TFT Display Module

Part Number

E35GH-CW400-N

Overview:

- 3.5-inch TFT (56.54x84.96mm)
- 320x480 pixels
- MCU Interface
- Storage Temp -30C to 80C
- Operating Temp -20C to 70C
- View Direction 6:00

- Normally White / Transmissive
- No Touch Panel
- 400 NITS
- Controller: ILI9488
- 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 3.5" TFT-LCD contains 320(RGB)x480 pixels and can display up to 262K colors.

TFT Features

Low Input Voltage: IOVCC: 1.65-3V, VCI: 2.5-3.3V
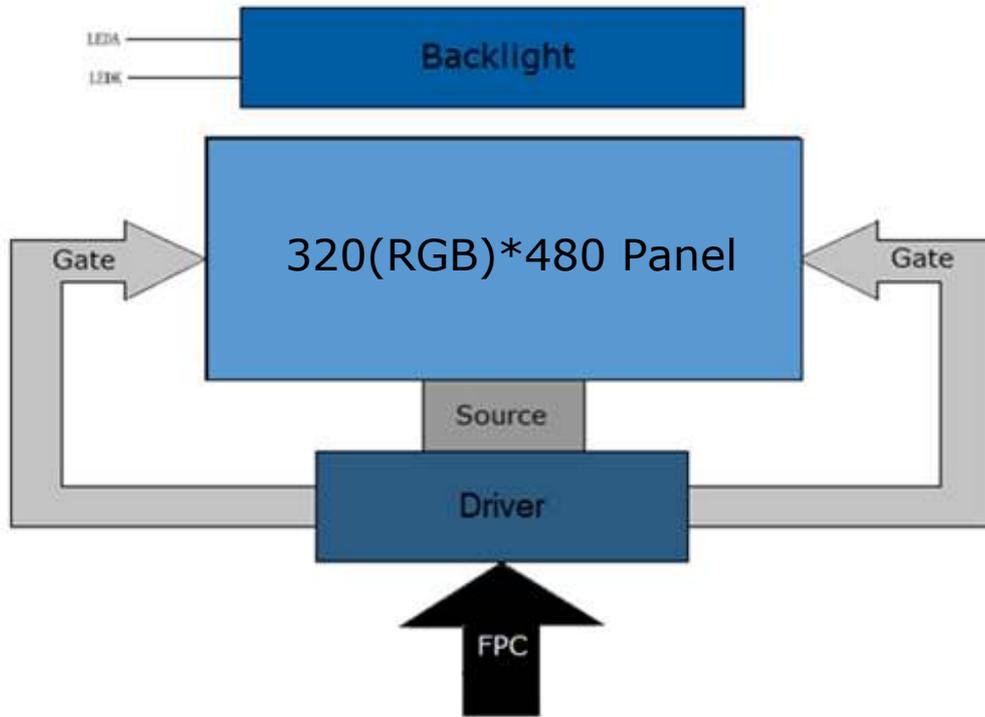Display Colors: 262K colors
TFT Interfaces: MCU
Internal Power Supply Circuit

General Information Items	Specification	Unit	Note
	Main Panel		
TFT Display area (AA)	48.96 (H) x 73.44 (V) (3.5 inch)	mm	-
Driver element	TFT active matrix	-	-
Display colors	262K	colors	-
Number of pixels	320(RGB)x480	dots	-
TFT Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	51 (H) x 153 (V)	mm	-
Viewing angle	6:00	-	-
TFT Controller IC	ILI9488	-	-
LCM Interface	MCU	-	-
Display mode	Transmissive/ Normally White	-	-
Operating temperature	-20～+70	℃	-
Storage temperature	-30～+80	℃	-

Mechanical Information

Item		Min	Typ.	Max	Unit	Note
Module size	Height (H)		56.54		mm	-
	Vertical (V)		84.96		mm	-
	Depth (D)		2.4		mm	-

1. Block Diagram

2. Outline Dimensions

Rev.	Description	Date
1.0	First	5/16/22

3.5" TFT
320RGB(H)*480(V)

