$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points(1-9)}}{\text{maximum luminance in 9 points(1-9)}}$$

6. AC Characteristic

6.1 RGB Interface Characteristics

Vertical Timings for RGB I/F

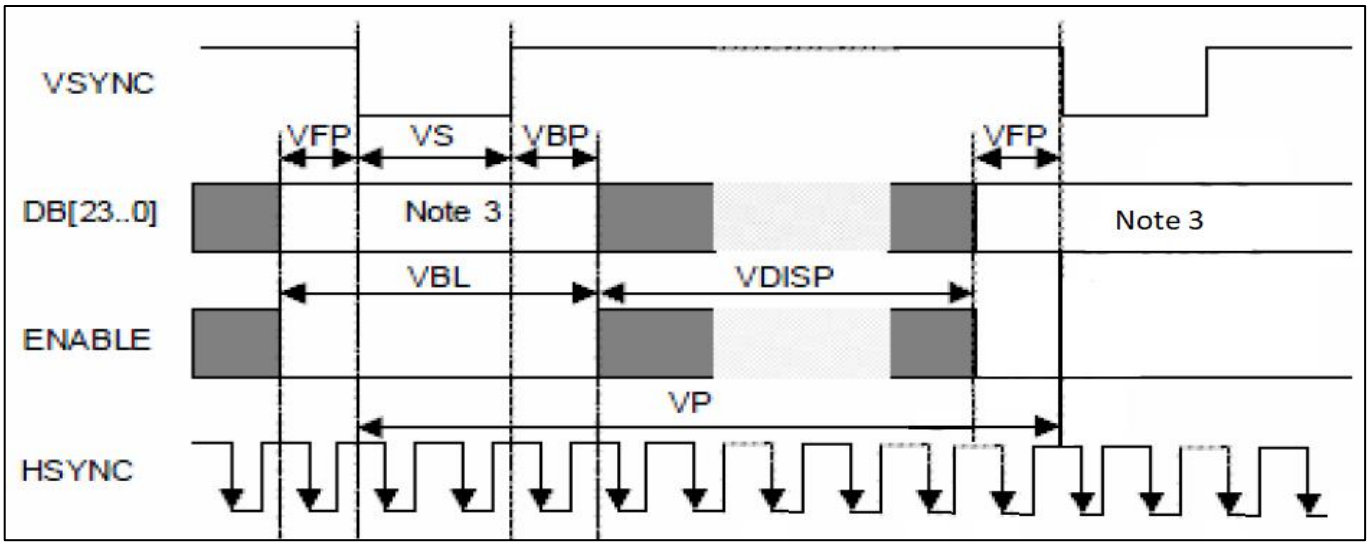


Figure 6.2: RGB Interface Vertical Timing Diagram

Resolution=480x854, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, TA= -30 to 70°C

Item	Symbol	Condition	Min	Typ.	Max	Unit
Vertical cycle	VP	--	860	--	864	Line
Vertical low pulse width	VS	--	2	--	4	Line
Vertical front porch	VFP	--	2	--	4	Line
Vertical back porch	VBP	--	2	--	4	Line
Vertical data start point	-	VS+VBP	4	--	8	Line
Vertical blanking period	VBL	VS+VBP+VFP	6	--	10	Line
Vertical active area	-	VDISP	--	854	--	Line
Vertical refresh rate	VRR	--	50	--	70	Hz

Table 6.3: RGB Interface Vertical Timing Characteristics (Resolution 480x854)

Note:

(1) Signal rise and fall times are equal to or less than 20ns.
(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.
(3) Data lines can be set to “high” or “low” during blanking time.
(4) VRR must keep from 50Hz to 70Hz when adjusting other items.

Resolution=480x800, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, TA= -30 to 70°C

Item	Symbol	Condition	Min	Typ.	Max	Unit
Vertical cycle	VP	--	806	--	810	Line
Vertical low pulse width	VS	--	2	--	4	Line
Vertical front porch	VFP	--	2	--	4	Line
Vertical back porch	VBP	--	2	--	4	Line
Vertical data start point	-	VS+VBP	4	--	8	Line
Vertical blanking period	VBL	VS+VBP+VFP	6	--	10	Line
Vertical active area	-	VDISP	--	800	--	Line
Vertical refresh rate	VRR	--	50	--	70	Hz

Table 6.4: RGB Interface Vertical Timing Characteristics (Resolution 480x800)

