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

## TFT Display Module

Part Number

E101RA-I-MS300-C

### Overview:

- 10.1-inch TFT (42.72x60.4 I I)
- 1200x1920 iC-F1
- 4-lane MIPI LIT ↑ LIT
- 16.7M colors
- All View
- Transmissive
- Capacitive Touch Panel
- 300 NITS
- TFT IC: NT51021
- 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, a capacitive touch panel and a backlight unit. The resolution of the 10.1" TFT LCD contains 1200(RGB)x1920 pixels and can display up to 16.7M colors.

## TFT Features

Low Input Voltage: 3.3V

Display Colors: 16.7M (RGB 888)

TFT Interface: 4-lane MIPI

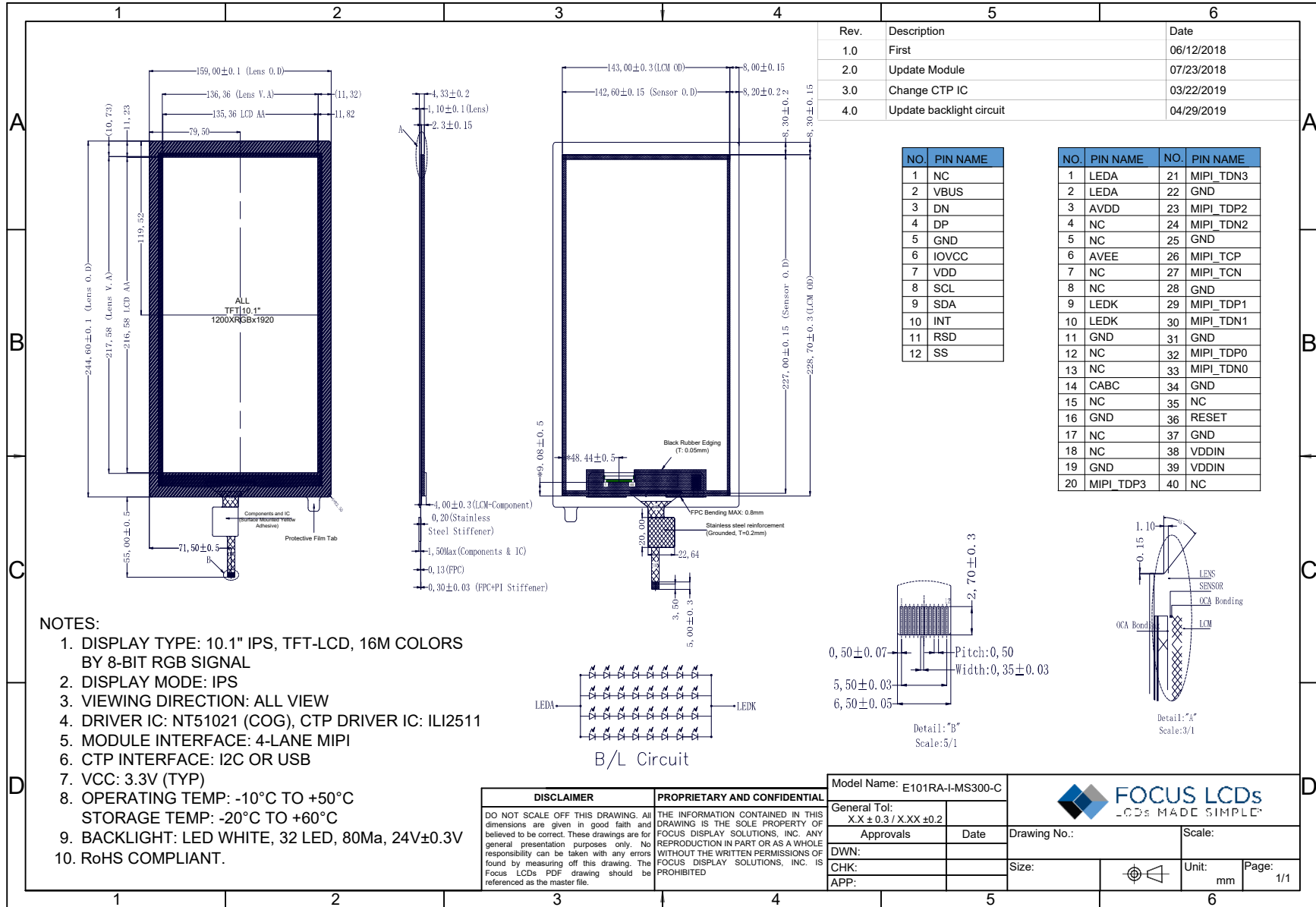
CTP Interface: I2C, USB

General Information Items	Specification	Unit	Note
