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E20RD-XW350-N

Product Description

- 2.0-inch TFT (46.50x41.56mm)
- 320x240 Pixels
- 8/9/16/18-Bit MCU, 3/4-SPI+16/18-Bit RGB, 3/4-line Serial Interfaces
- Wide Temperature Range
- Wide Viewing Angle

- TN, Transflective
- No Touch Panel
- 350 NITS
- TFT IC: ILI9342C
- RoHS Compliant

LCD@FocusLCDs.com | 480-503-4295

Revision History

Date	Rev. No	Page	Summary
12/19/2019	1.0	All	First issue

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, and backlight unit. The resolution of the 2.0” TFT-LCD contains 320x240 pixels and can display up to 65K/262Kcolors.

Features

Input Voltage: 3.3V

TFT Interface: 8/9/16/18-Bit MCU, 3/4-SPI+16/18-Bit RGB, 3/4-line Serial

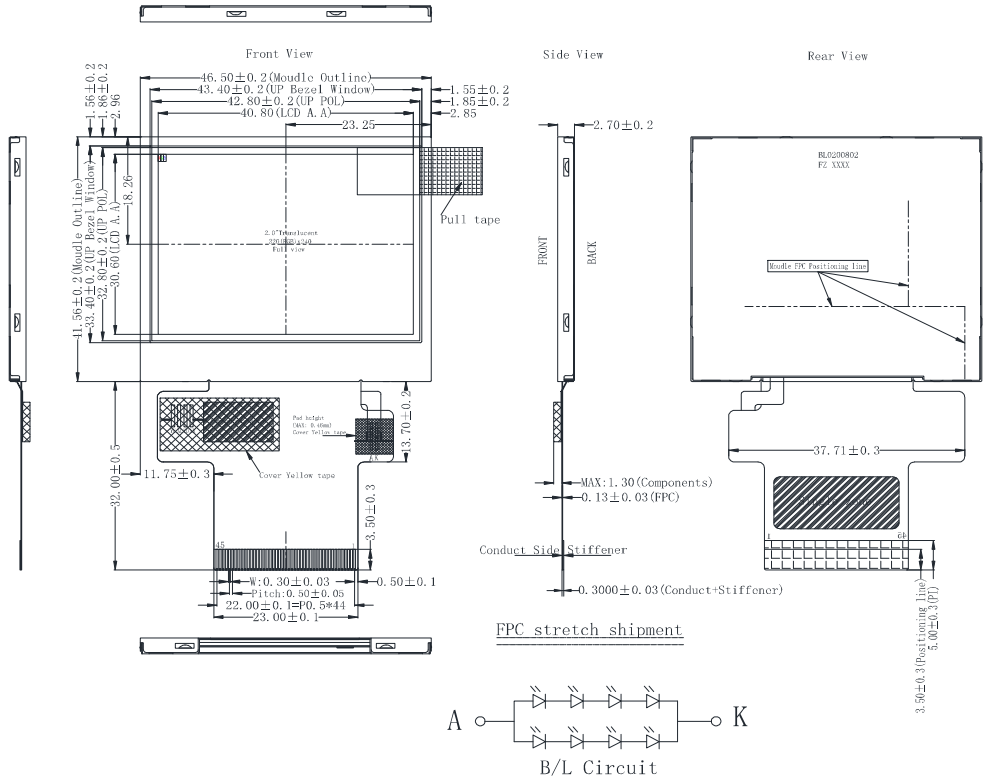
General Information Items	Specification	Unit	Note
	Main Panel		
TFT Display Area (AA)	40.80(H) x 30.60(V) (2.0 inch)	mm	--
Driver Element	TFT active matrix	--	--
Display Colors	65K/262K	colors	--
Number of Pixels	320(RGB)x240	dots	--
TFT Pixel Arrangement	RGB vertical stripe	--	--
Pixel Pitch	0.1275 (H) x 0.1275 (V)	mm	--
Viewing Angle	Wide	o'clock	--
TFT Controller IC	ILI9342C	--	--
Display Mode	Transflective/Normally Black	--	--
Operating Temperature	-20 to +70	°C	--
Storage Temperature	-30 to +80	°C	--

