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

TFT LCD Module

Part Number

E20RA-FW700-N

Overview:

- 2.0-inch TFT (46.50x41.56mm)
- 8/9/16/18-bit MCU Interface
- 3/4-wire Serial Interface
- 3/4SPI+16/18 RGB Interface
- White LED back-light

- Transmissive/Normally Black
- No Touch Panel
- 700 NITS
- Controller: ILI9342
- 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 transmissive type TFT-LCD Panel, driver circuit, and a backlight unit. The resolution of the 2.0" TFT-LCD contains 320(RGB)x240 pixels and can display up to 262k colors.

TFT Features

Low Input Voltage: 3.3V
Display Colors: 65k/262k colors
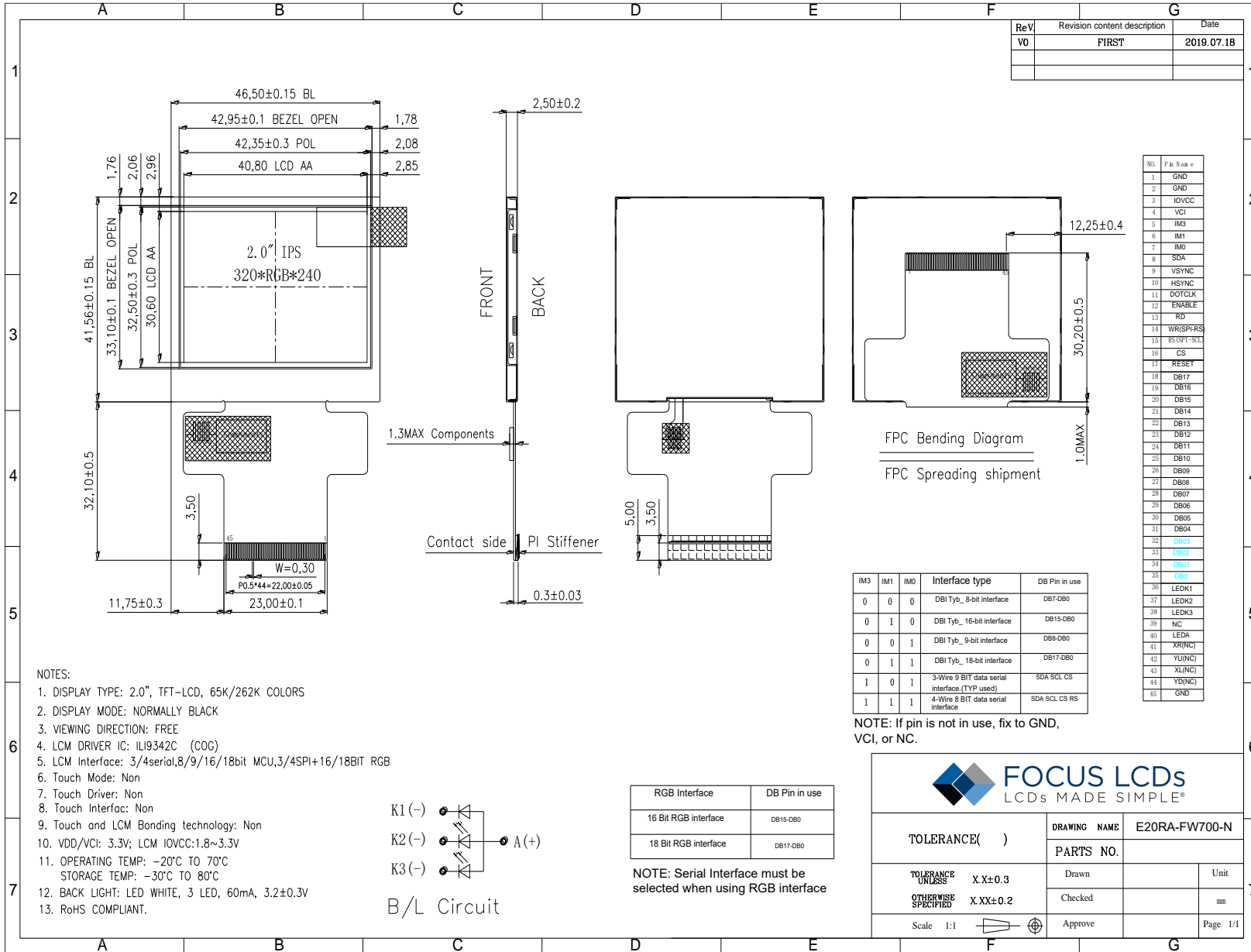Interface: 3/4-wire serial
        8/9/16/18-bit MCU
        3/4-wire SPI+16/18-bit RGB