	Main Panel		
TFT Display area (AA)	135.36(H) x 216.58(V) (10.1 inch)	mm	-
Driver Element	TFT active matrix	-	-
Display Colors	16.7M	colors	-
Number of pixels	1200(RGB)x1920	dots	-
TFT Pixel arrangement	RGB vertical stripe	-	-
Pixel Pitch	0.1128(H)x0.1128(V)	mm	-
Viewing angle	All	o'clock	-
Display mode	Transmissive, Normally Black	-	-
Touch Mode	True Multi-touch	-	-
Touch IC	ILI2511	-	-
TFT IC	NT51021	-	-
Bonding Type	Tape	-	-
Operating temperature	-10-+50	°C	-
Storage temperature	-20-+60	°C	-

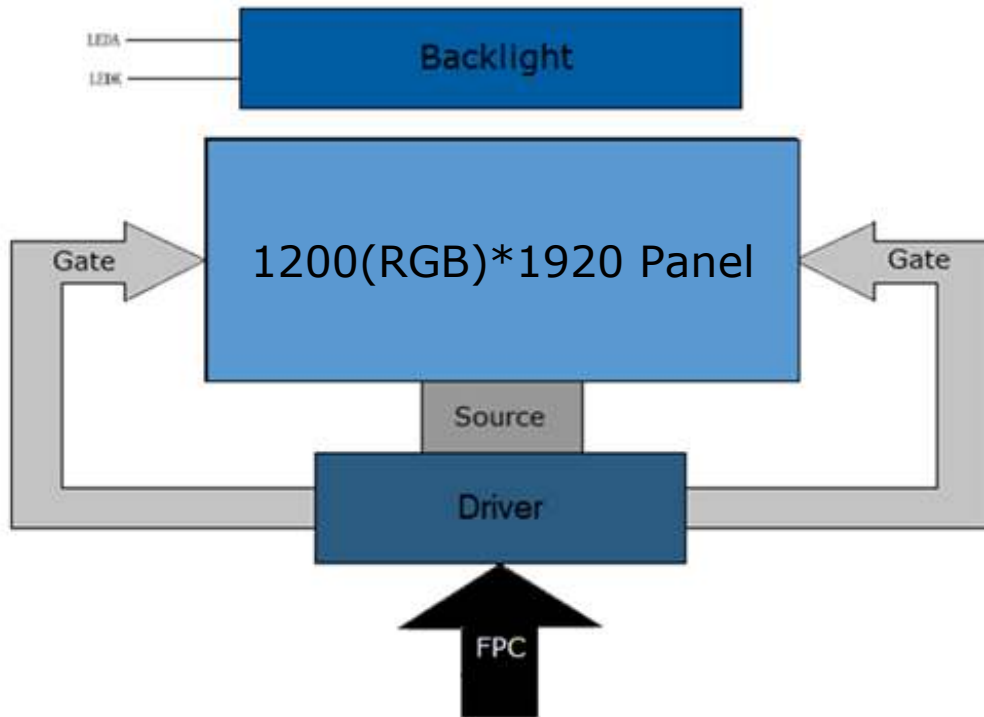
## Mechanical Information

Item		Min	Typ.	Max	Unit	Note
Module Size	Horizontal (H)		159.0		mm	-
	Vertical (V)		244.6		mm	-
	Depth (D)		4.33		mm	-
	Weight		--		g	