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	46.50	--	mm	--
	Vertical (V)	--	41.56	--	mm	--
	Depth (D)	--	2.70	--	mm	--
Weight		--	10	--	g	Approximate

1. Outline Dimensions

Rev.	Description	Date
1.0	First	12/19/2019



NO	PIN
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	NC
37	NC
38	LEDK
39	NC
40	LEDA
41	XR(NC)
42	YU(NC)
43	XL(NC)
44	YD(NC)
45	GND

NOTES:
1. DISPLAY TYPE: 2.0" TFT-LCD
2. DISPLAY MODE: TRANSFLECTIVE/NORMALLY BLACK
3. LCM DRIVER IC: ILI9342C
4. SUPPLY VOLTAGE: 3.3V
5. OPERATING TEMPERATURE: -20°C TO +70°C
6. STORAGE TEMPERATURE: -30°C TO +80°C
7. VIEWING DIRECTION: ALL
8. BACKLIGHT: 8 LED WHITE, VF = 12.0±0.3V, IF = 40mA
9. ROHS COMPLIANT.

Note: MCU Interface SET for IM PINS.

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	SDA SCL CS
1	1	1	4-Wire 8 BIT data serial interface	SDA SCL CS RS

NOTE: Fix pin to IOVCC, GND, or NC when not in use.

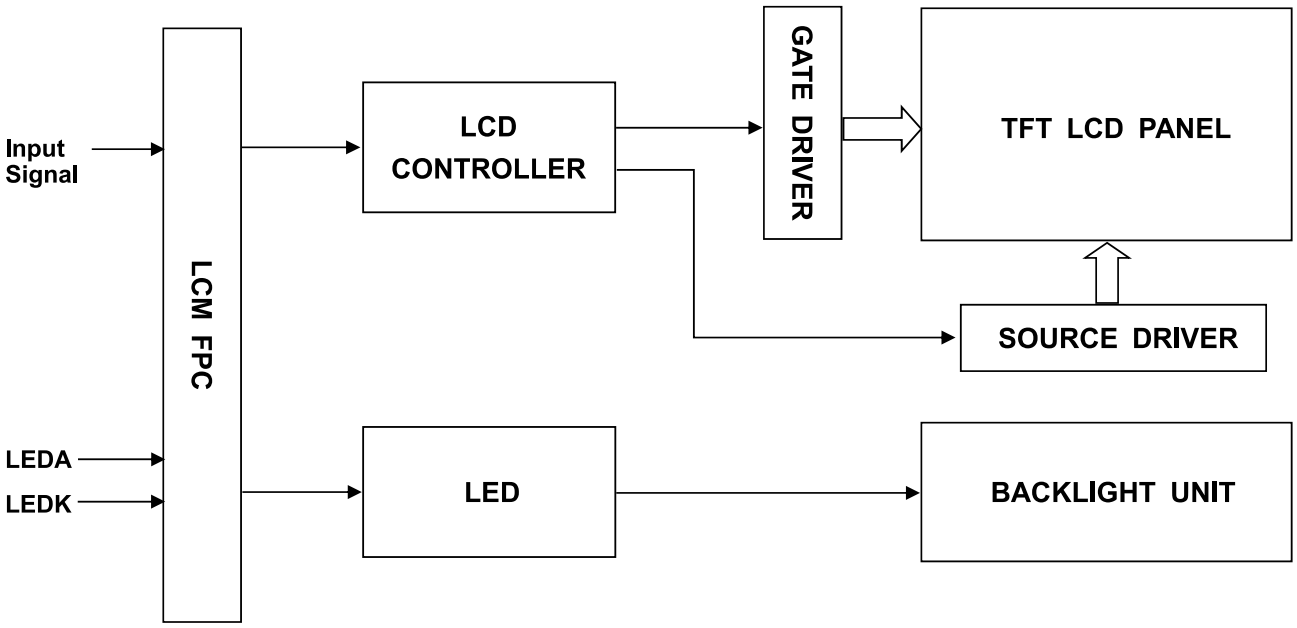
NOTE: RGB Interface

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

NOTE: If using the RGB mode, a serial interface must be selected.