General Information Items	Specification Main Panel	Unit	Note
TFT Display area (AA)	40.80(H) x 30.60(V) (2.0 inch)	mm	-
Driver Element	TFT active matrix	-	-
Display Colors	65k/262k	colors	-
Number of pixels	320(RGB)x240	dots	-
TFT Pixel arrangement	RGB vertical stripe	-	-
Pixel Pitch	0.1275x0.1275	mm	-
Viewing angle	ALL	o'clock	-
TFT Controller IC	ILI9342C	-	-
Interface	3/4-serial 8/9/16/18-bit MCU 3/4-SPI+16/18-bit RGB	-	-
Display mode	Transmissive/ Normally Black	-	-
Operating temperature	-20～+70	℃	-
Storage temperature	-30～+80	℃	-

Mechanical Information

Item		Min	Typ.	Max	Unit	Note
Module Size	Horizontal (H)		46.50		mm	-
	Vertical (V)		41.56		mm	-
	Depth (D)		2.50		mm	-
	Weight		10		g	

1. Outline Dimensions

ReV	Revision content description	Date
V0	FIRST	2019.07.18

2.0" IPS 320*RGB*240

FRONT BACK

2,50±0.2

1.3MAX Components

Contact side PI Stiffener

0.3±0.03

FPC Bending Diagram

FPC Spreading shipment

W=0,30

P0.5*44=22,00±0.05

11,75±0.3   23,00±0.1

46,50±0.15 BL
42,95±0.1 BEZEL OPEN
42,35±0.3 POL
40,80 LCD AA
1,78 2,08 2,85
1,76 2,06 2,96
41,56±0.15 BL
33,10±0.1 BEZEL OPEN
32,50±0.3 POL
30,60 LCD AA
32,10±0.5
3,50
12,25±0.4
30,20±0.5
1.0MAX
5,00 3,50

NOTES:
1. DISPLAY TYPE: 2.0", TFT-LCD, 65K/262K COLORS
2. DISPLAY MODE: NORMALLY BLACK
3. VIEWING DIRECTION: FREE
4. LCM DRIVER IC: ILI9342C (COG)
5. LCM Interface: 3/4serial,8/9/16/18bit MCU,3/4SPI+16/18BIT RGB
6. Touch Mode: Non
7. Touch Driver: Non
8. Touch Interfac: Non
9. Touch and LCM Bonding technology: Non
10. VDD/VCI: 3.3V; LCM IOVCC:1.8~3.3V
11. OPERATING TEMP: −20℃ TO 70℃
    STORAGE TEMP: −30℃ TO 80℃
12. BACK LIGHT: LED WHITE, 3 LED, 60mA, 3.2±0.3V
13. RoHS COMPLIANT.

NO.	Pin Name
1	GND
2	GND
3	IOVCC
4	VCI
5	IM3
6	IM1
7	IM0
8	SDA
9	VSYNC
10	HSYNC
11	DOTCLK
12	ENABLE
13	RD
14	WR(SPI-RS)
15	RS(SPI-SCL)
16	CS
17	RESET
18	DB17
19	DB16
20	DB15
21	DB14
22	DB13
23	DB12
24	DB11
25	DB10
26	DB09
27	DB08
28	DB07
29	DB06
30	DB05
31	DB04
32	DB03
33	DB02
34	DB01
35	DB0
36	LEDK1
37	LEDK2
38	LEDK3
39	NC
40	LEDA
41	XR(NC)
42	YU(NC)
43	XL(NC)
44	YD(NC)
45	GND

IM3	IM1	IM0	Interface type	DB Pin in use
0	0	0	DBI Tyb_ 8-bit interface	DB7-DB0
0	1	0	DBI Tyb_ 16-bit interface	DB15-DB0
0	0	1	DBI Tyb_ 9-bit interface	DB8-DB0
0	1	1	DBI Tyb_ 18-bit interface	DB17-DB0
1	0	1	3-Wire 9 BIT data serial interface.(TYP used)	SDA SCL CS
1	1	1	4-Wire 8 BIT data serial interface	SDA SCL CS RS

NOTE: If pin is not in use, fix to GND, VCI, or NC.