# 1. Outline Dimensions



## 2. Block Diagram



### 3. Input Terminal Pin Assignment

#### 3.1 TFT

NO.	Symbol	Description	I/O
1-2	LEDA	Anode pin of the backlight	P
3	AVDD	Open	
4-5	NC		
6	AVEE		
7-8	NC		
9-10	LEDK	Cathode pin of the backlight	P
11	GND	Ground	P
12-13	NC	Open	
14	CABC	PWM control of the backlight LED driver	I
15	NC	Open	
16	GND	Ground	P
17-18	NC	Open	
19	GND	Ground	P
20	MIPI_TDP3	MIPI data input	I/O
21	MIPI_TDN3		
22	GND	Ground	P
23	MIPI_TDP2	MIPI data input	I/O
24	MIPI_TDN2		
25	GND	Ground	P
26	MIPI_TCP	MIPI clock input	I
27	MIPI_TCN		
28	GND	Ground	P
29	MIPI_TDP1	MIPI data input	I/O
30	MIPI_DSN1		
31	GND	Ground	P
32	MIPI_TDP0	MIPI data input	I/O
33	MIPI_TDN0		
34	GND	Ground	P
35	NC	Open	
36	RESET	Reset signal of the device	I
37	GND	Ground	P
38-39	VDDIN	Power supply, 3.3V	P
40	NC	Open	

#### 3.2 CTP

NO.	Symbol	Description	I/O
1	PSEL	Power select pin. Low, powered by external voltage. High, powered by USB.	I
2	VBUS	VBUS sensor input pin. Should be connected to USB power when used.	P
3	DN	USB D-	I/O
4	DP	USB D+	I/O
5	GND	Ground	P
6	IOVCC	I/O power supply voltage for the I2C interface	P
7	VDD	Supply voltage	P
8	SCL	I2C clock input	I
9	SDA	I2C data input	I
10	INT	External interrupt pin	I
11	RST	Reset signal	I
12	SS	Ground	P

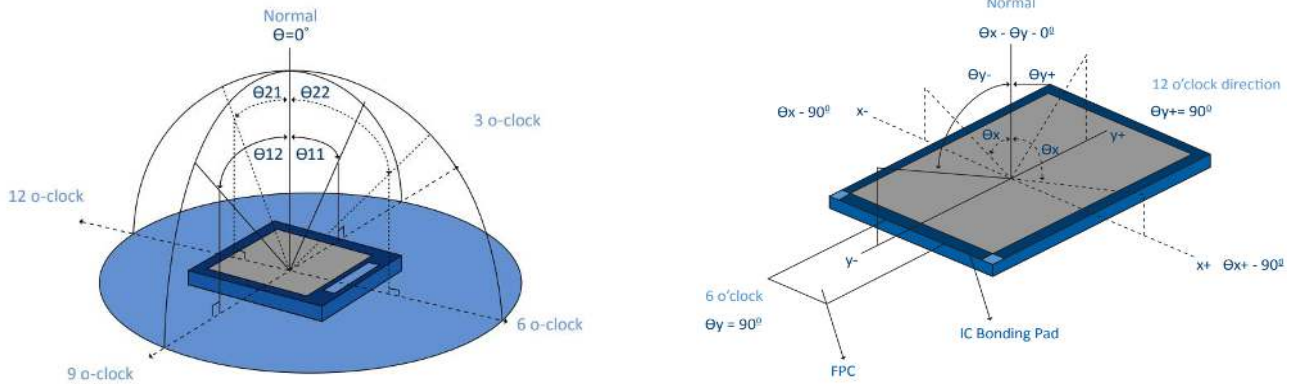
## 4. LCD Optical Characteristics

### 4.1 Optical Specifications

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note	
Color Gamut	S	Normal viewing angle $\theta=0$	--	80	--	%	(3)	
Contrast Ratio	CR		600	800	--	%	(2)	
Response Time	Rising		TR	--	25	50	ms	(4)
	Falling		TF					
Color Filter Chromaticity	White		W <sub>X</sub>	0.246	0.286	0.326		(5)(6)
			W <sub>Y</sub>	0.281	0.321	0.361		
	Red		R <sub>X</sub>	0.579	0.619	0.659		
			R <sub>Y</sub>	0.289	0.329	0.369		
	Green		G <sub>X</sub>	0.261	0.301	0.341		
			G <sub>Y</sub>	0.560	0.600	0.640		
	Blue	B <sub>X</sub>	0.110	0.150	0.190			
		B <sub>Y</sub>	0.019	0.059	0.099			
Viewing Angle	Hor.	ΘL	--	85	--	degrees	(1)(6)	
		ΘR	--	85	--			
	Ver.	ΘT	--	85	--			
		ΘB	--	85	--			
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.