Reflector tape

CONDUCTOR — STIFFENER

LED Circuit

LED-K1

LED-A

LED-K2

LED: U=3.2V , I=120mA

Pin	Name
1	LEDA
2	LEDK1
3	LEDK2
4	NC
5	NC
6	NC
7	IMO
8	IM1
9	IM2
10	RESET
11	VSYNC
12	HSYNC
13	DOTCLK
14	DE
15	DB17
16	DB16
17	DB15
18	DB14
19	DB13
20	DB12
21	DB11
22	DB10
23	DB9
24	DB8
25	DB7
26	DB6
27	DB5
28	DB4
29	DB3
30	DB2
31	DB1
32	DB0
33	SDO
34	SDI
35	RD
36	WR(D/C)
37	D/C(SCL)
38	CS
39	TE
40	VDDI
41	VDDI
42	VCI
43	GND
44	XR(NC)
45	YD(NC)
46	XL(NC)
47	YU(NC)
48	GND
49	GND
50	GND

Notes:
1.) Display Type: 262k TFT
2.) Driver IC: ILI9488
3.) Operating Voltage; VCI =3.0V, VDDI=3V
4.) Operating Temp: -20C to 70C
5.) Storage Temp: -30C to 80C
6.) Backlight: 6 LED White
7.) RoHS Compliant

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Model Name: E35GH-CW400-N

General Tol:	± 0.2
Approvals	Date
DWN:	
CHK:	
APP:	

Drawing No.:

Size:

Scale:

Unit: mm

Page: 1/1

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3. Input Terminal Pin Assignment

Recommended Connector: FH12S-50S-0.5SH(55)

Pin	Name	I/O	Function
1	LEDA	P	Power for Backlight (anode)
2	LEDK1	P	Power for Backlight (cathode)
3	LEDK2	P	Power for Backlight (cathode)
4	NC	-	Not Connected
5	NC	-	Not Connected
6	NC	-	Not Connected
7	IM0	I	Select the interface mode
8	IM1	I	
9	IM2	I	
10	RESET	I	Reset Input Signal
11	VSYNC	I	DPI: Frame Sync Signal - Fix to DGND level when not in use
12	HSYNC	I	DPI: Line Sync Signal - Fix to DGND level when not in use
13	DOTCLK	I	DPI: Dot Clock Signal - Fix to IOVCC level when not in use
14	DE	I	DPI: Data Enable Input Signal - Fix to DGND level when not in use
15	DB17	I/O	
16	DB16	I/O	
17	DB15	I/O	
18	DB14	I/O	
19	DB13	I/O	
20	DB12	I/O	
21	DB11	I/O	
22	DB10	I/O	
23	DB9	I/O	
24	DB8	I/O	
25	DB7	I/O	
26	DB6	I/O	
27	DB5	I/O	
28	DB4	I/O	
29	DB3	I/O	
30	DB2	I/O	
31	DB1	I/O	
32	DB0	I/O	
33	SDO	O	DBI Type C ; SDO - Serial Data Output - Leave pin open when not in use
34	SDI	I/O	DBI Type C ; DINA/SDA: Serial Data Input/Output bi-directional pin - Fix to IOVCC or DGND when not in use
35	RD	I	DBI Type B: Serves at read signal - Fix to IOVCC or DGND when not in use
36	WR(D/C)	I	DBI Type B; WRX Pin, serves as write signal ; DBI Type C: SCL Pin as serial clock when operating in serial interface. Fix to IOVCC or DGND level when not in use.
37	D/C(SCL)	I	DBI Type B: Data/Command Selection Pin; Low: Command; High: Parameter
38	CS	I	DBI Type B: Chip select input signal; Low - Chip selected and accessible; High - Chip is not selected and not accessible. Fix to IOVCC or DGND level when not in use.
39	TE	O	Tearing Effect Output Signal - Leave open when not in use.
40	VDDI	P	Supply voltage to digital circuit - connected to external power supply of 1.65~3.3V
41	VDDI	P	Supply voltage to digital circuit - connected to external power supply of 1.65~3.3V
42	VCI	P	Supply voltage to analog circuit - connected to external power supply of 2.5~3.3V; Connect to a stabilizing capacitor between VCI and GND
43	GND	P	Power Ground
44	XR(NC)	I	TP Signal (Not Connected)
45	YD(NC)	I	TP Signal (Not Connected)
46	XL(NC)	I	TP Signal (Not Connected)
47	YU(NC)	I	TP Signal (Not Connected)
48	GND	P	Power Ground
49	GND	P	Power Ground
50	GND	P	Power Ground