RGB Interface	DB Pin in use
16 Bit RGB interface	DB15-DB0
18 Bit RGB interface	DB17-DB0

NOTE: Serial Interface must be selected when using RGB interface

K1(−)
K2(−)   A(+)
K3(−)

B/L Circuit

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TOLERANCE( )		DRAWING NAME	E20RA-FW700-N	
		PARTS NO.		
TOLERANCE UNLESS	X.X±0.3	Drawn		Unit
OTHERWISE SPECIFIED	X.XX±0.2	Checked		mm
Scale 1:1		Approve		Page 1/1

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2. Block Diagram

3. Input Terminal Pin Assignment

Recommended Connector: FH12S-45S-0.5SH(55)

NO.	Symbol	Description						I/O
1	GND	Ground						P
2	GND	Ground						P
3	IOVCC	Supply voltage (1.8-3.3V)						P
4	VCI	Supply voltage (3.3V)						P
5-7	IM3 IM1 IM0	Interface selection	IM3	IM1	IM0	Interface	Pins Used	I
			0	0	0	DBI Type 8-bit	DB7-DB0	
			0	1	0	DBI Type 16-bit	DB15-DB0	
			0	0	1	DBI Type 9-bit	DB8-DB0	
			0	1	1	DBI Type 18-bit	DB17-DB0	
			1	0	1	3-wire 9 bit serial	SDA SCL CS	
			1	1	1	4-wire 8 bit serial	SDA SCL CS RS	
8	SDA	Serial data input. The data is applied at the rising edge of the SCL signal.						I
9	VSYNC	Frame synchronizing signal for the RGB interface						I
10	HSYNC	Line synchronizing signal for the RGB interface						I
11	DOTCLK	Dot clock signal for the RGB interface						I
12	ENABLE	Data enable signal for the RGB interface						I
13	RD	Read signal for the MCU parallel interface						I
14	WR(SPI-RS)	Write signal for the MCU parallel interface. Additionally, this is the register select signal for the SPI interface.						I
15	RS(SPI-SCL)	Register select signal for the MCU parallel interface. Additionally, this is the clock signal for the SPI interface.						I
16	CS	Chip select signal for the serial interface						I
17	RESET	Reset signal of the device						I
18-35	DB17-DB0	Bi-directional 18-bit parallel data bus for the RGB and MCU interfaces.						I/O
36	LEDK1	Cathode pin of the backlight						P
37	LEDK2	Cathode pin of the backlight						P
38	LEDK3	Cathode pin of the backlight						P
39	NC	Not connected						
40	LEDA	Anode pin of the backlight						P
41	XR(NC)	Not connected						
42	YU(NC)	Not connected						
43	XL(NC)	Not connected						
44	YD(NC)	Not connected						
45	GND	Ground						P

I: Input, O: Output, P: Power

4. LCD Optical Characteristics

4.1 Optical Specifications

Item		Symbol	Condition	Min	Typ.	Max	Unit	Note
Color Gamut		S%		55	60	--	%	(3)
Contrast Ratio		CR		1000	1500	--	%	(2)
Response Time	Rising	TR+TF		--	30	40	ms	(4)
	Falling							
Color Filter Chromaticity	White	W_X	$\theta=0$ Normal viewing angle	0.2599	0.299	0.3399		(5)(6)
		W_Y		0.2858	0.3258	0.3658		
	Red	R_X		0.5889	0.6089	0.6289		
		R_Y		0.3441	0.3641	0.3841		
	Green	G_X		0.3068	0.3268	0.3468		
		G_Y		0.5607	0.5807	0.6007		
	Blue	B_X		0.1308	0.1508	0.1708		
		B_Y		0.0640	0.0840	0.1040		
Viewing Angle	Hor.	ΘL	CR≥10	70	80	--	degree	(1)(6)
		ΘR		70	80	--		
	Ver.	ΘT		70	80	--		
		ΘB		70	80	--		
Option View Direction			ALL					(1)

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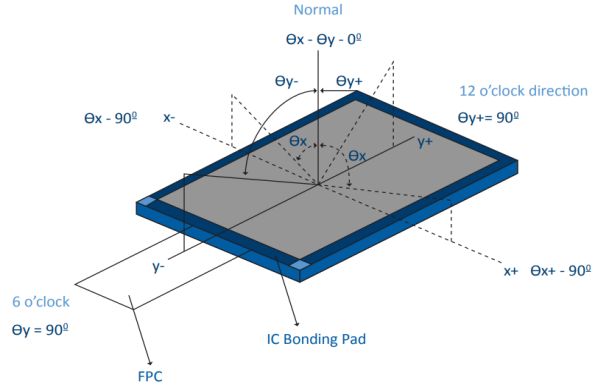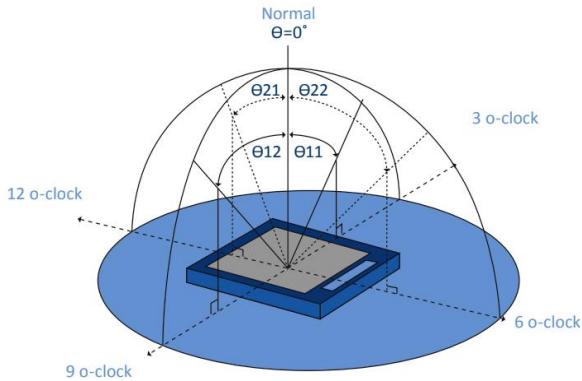
(2) Definition of Contrast Ratio (Cr): measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