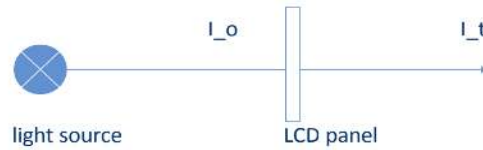


(2) Definition of Contrast Ratio (Cr): measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

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

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

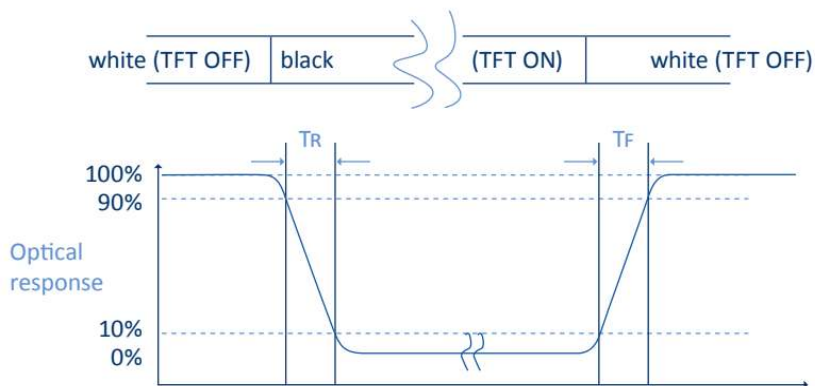
$$Tr = \frac{I_t}{I_o} \times 100\%$$



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.

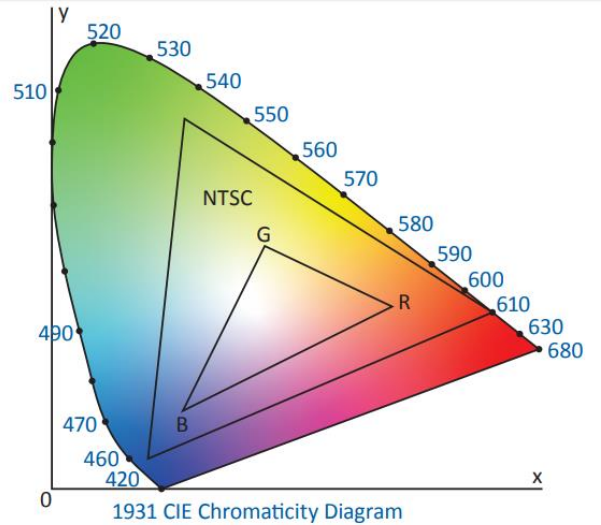
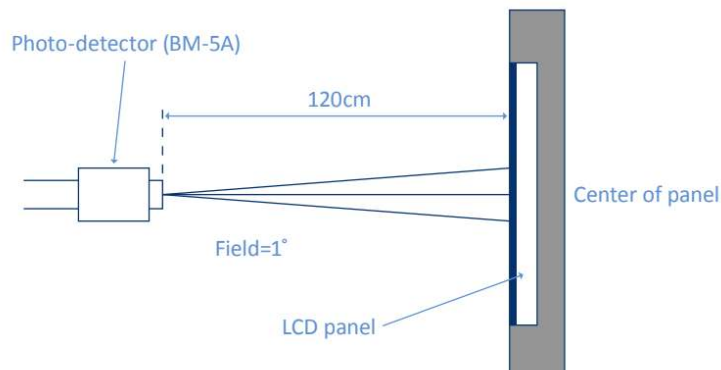
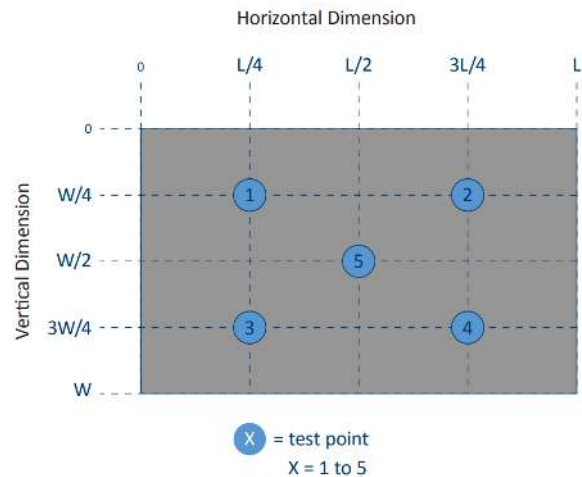
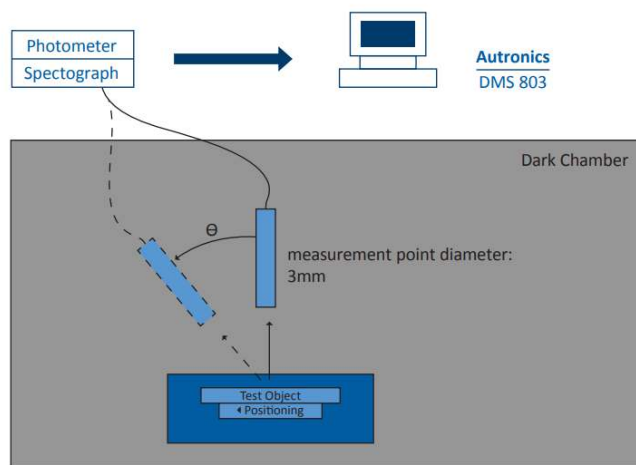