Interface mode selection (pins 7-9):

IM2	IM1	IM0	Interface
0	0	0	MIPI-DBI Type B 24-bit bus (DB_EN = 1)
0	0	0	MIPI-DBI Type B 18-bit bus (DB_EN = 0)
0	0	1	MIPI-DBI Type B 9-bit bus
0	1	0	MIPI-DBI Type B 16-bit bus
0	1	1	MIPI-DBI Type B 8-bit bus
1	0	1	MIPI-DBI Type C Option 1 (3-line SPI)
1	1	0	MIPI DSI
1	1	1	MIPI-DBI Type C Option 3 (4-line SPI)

Data pins in use (pins 15-32):

Interface Mode	Data Pin in Use
MIPI-DBI Type B 24-bit bus (DB_EN = 1)	DB [23:0]
MIPI-DBI Type B 18-bit bus (DB_EN = 0)	DB [17:0]
MIPI-DBI Type B 16-bit bus	DB [15:0]
MIPI-DBI Type B 9-bit bus	DB [8:0]
MIPI-DBI Type B 8-bit bus	DB [7:0]
MIPI-DPI 24-bit	DB [23:0]
MIPI-DPI 18-bit	DB [17:0]
MIPI-DPI 16-bit	DB [15:0]

4. LCD Optical Characteristics

4.1 Optical Specifications

Item		Symbol	Condition	Min	Typ.	Max	Unit	Note
Response time		T_r	$\theta=0°$	-	4	(8)	ms	.
		T_f		--	12	(24)	ms	
Contrast ratio		CR	At optimized Viewing Angle	--	500	--	--	
Luminance Uniformity		$\triangle L$		75	85		%	
Color Chromacicity (CIE 1931)	White	Wx	$\theta=0°$ Normal Viewing Angle	0.247	0.282	0.367	--	BM-7A
		Wy		0.288	0.318	0.388		
Viewing Angle (6H)	Hor.	θ_R	CR≥10	60	70	-	Degree	
		θ_L		60	70	-		
	Ver.	θ_U		60	70	-		
		θ_D		50	60	-		

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.
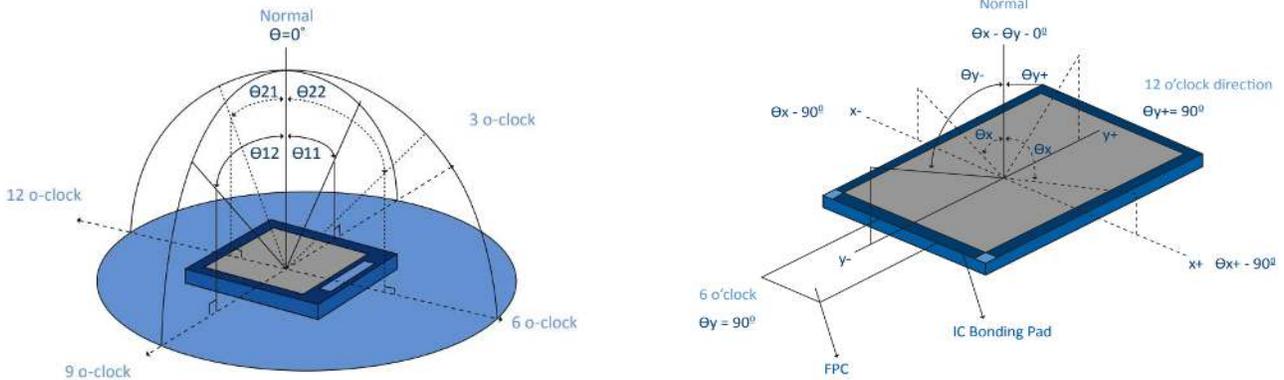