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

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

$$Tr = \frac{It}{Io} \: x \: 100\%$$
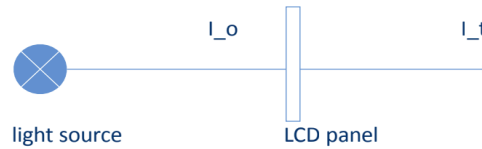
Io = the brightness of the light source.
It = the brightness after panel transmission

(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.
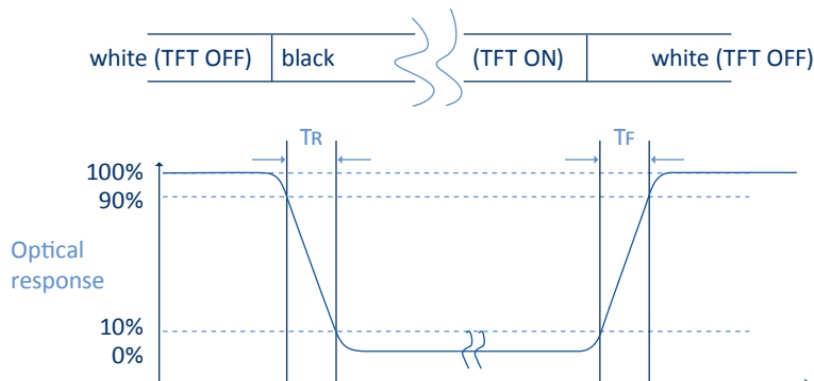
(5) Definition of Color Gamut:

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.The color chromaticity shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.
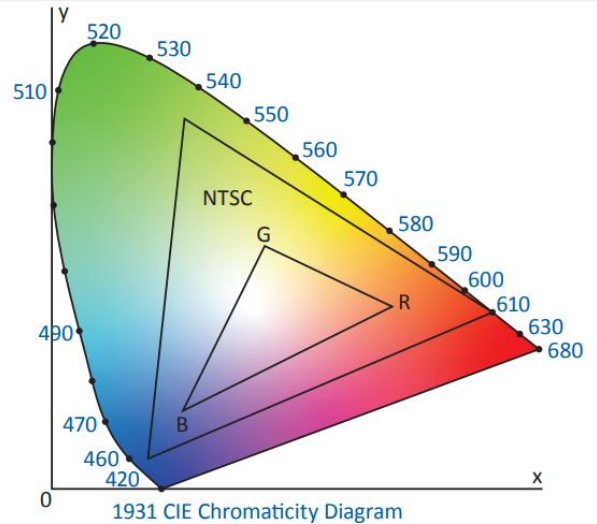
Fig. 1931 CIE chromacity diagram

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

(6) Definition of Optical Measurement Setup:

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.
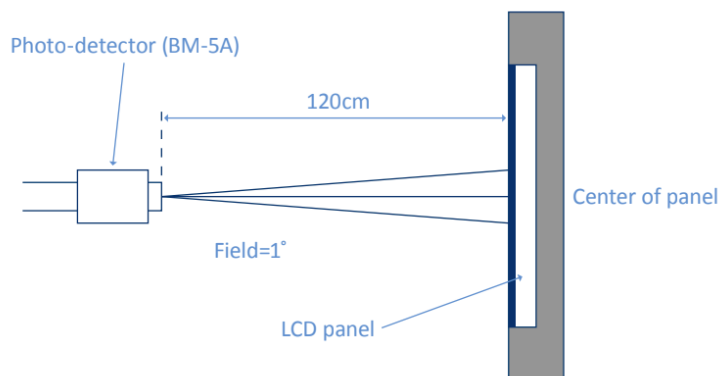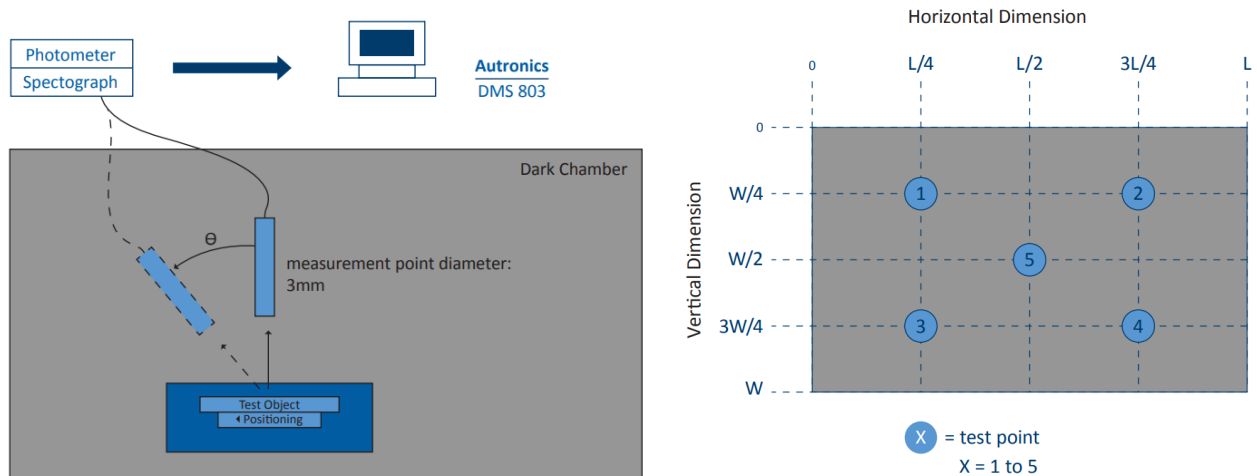
5. TFT Electrical Characteristics