Fig. 1931 CIE chromacity diagram

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

(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	VCI	-0.3	4.0	V
Operating Temperature	TOP	-20	+70	°C
Storage Temperature	TST	-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	VDD	3.1	3.3	3.6	V	
Level Input Voltage	V <sub>IH</sub>	0.7VDD	--	VDD	V	
	V <sub>IL</sub>	GND	--	0.3VDD	V	

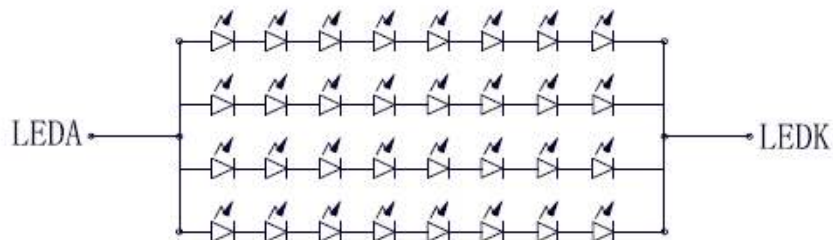
### 5.3 LED Backlight Characteristics

Item	Symbol	Min	Typ.	Max	Unit	Note
Forward Current	IF	60	80	--	mA	
Forward Voltage	VF	--	24	--	V	
LCM Luminance	LV	--	300	--	cd/m <sup>2</sup>	Note 3
LED lifetime	Hr	--	50000	--	hour	Note1 & 2
Uniformity	AVg	80	--	--	%	Note 3

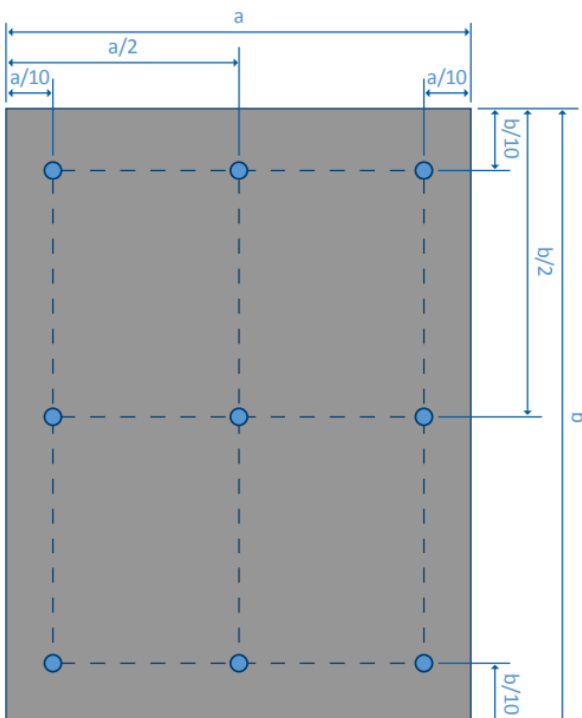
The back-light system is edge-lighting type with 28 white LEDs.

Note 1: LED lifetime (Hr) can be defined as the time in which it continues to operate under the condition:  $T_a=25\pm 3\text{ }^\circ\text{C}$ , 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  $T_a=25^\circ\text{C}$  and  $I_L=80\text{mA}$ . The LED lifetime could be decreased if operating  $I_L$  is larger than 80mA. The constant current driving method is suggested.