(2) Definition of Contrast Ratio (Cr): measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

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

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

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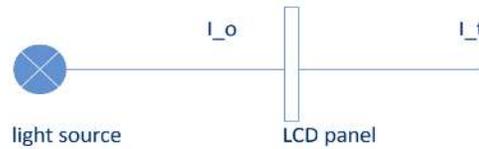
Io = the brightness of the light source.
It = the brightness after panel transmission

(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.

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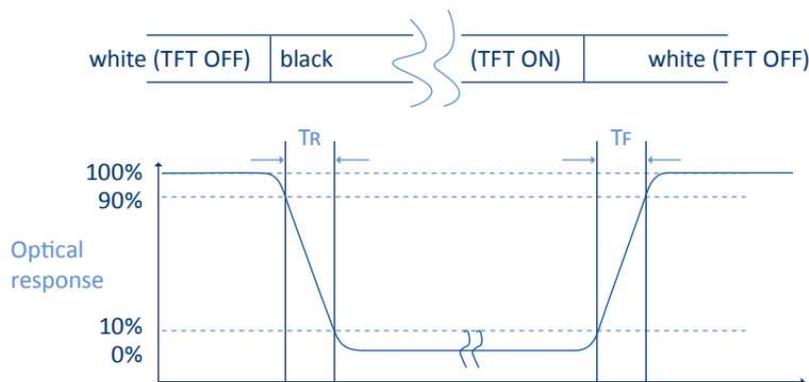
(5) Definition of Color Gamut:

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.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.

LED Circuit

LED: U=3.2V, I=120mA
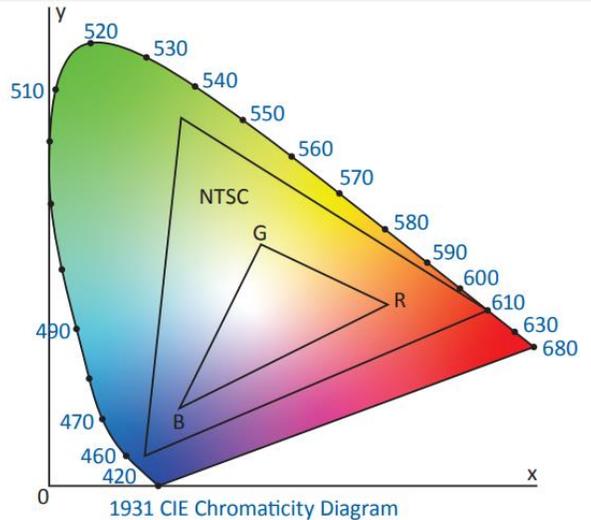
Fig. 1931 CIE chromacity diagram

