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

TFT Display Module

Part Number

E35KB-FW1000-N

Overview:

- 3.5-inch TFT (54.46x82.94mm)
- 320x480 pixels
- MIPI/DSI Interface
- Wide Temp
- White LED back-light
- Transmissive
- No Touch Panel
- 1000 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 16.7M colors.

TFT Features

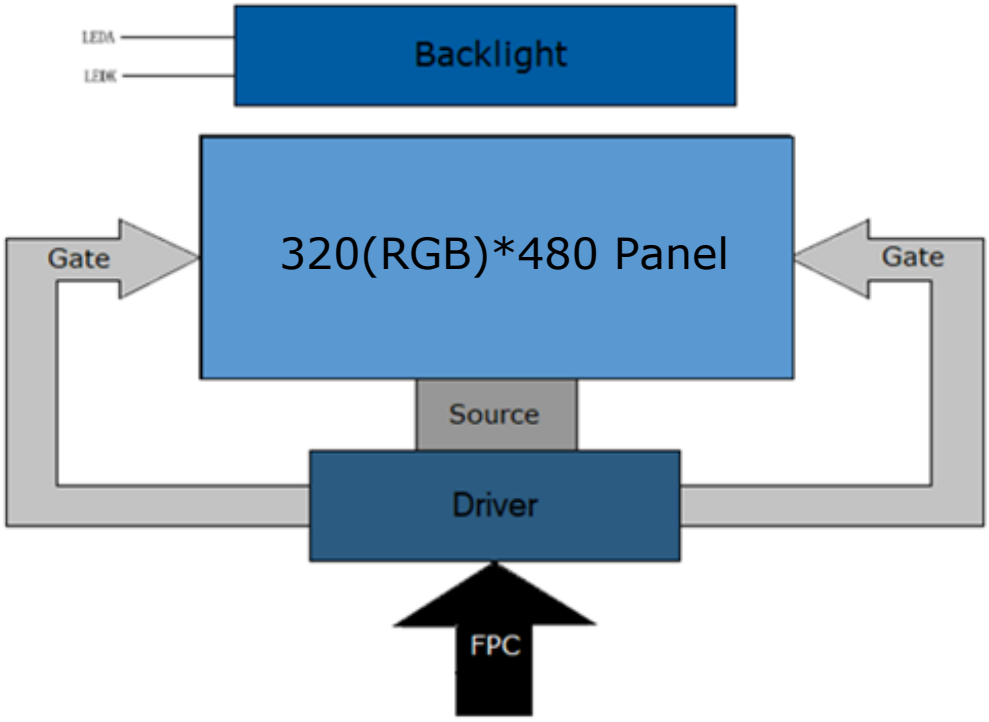
Low Input Voltage: IOVCC: 1.65-3V, VCI: 2.5-3.3V
Display Colors: 16.7M colors
TFT Interfaces: MIPI Video Mode
Internal Power Supply Circuit

General Information Items	Specification Main Panel	Unit	Note
TFT Display area (AA)	48.96 (H) x 73.44 (V) (3.5 inch)	mm	-
Driver element	TFT active matrix	-	-
Display colors	16.7M	colors	-
Number of pixels	320(RGB)x480	dots	-
TFT Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	51 (H) x 153 (V)	mm	-
Viewing angle	ALL	o'clock	-
TFT Controller IC	ILI9488	-	-
LCM Interface	MIPI	-	-
Display mode	Transmissive/ Normally Black	-	-
Operating temperature	-20～+70	℃	-
Storage temperature	-30～+80	℃	-