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

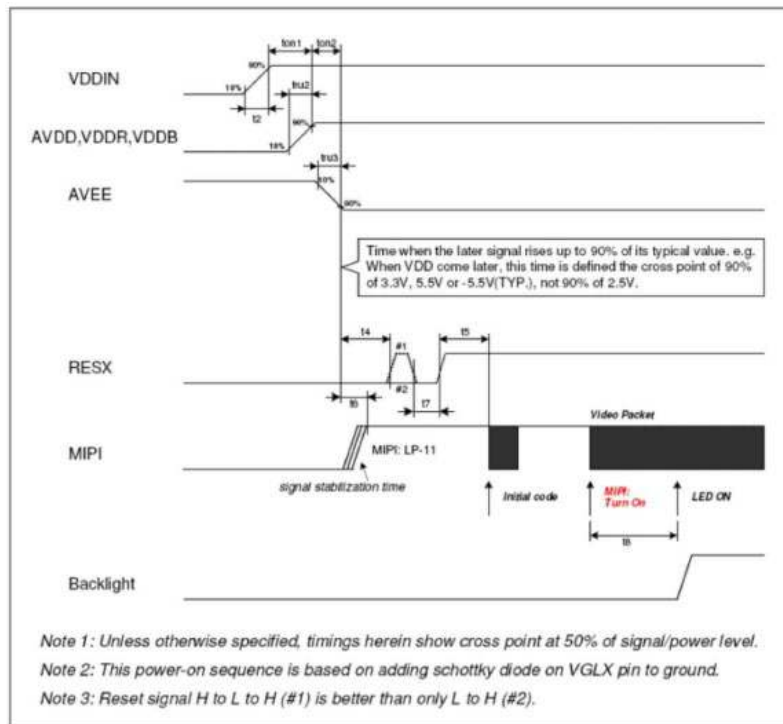


$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

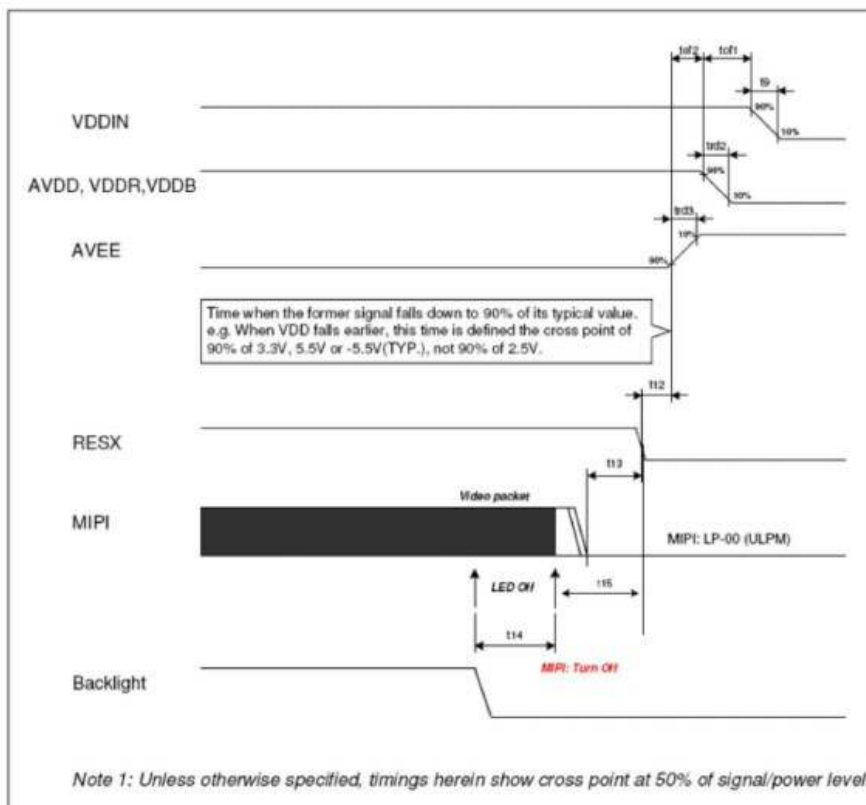
$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points(1-9)}}{\text{maximum luminance in 9 points(1-9)}}$$