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

Characteristics	Symbol	Min	Max	Unit
Digital Supply Voltage	VDD	-0.3	4.2	V
Digital Interface Supply Voltage	IOVCC	-0.3	3.3	V
Operating Temperature	TOP	-20	+70	℃
Storage Temperature	TST	-30	+80	℃

NOTE: If the absolute maximum rating of the above parameters is exceeded, even momentarily, the quality of the product may be degraded. Absolute maximum ratings specify the values which the product may be physically damaged if exceeded. 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	
Digital Interface Supply Voltage	IOVCC	1.65	1.8	3.3	V	
Normal Mode Current Consumption	IDD	--	5	--	mA	
Level Input Voltage	VIH	0.7IOVCC	--	IOVCC+0.3	V	
	VIL	GND-0.3	--	0.3IOVCC	V	
Level Output Voltage	VOH	IOVCC-0.4	--	--	V	
	VOL	GND	--	GND+0.4	V	

5.3   LED Backlight Characteristics

The backlight system is edge lighting type with 3 chips LED.

Item	Symbol	Min	Typ.	Max	Unit	Note
Forward Current	I_F	--	60	--	mA	
Forward Voltage	V_F	--	3.	--	V	
LCM Luminance	LV	--	700	--	cd/m2	Note 3
LED lifetime	Hr	--	50000	--	hour	Note1 & 2
Uniformity	AVg	80	--	--	%	Note 3

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 = 60mA

Backlight LED Circuit
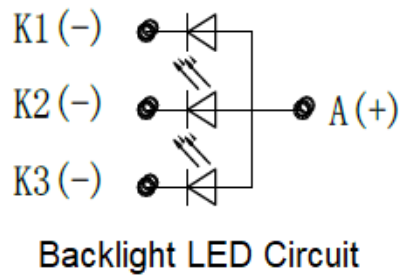
Note 3: Luminance Uniformity of these 9 points is defined as below:
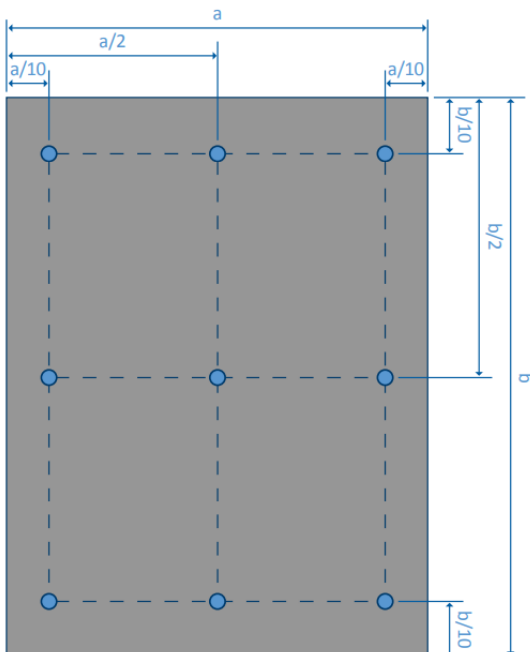
$$Luminance = \frac{(\text{Total Luminance of 9 points})}{9}$$