Model Name:	E20RD-XW350-N	FOCUS LCDs LCDs MADE SIMPLE®	
General Tol:	±0.3		
Approvals	Date	Drawing No.:	Scale:
DWN:			
CHK:		Size:	Unit: mm / Page: 1/1
APP:			

2. Block Diagram



3. Input Terminal Pin Assignment

3.1 TFT Pin Assignment

<table>
<tr><th>NO.</th><th>Symbol</th><th>Description</th><th>I/O</th></tr>
<tr><td>1</td><td>GND</td><td>Ground.</td><td>P</td></tr>
<tr><td>2</td><td>GND</td><td>Ground.</td><td>P</td></tr>
<tr><td>3</td><td>IOVCC</td><td>Supply voltage (1.65-3.3V).</td><td>P</td></tr>
<tr><td>4</td><td>VCI</td><td>Supply voltage (3.3V).</td><td>P</td></tr>
<tr><td>5</td><td>IM3</td><td rowspan="3">Select the MCU interface mode
<table>
<tr><th>IM3</th><th>IM1</th><th>IM0</th><th>Interface type</th><th>DB Pin in use</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>DBI Tyb_ 8-bit interface</td><td>DB7-DB0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>DBI Tyb_ 16-bit interface</td><td>DB15-DB0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>DBI Tyb_ 9-bit interface</td><td>DB8-DB0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>DBI Tyb_ 18-bit interface</td><td>DB17-DB0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>3-Wire 9 BIT data serial interface.</td><td>SDA SCL CS</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>4-Wire 8 BIT data serial interface</td><td>SDA SCL CS RS</td></tr>
</table></td><td rowspan="3">I</td></tr>
<tr><td>6</td><td>IM1</td></tr>
<tr><td>7</td><td>IM0</td></tr>
<tr><td>8</td><td>SDA</td><td>Serial input signal. The data is applied on the rising edge of the SCL signal.
If not used, fix this pin at IOVCC or GND.</td><td>I</td></tr>
<tr><td>9</td><td>VSYNC</td><td>Frame synchronizing signal for RGB interface operation.
Fix this pin at IOVCC or GND when not in use.</td><td>I</td></tr>
<tr><td>10</td><td>HSYNC</td><td>Line synchronizing signal for RGB interface operation.
Fix this pin at IOVCC or GND when not in use.</td><td>I</td></tr>
<tr><td>11</td><td>DOTCLK</td><td>Dot clock signal for RGB interface operation.
Fix this pin at IOVCC or GND when not in use.</td><td>I</td></tr>
<tr><td>12</td><td>ENABLE</td><td>Data enable signal for RGB interface operation.
Fix this pin at IOVCC or GND when not in use.</td><td>I</td></tr>
<tr><td>13</td><td>RD</td><td>Serves as a read signal and MCU read data at the rising edge.
Fix this pin at IOVCC or GND when not in use.</td><td>I</td></tr>
<tr><td>14</td><td>WR(SPI-RS)</td><td>(WR): Serves as a write signal and writes data at the rising edge.
4-line system (RS): Serves as a command or parameter selection.
Fix to IOVCC or GND level when not in use.</td><td>I</td></tr>
<tr><td>15</td><td>RS(SPI-SCL)</td><td>This pin is used to select “Data or Command” in the parallel interface.
When RS = ’1’, data is selected.
When RS = ’0’, command is selected.
This pin is used as a serial interface clock in a 3-wire 9-bit / 4-wire 8-bit serial data interface.
If not used, this pin should be connected to IOVCC or GND.
RS_SCL1 is equal to RS(SCL).</td><td>I</td></tr>
<tr><td>16</td><td>CS</td><td>Chip select input pin (“Low” enable).
This pin can be permanently fixed “Low” in MPU interface mode only.
CSX1 is equal to CSX.</td><td>I</td></tr>
<tr><td>17</td><td>RESET</td><td>This signal resets the device and must be applied to properly initialize the chip.
Signal is active low.
RESX1 is equal to RESX.</td><td>I</td></tr>
</table>

18-35	DB17-DB0	18-bit parallel bi-directional data bus for MCU and RGB interface mode. Fix to GND level when not in use.	I/O
36	NC	Not connected.	--
37	NC	Not connected.	--
38	LEDK	Cathode pin of backlight.	P
39	NC	Not connected.	--
40	LEDA	Anode pin of backlight.	P
41	XR	Not connected.	--
42	YU	Not connected.	--
43	XL	Not connected.	--
44	YD	Not connected.	--
45	GND	Ground.	P