## 6. AC Electrical Characteristics

### 6.1 Power On Timing



### 6.2 Power Off Timing



## 7. CTP Specifications

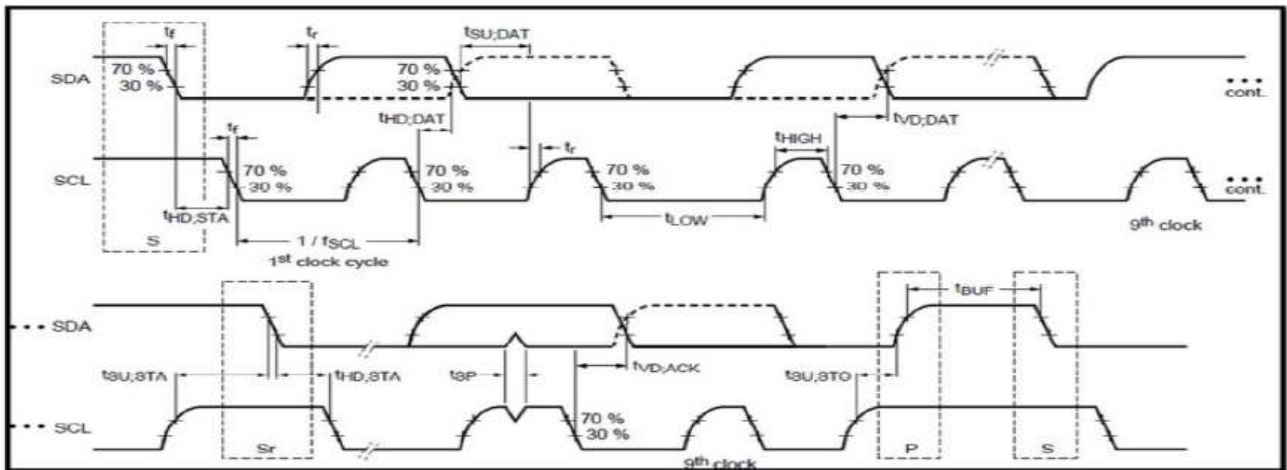
Characteristics	Symbol	Min	Max	Unit
Digital Supply Voltage	VDD	-0.3	3.6	V
I/O Digital Voltage	IOVCC	0.3	3.6	V
Operating Temperature	TOP	-40	+105	°C
Storage Temperature	TST	-40	+150	°C

*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.*

### 7.1 DC Electrical Characteristics

Characteristics	Symbol	Min	Typ.	Max	Unit	Note
Digital Supply Voltage	VDD	3.0	3.3	3.6	V	
USB 5V Input Voltage	VDD5	4.4	5	5.5	V	
Analog Input Voltage	VDD3A	3.0	3.3	3.6	V	
I/O Input Voltage	VDDIO	1.8	--	3.6	V	
Level Input Voltage	V <sub>IH</sub>	0.6VDDIO	--	VDDIO+0.5	V	
	V <sub>IL</sub>	GND	--	0.3VDDIO	V	
Level Output Voltage	V <sub>OH</sub>	0.7VDDIO	--	--		
	V <sub>OL</sub>	--	--	0.4VDDIO		

## 7.2 I2C AC Characteristics



Characteristics	Symbol	Standard Mode		Fast Mode		Unit
		Min	Max	Min	Max	
SCL clock frequency	$t_{SCL}$	0	100	0	400	kHz
Hold time start condition	$t_{HD:STA}$	4	--	0.6	--	us
Low period of the SCL clock	$t_{LOW}$	4.7	--	1.3	--	us
High period of SCL	$t_{HIGH}$	4	--	0.6	--	us
Setup time for repeat start	$t_{SU:STA}$	4.7	--	0.6	--	us
Data hold time	$t_{HD:DAT}$	300	--	300	--	ns
Data setup time	$t_{SU:DAT}$	250	--	100	--	ns
Rise time of SDA and SCL	$t_R$	--	1000	20	300	ns
Fall time of SDA and SCL	$t_F$	--	300	20	300	ns
Setup time for stop	$t_{SU:STO}$	4.0	--	0.6	--	us
Bus free time between stop and start	$t_{BUF}$	4.7	--	1.3	--	us
Capacitive load for each bus line	$C_b$	--	400	--	400	pF
Noise margin at low level	$V_{nL}$	0.1VDD	--	0.1VDD	--	V
Noise margin at high level	$V_{nH}$	0.2VDD	--	0.2VDD	--	V

## **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 °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.