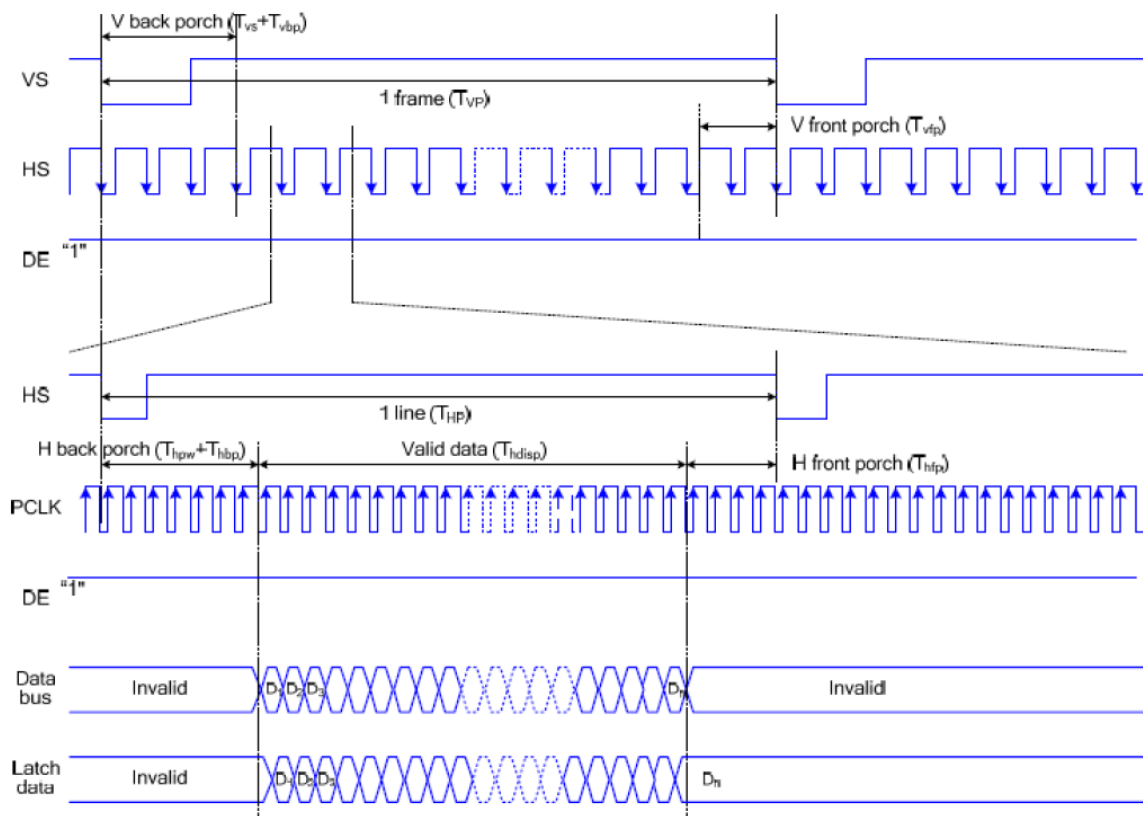$$Uniformity = \frac{\text{minimum luminance in 9 points(1-9)}}{\text{maximum luminance in 9 points(1-9)}}$$