4. LCD Optical Characteristics

4.1 Optical Specifications

Item		Symbol	Condition	Min	Typ.	Max	Unit	Note
Color Gamut		S(%)		37	42	--	%	(5)
Reflection Ratio (With Polarizer)		R	θ=0 Normal viewing angle	5	7	--	%	
Reflective Contrast Ratio		Cr		--	5	--	%	
Contrast Ratio		CR		120	170	--		(2)
Response Time	Rising	T_R		--	30	50	ms	(4)
	Falling	T_F						
Color Filter Chromaticity	White	W_X		0.2517	0.2917	0.3317		(5)(6)
		W_Y		0.2626	0.3026	0.3426		
	Red	R_X		0.5101	0.5501	0.5901		
		R_Y		0.3079	0.3479	0.3879		
	Green	G_X		0.2931	0.3331	0.3731		
		G_Y		0.4998	0.5398	0.5798		
	Blue	B_X		0.1181	0.1581	0.1981		
		B_Y		0.0441	0.0841	0.1241		
Viewing Angle	Hor.	Θ_L	CR>10	60	80	--	degree	(1)(6)
		Θ_R		60	80	--		
	Ver.	Θ_T		60	80	--		
		Θ_B		60	80	--		
Option View Direction		ALL						(1)

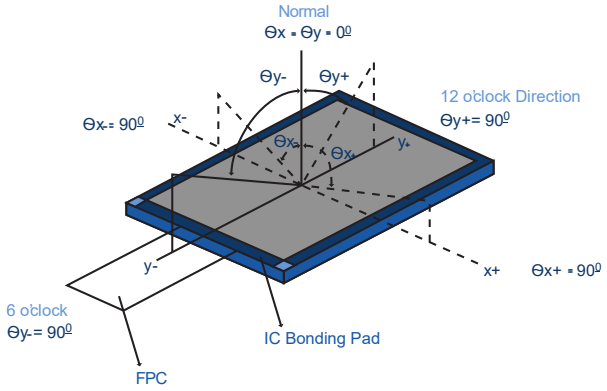
Measuring Conditions:

1. Dark Room
2. Ambient Temperature of 25±2°C
3. 15 Minute Warm up

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:

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).

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

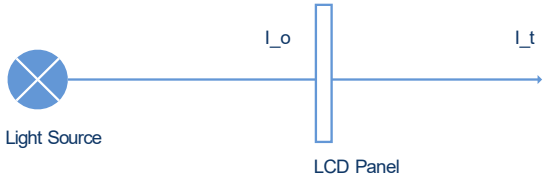
(3) Definition of Transmittance (T%):

The transmittance of the panel including the polarizers is measured with electrical driving. The equation for transmittance Tr is:

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

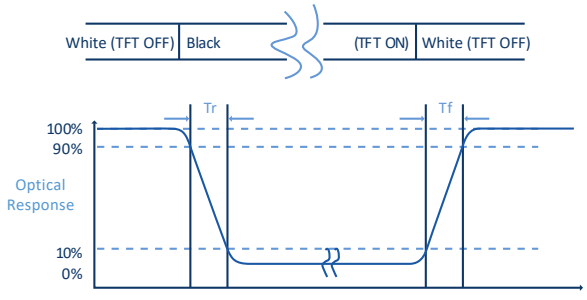
Io = the brightness of the light source.

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.