Horizontal Timings for RGB I/F

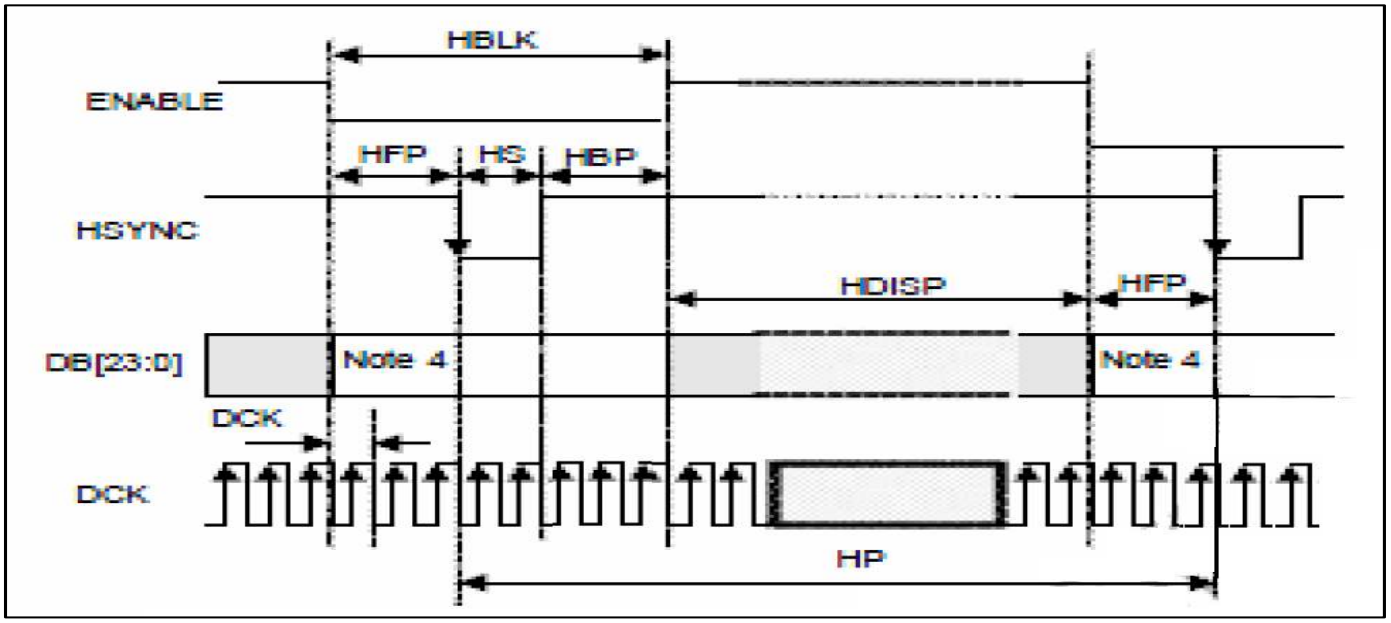


Figure 6.3: RGB Interface Horizontal Timing Diagram

Resolution=480x854, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, TA= -30 to 70°C

Item	Symbol	Condition	Min	Typ.	Max	Unit
HS cycle	HP	Note 3	504	--	568	DCK
HS low pulse width	HS	--	5	--	78	DCK
Horizontal front porch	HFP	--	5	--	78	DCK
Horizontal back porch	HBP	--	5	--	78	DCK
Horizontal data start point	-	HS+HBP	19	--	83	DCK
			700		--	ns
Horizontal blanking period	HBLK	HS+HBP+HFP	24	--	88	DCK
Horizontal active area	HDISP	--	--	854	--	DCK
Pixel clock frequency when RGB I/F is runnig	DCK	VRR=min 50Hz-max 70Hz	21.6	--	34.3	MHz
			29.1		46.2	Ns

Table 6.5: RGB Interface Horizontal Timing Characteristics (Resolution 480x854)

Note:

(1) Signal rise and fall times are equal to or less than 20ns.
(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.
(3) Data lines can be set to “high” or “low” during blanking time.
(4) VRR must keep from 50Hz to 70Hz when adjusting other items.

Resolution=480x800, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, TA= -30 to 70°C

Item	Symbol	Condition	Min	Typ.	Max	Unit
HS cycle	HP	Note 3	504	--	568	DCK
HS low pulse width	HS	--	5	--	78	DCK
Horizontal front porch	HFP	--	5	--	78	DCK
Horizontal back porch	HBP	--	5	--	78	DCK
Horizontal data start point	-	HS+HBP	19	--	83	DCK
			700		--	ns
Horizontal blanking period	HBLK	HS+HBP+HFP	24	--	88	DCK
Horizontal active area	HDISP	--	--	854	--	DCK
Pixel clock frequency when RGB I/F is runnig	DCK	VRR=min 50Hz-max 70Hz	20.3	--	32.2	MHz
			31		49.2	Ns

Table 6.6: RGB Interface Horizontal Timing Characteristics (Resolution 480x854)

General timings for RGB I/F:

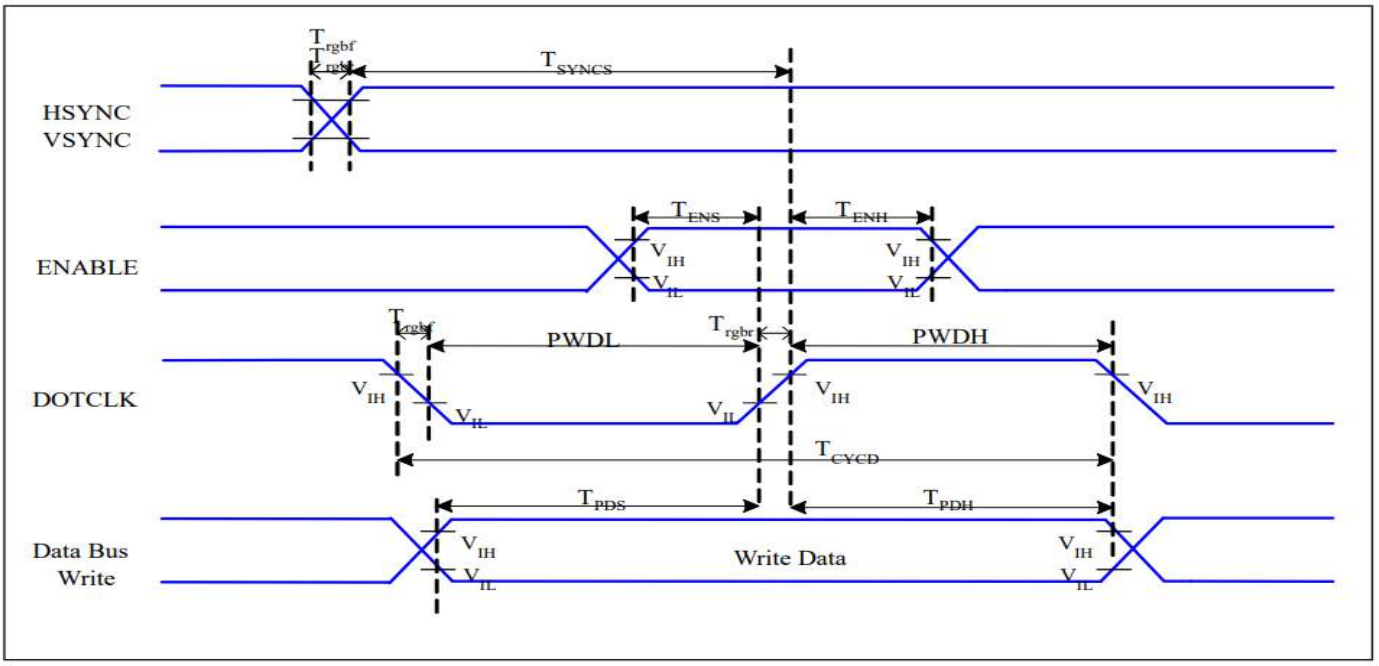


Figure 6.4: RGB Interface General Timing Diagram

Resolution=480x854, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, TA= -30 to 70°C

Item	Symbol	Condition	Min	Typ.	Max	Unit
Vertical sync setup time	VSST	--	5	--	--	ns
Vertical sync hold time	VSHT	--	5	--	--	ns
Horizontal sync setup time	HSST	--	5	--	--	ns
Horizontal sync hold time	HSHT	--	5	--	--	ns
Pixel clock cycle when RGB I/F is running	DCKCYC	VRR = min 50Hz, max 70Hz	29.1 (3)	--	46.2 (4)	ns
Pixel clock low time	DCKLT		5	--	--	ns
Pixel clock high time	DCKHT		5	--	--	ns
Data setup time DB[23:0]	DST	--	5	--	--	ns
Data hold time DB[23:0]	DHT		5		--	ns

Table 6.7: RGB Interface General Timing Characteristics (Resolution 480x854)

Note:

(1) Signal rise and fall times are equal to or less than 20ns.
(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.
(3) 34.3 MHz
(4) 21.6 MHz

Resolution=480x800, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, TA= -30 to 70°C

Item	Symbol	Condition	Min	Typ.	Max	Unit
Vertical sync setup time	VSST	--	5	--	--	ns
Vertical sync hold time	VSHT	--	5	--	--	ns
Horizontal sync setup time	HSST	--	5	--	--	ns
Horizontal sync hold time	HSHT	--	5	--	--	ns
Pixel clock cycle when RGB I/F is running	DCKCYC	VRR = min 50Hz, max 70Hz	31	--	49.2	ns
			32.2		20.3	MHz
Pixel clock low time	DCKLT		5	--	--	ns
Pixel clock high time	DCKHT		5	--	--	ns
Data setup time DB[23:0]	DST	--	5	--	--	ns
Data hold time DB[23:0]	DHT		5		--	ns