6. RGB Interface Timing Diagram

DE Mode
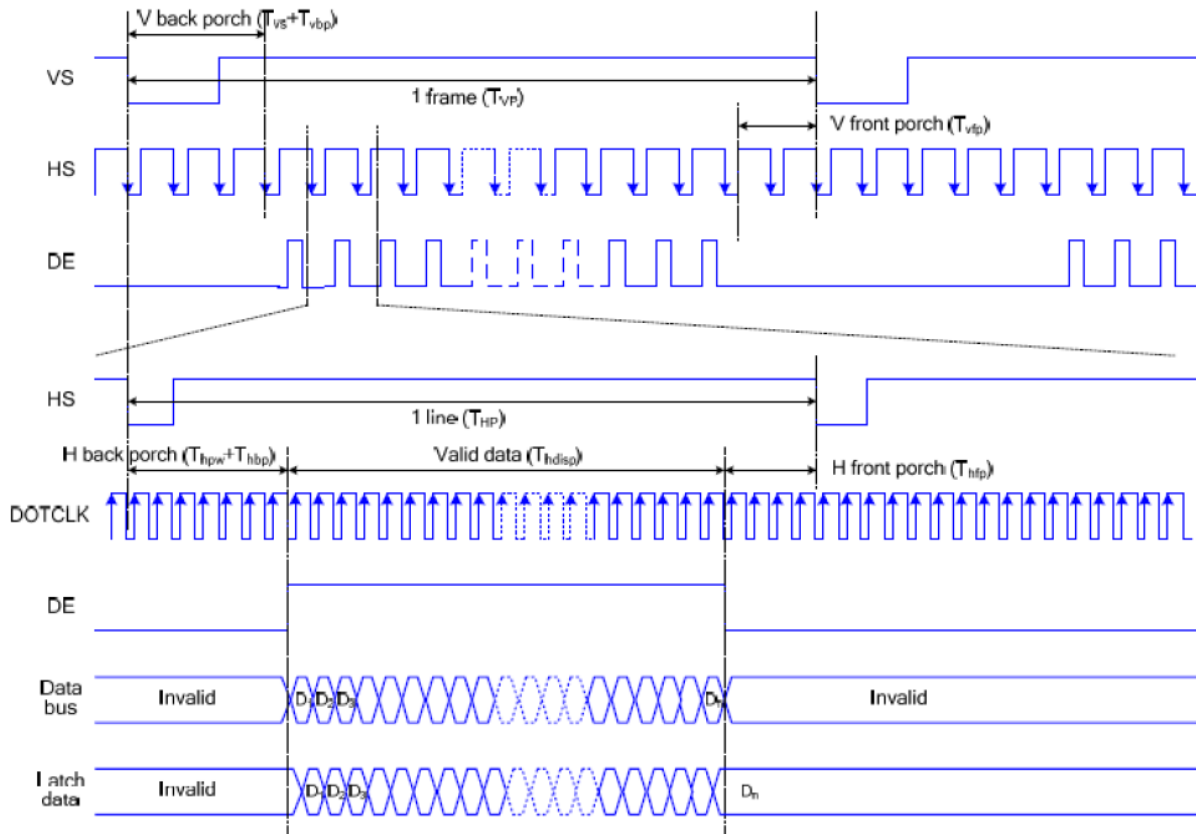
Note: The setting of front porch and back porch in host must match that in IC as this mode.

HV Mode

7.5 RGB Interface Definition

The display operation via the RGB interface is synchronized with the VSYNC, HSYNC and DOTCLK signals. The data can be written only within the specified area with low power consumption by using the window address function. The back porch and front porch are used to set the RGB interface timing signals.
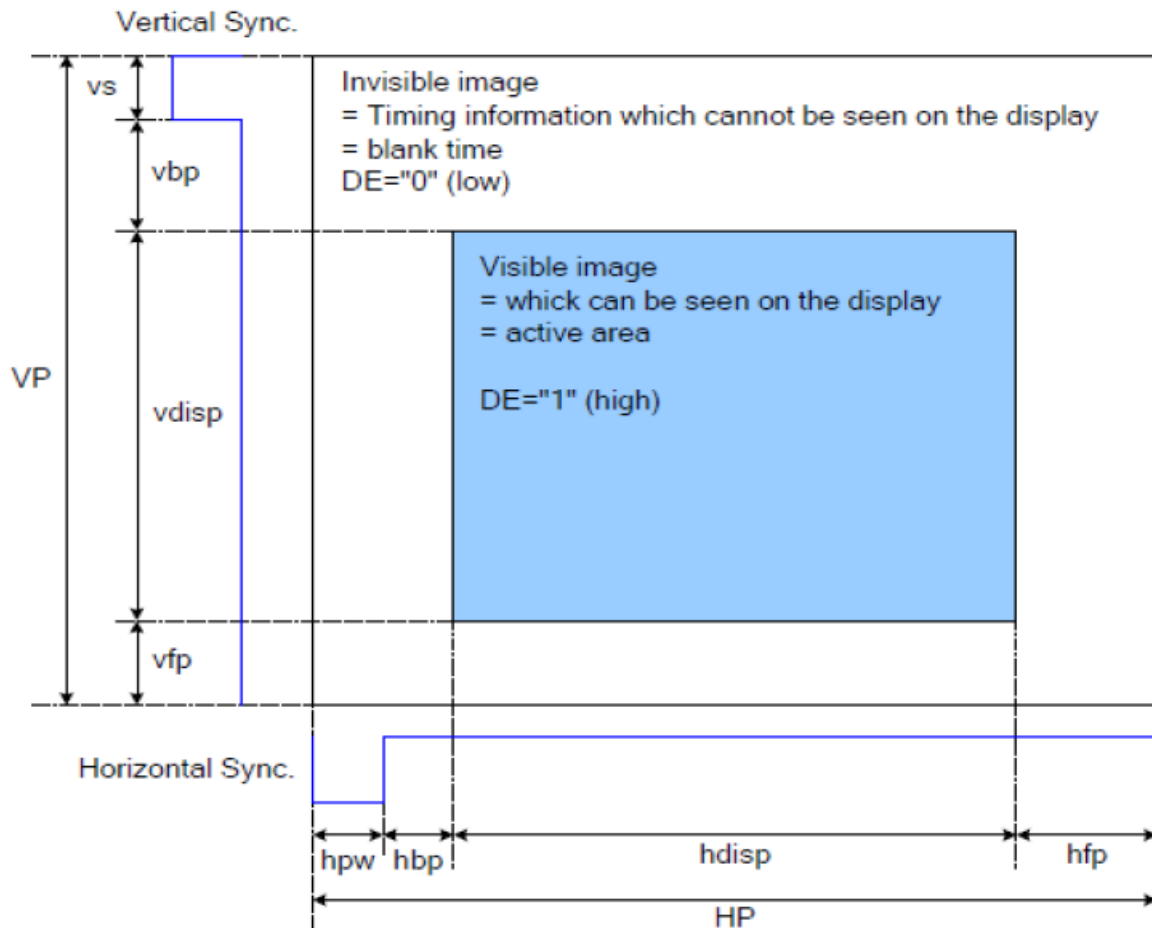
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Refresh Rate	fclk		--	60	--	Hz
Horizontal sync width	hpw		6	--	78	Clock
Horizontal back porch	hbp		5	--	78	Clock
Horizontal front porch	hfp		5	--	78	Clock
Vertical sync width	vs		2	--	--	Line
Vertical back porch	vbp		2	--	--	Line
Vertical front porch	vfp		2	--	--	Line