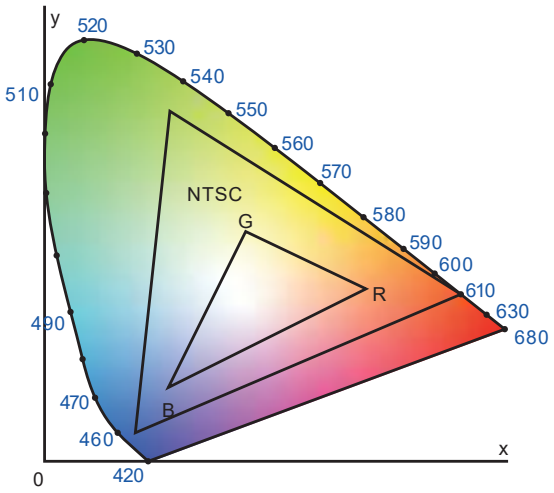
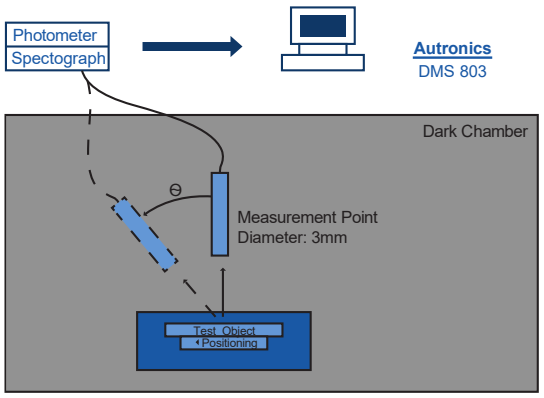


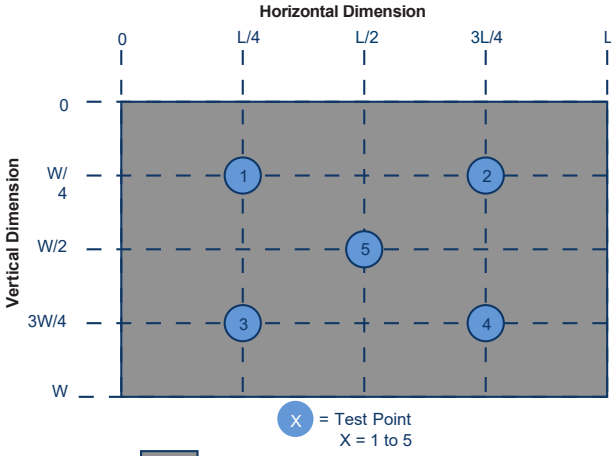
Fig. 1931 CIE Chromacity Diagram

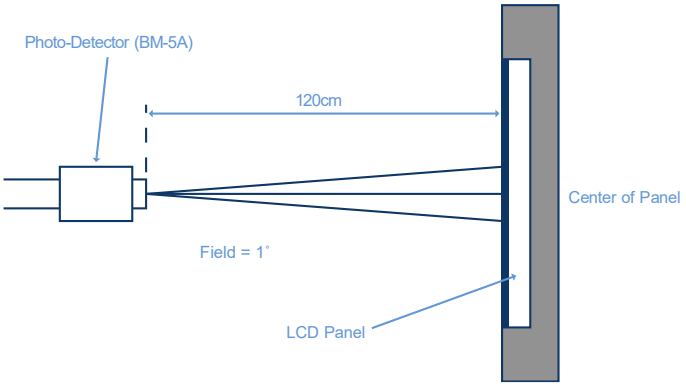
Color Gamut: $S = \frac{\text{Area of RGB Triangle}}{\text{Area of NTSC Triangle}} \times 100\%$

(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	VCI	-0.3	4.2	V
Supply Voltage (Logic)	IOVCC	-0.3	3.3	V
Operating Temperature	T_{OP}	-20	+70	°C
Storage Temperature	T_{ST}	-30	+80	°C

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	2.8/3.3	3.6	V	--
Supply Voltage (Logic)	IOVCC	1.65	1.8	3.3	V	--
Normal Mode Current Consumption	IDD	--	5	--	mA	--
Level Input Voltage	V_{IH}	0.7*IOVCC	--	IOVCC	V	--
	V_{IL}	GND	--	0.3*IOVCC	V	--
Level Output Voltage	V_{OH}	0.8*IOVCC	--	IOVCC	V	--
	V_{OL}	GND	--	0.2*IOVCC	V	--