Table 6.8: RGB Interface General Timing Characteristics (Resolution 480x854)

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6.2 Reset Timing

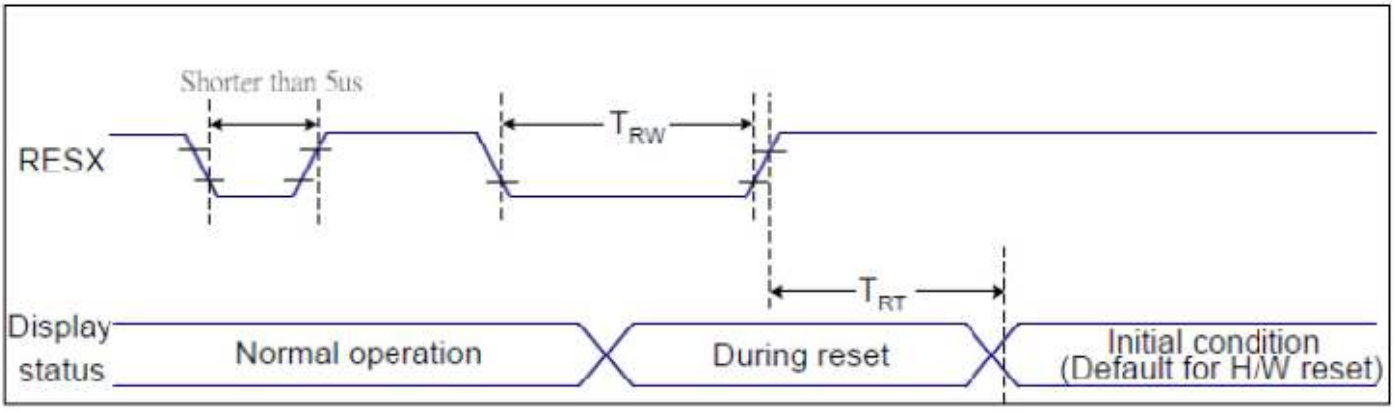


Figure 6.5: Reset Timing Diagram

Related Pins	Symbol	Parameter	Min	Max	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1,5)	ms
				120 (Note 1, 6, 7)	ms

Notes:

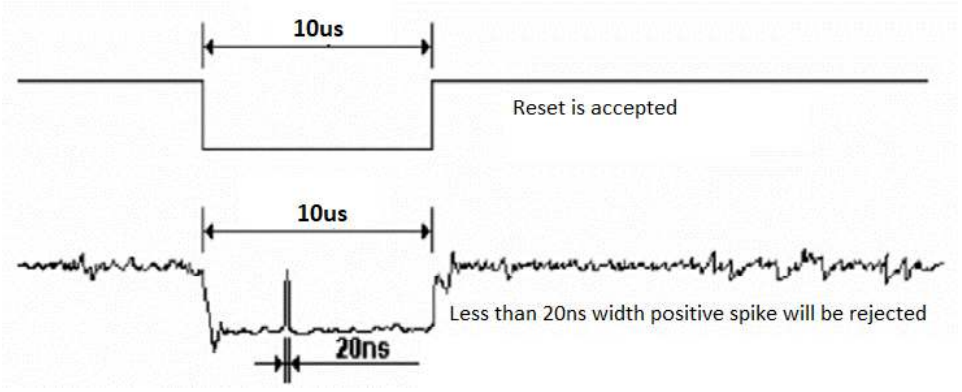
1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5ms after a rising edge of RESX.

2. Spike due to an electrostatic discharge on RESX line does not because irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9 us	Reset starts

3. During the resetting period, the display will be blanked (the display is entering blanking sequence, which maximum time is 120ms, when reset starts in Sleep Out mode. The display remains the blank state in Sleep in mode) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:



5. When Reset applied during Sleep In Mode.
6. When Reset applied during Sleep Out Mode.
7. It is necessary to wait 5ms after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120ms.

7. Cautions and Handling Precautions

7.1 Handling and Operating the Module

1. When the module is assembled, it should be attached to the system firmly. Do not warp or twist the module during assembly work.
2. Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
3. Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
4. Do not allow drops of water or chemicals to remain on the display surface. If you have the droplets for a long time, staining and discoloration may occur.
5. If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
6. The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
7. 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, legs, or clothes, it must be washed away thoroughly with soap.
8. Protect the module from static; it may cause damage to the CMOS ICs.
9. Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
10. Do not disassemble the module.
11. Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
12. Pins of I/F connector shall not be touched directly with bare hands.
13. Do not connect, disconnect the module in the “Power ON” condition.
14. Power supply should always be turned on/off by the item Power On Sequence & Power Off Sequence

7.2 Storage and Transportation

1. Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%
2. Do not store the TFT-LCD module in direct sunlight.
3. The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
4. It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module. In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
5. This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.