6.3   Reset Timing
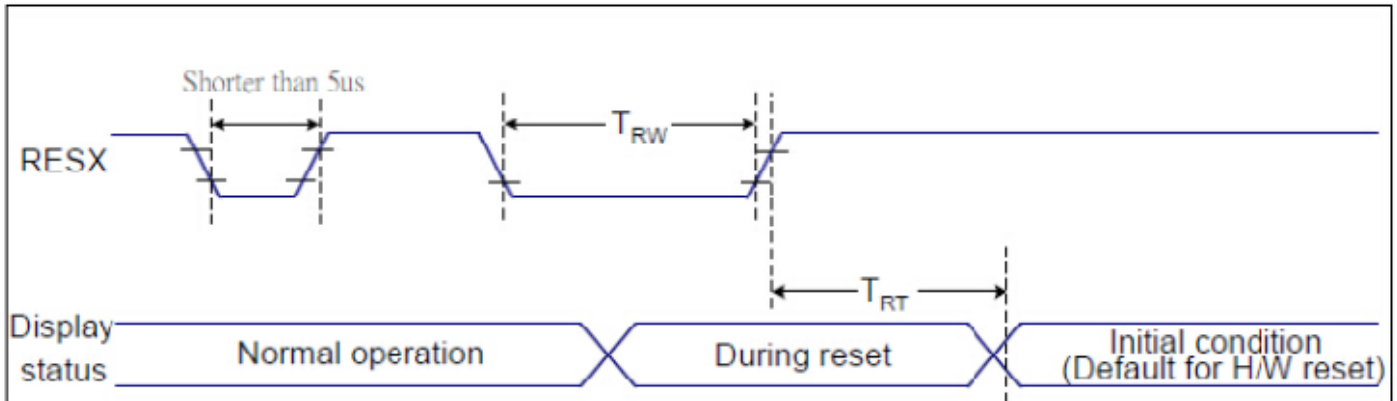
Figure 6.3: Reset Timing Diagram

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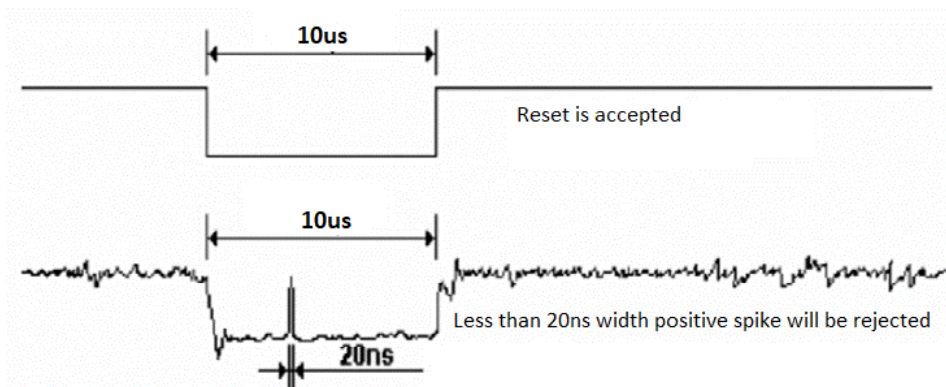
5. When Reset applied during Sleep In Mode.
6. When Reset applied during Sleep Out Mode.
7. It is necessary to wait 5ms after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120ms.

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.