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

(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

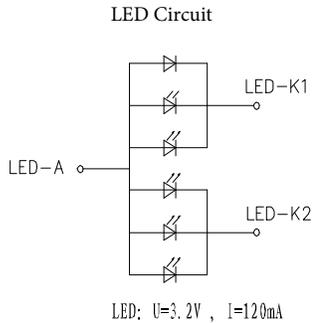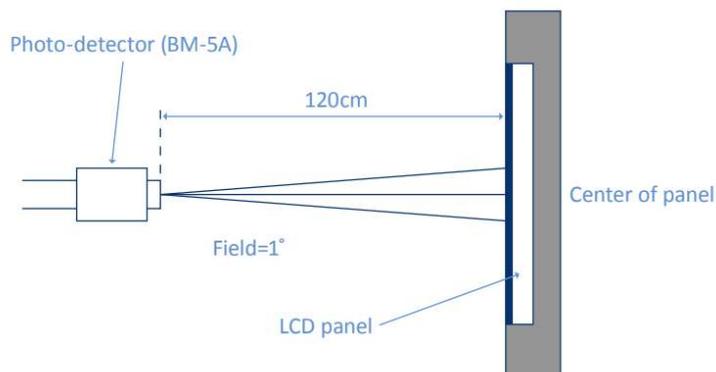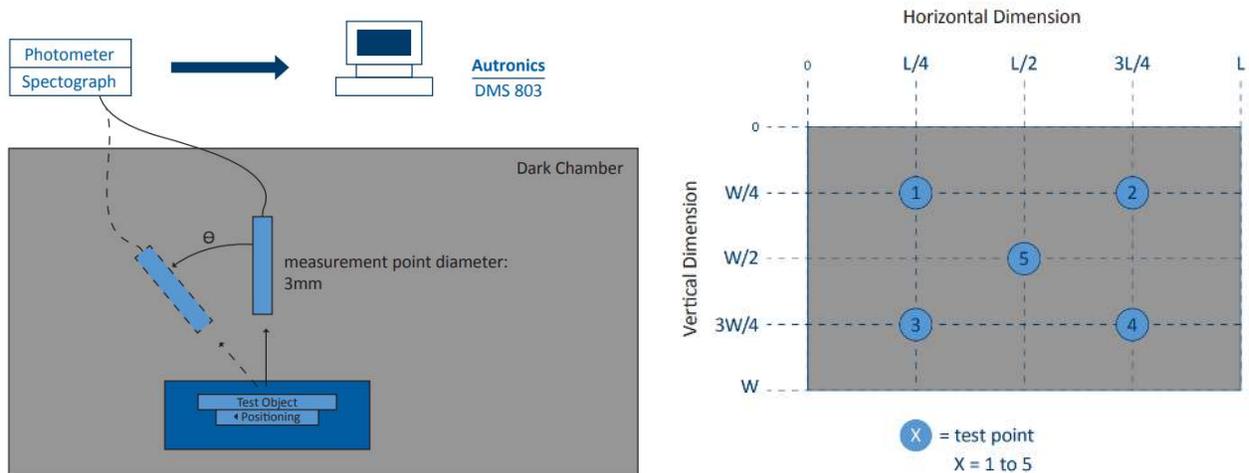## 5.1 Absolute Maximum Rating (Ta=25 ˚C, VSS=0V)

Characteristics	Symbol	Min	Max	Unit
Digital Power Supply Voltage	VDD	VSS-0.3	3.3	V

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.

5.1.1 LCD Electrical Characteristics

| Characteristics		Symbol	Min	Typ.	Max	Unit	Note
Power supply		VDD	2.8	3.0	3.3	V	
Input Voltage for Logic	H Level	VIH	0.7xVDD	-	VDD	V	
	L Level	VIL	0	-	0.3xVDD	V	
Power Supply current		IDD	-	-	50	mA	Note 1

5.2 Electrical Characteristics

5.2.1 Backlight Unit

The back-light system is an edge-lighting type with six white LEDs (Light Emitting Diode).   (Ta=25±2°C)

Characteristics	Symbol	Min	Typ.	Max	Unit	Note
LED Voltage	VF	2.8	3.2	3.4	V	
LED Current	IF	--	120	--	mA	
Power Consumption	P_{BL}	--	--	--	mW	
Luminance	cd/m^2	--	400	--	mW	