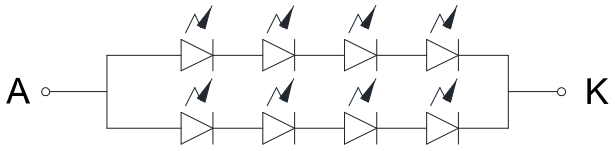
5.3 LED Backlight Characteristics

The backlight system is edge lighting type with 8 LED Chips

Item	Symbol	Min	Typ.	Max	Unit	Note
Forward Current	I_F	30	40	--	mA	--
Forward Voltage	V_F	--	12	--	V	--
LCM Luminance	L_V	300	350	--	cd/m^2	(3)
LED Lifetime	Hr	50000	--	--	hour	(1)(2)
Uniformity	Avg	80	--	--	%	(3)

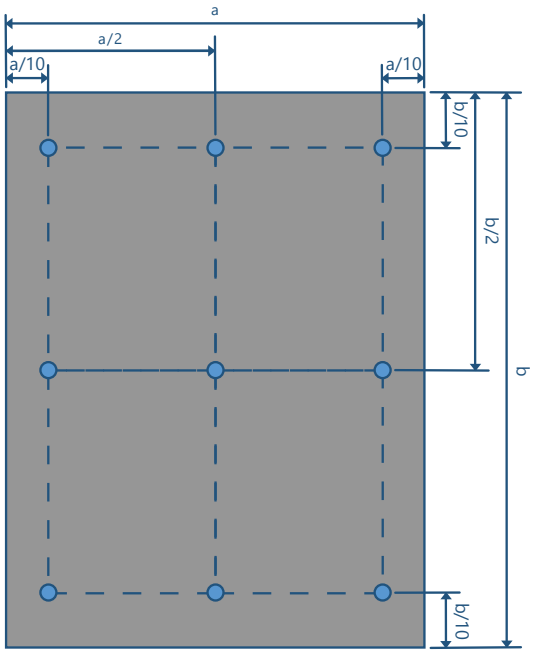
Note 1: *LED lifetime (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25 ±3°C, typical IL value indicated in the above table until the brightness becomes less than 50%.*

Note 2: *The "LED lifetime" is defined as the module brightness decrease to 50% original brightness at Ta=25° C and IF = 40mA. The LED lifetime could be decreased if operating IF is larger than 40mA. The constant current driving method is suggested.*



BL CIRCUIT DIAGRAM

Note 3: 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. TFT AC Characteristics

6.1 Display Parallel 8/9/16/18-bit Interface Timing Characteristics (8080 System)

For display parallel 8/9/16/18-bit interface timing characteristics (8080 system) diagrams and table, see page 228 of the data sheet for controller IC ILI9342C. The data sheet can be found here:
https://focuslcds.com/wp-content/uploads/Drivers/ILI9342C.pdf

6.2 Display Serial Interface Timing Characteristics (3-line SPI System)

For display serial interface timing characteristics (3-line SPI system) diagrams and table, see page 232 of the data sheet for controller IC ILI9342C. The data sheet can be found here:
https://focuslcds.com/wp-content/uploads/Drivers/ILI9342C.pdf

6.3 Display Serial Interface Timing Characteristics (4-line SPI system)

For display serial interface timing characteristics (4-line SPI system) diagrams and table, see page 233 of the data sheet for controller IC ILI9342C. The data sheet can be found here:
https://focuslcds.com/wp-content/uploads/Drivers/ILI9342C.pdf

6.4 Parallel 16/18BIT RGB Interface Timing Characteristics

For parallel 16/18-bit RGB interface timing characteristics diagrams and table, see page 234 of the data sheet for controller IC ILI9342C. The data sheet can be found here:
https://focuslcds.com/wp-content/uploads/Drivers/ILI9342C.pdf

6.5 RGB Interface Timing Characteristics

For RGB interface timing characteristics charts, see page 50 of the data sheet for controller IC ILI9342C. The data sheet can be found here:
https://focuslcds.com/wp-content/uploads/Drivers/ILI9342C.pdf

6.6 Reset Timing Characteristics

For reset timing characteristics charts and tables, see page 222 of the data sheet for controller IC ILI9342C. The data sheet can be found here: *https://focuslcds.com/wp-content/uploads/Drivers/ILI9342C.pdf*

7. Quality Inspection Standards

For TFT quality inspection standards, please see the following link:
https://focuslcds.com/lcd-resources/tft-quality-inspection-standards/

8. Cautions and Handling Precautions

8.1 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.

8.2 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.