Note: Where I_F = 120A, V_F = 3.2V $P_{BL} = V_F \times I_F$

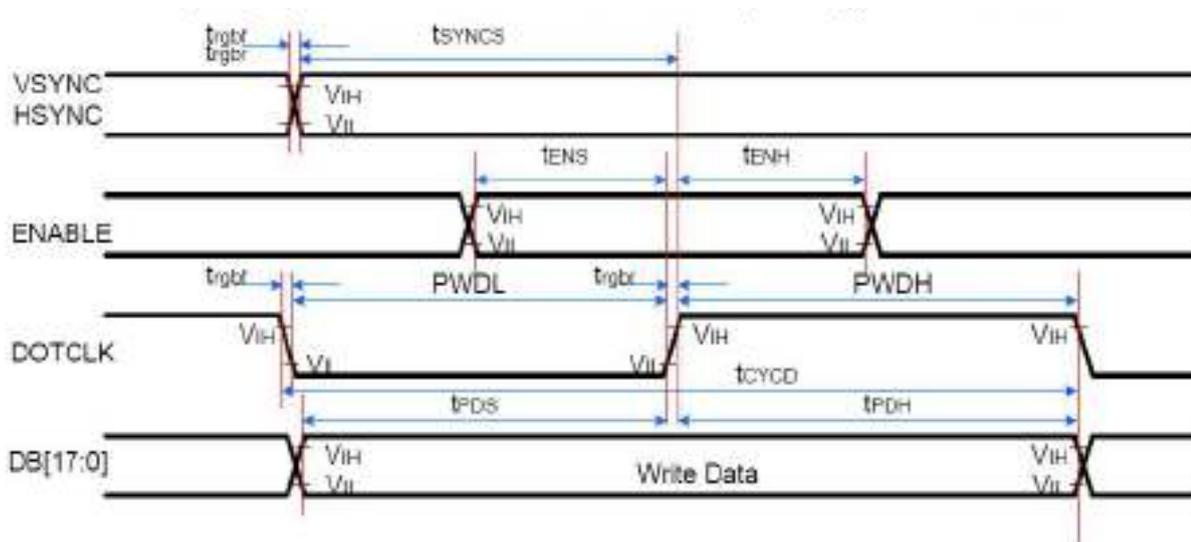Note: Luminance Uniformity of these 9 points is defined as below:
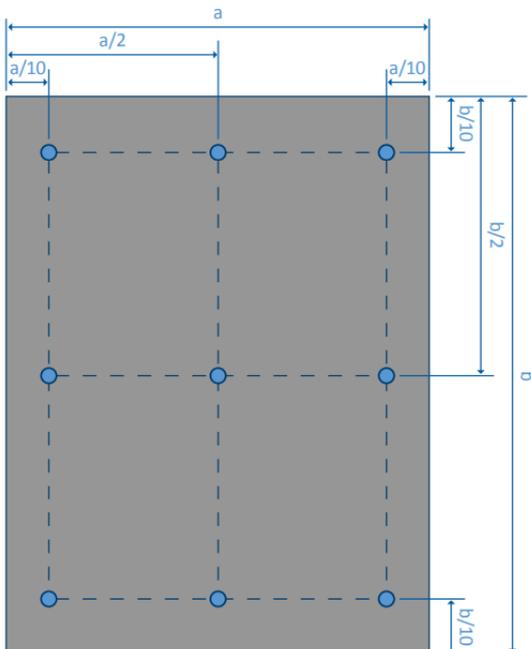
$$Luminance = \frac{(Total\ Luminance\ of\ 9\ points)}{9}$$

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

6. Interface Timing

6.1 DPI 16/18/24-bit Interface Timing Characteristics

Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC/ HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
ENABLE	t_{ENS}	ENABLE setup time	15	-	ns	
	t_{ENH}	ENABLE hold time	15	-	ns	
DB [23:0]	t_{PDS}	Data setup time	15	-	ns	16-/18-/24-bit bus RGB interface mode
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	20	-	ns	
	PWDL	DOTCLK low-level period	20	-	ns	
	t_{CYCD}	DOTCLK cycle time	50	-	ns	
	t_{rgbr}, t_{rgbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

Note: Ta = -30 to 70 ℃, IOVCC = 1.65V to 3.3V, VCI = 2.5V to 3.3V, AGND = DGND = 0V
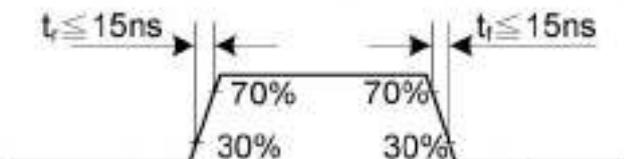
6.2 Controller Information

For more information on the controller, please see ILI9488 Controller Specification

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 °C 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.

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