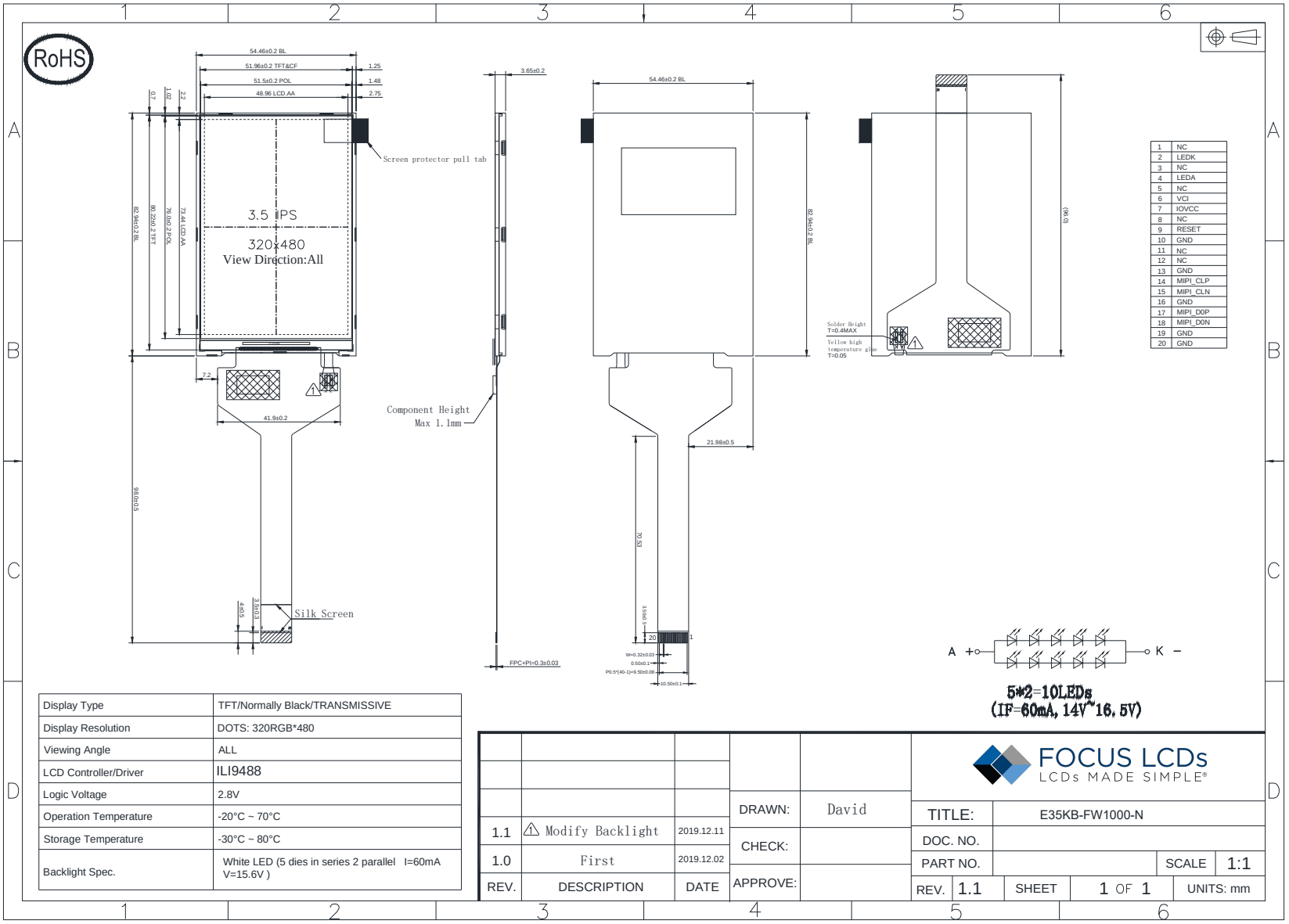
Mechanical Information

Item		Min	Typ.	Max	Unit	Note
Module size	Height (H)		54.46		mm	-
	Vertical (V)		82.94		mm	-
	Depth (D)		3.65		mm	-

1. Block Diagram



2. Outline Dimensions



Display Type	TFT/Normally Black/TRANSMISSIVE
Display Resolution	DOTS: 320RGB*480
Viewing Angle	ALL
LCD Controller/Driver	ILI9488
Logic Voltage	2.8V
Operation Temperature	-20°C ~ 70°C
Storage Temperature	-30°C ~ 80°C
Backlight Spec.	White LED (5 dies in series 2 parallel I=60mA V=15.6V)

REV.	DESCRIPTION	DATE
1.1	⚠ Modify Backlight	2019.12.11
1.0	First	2019.12.02

DRAWN: David
CHECK:
APPROVE:

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TITLE:	E35KB-FW1000-N		
DOC. NO.			
PART NO.		SCALE	1:1
REV. 1.1	SHEET 1 OF 1		UNITS: mm

3. Input Terminal Pin Assignment

Recommended Connector: FH19C-20S-0.5SH(10)

NO.	Symbol	Description	I/O
1	NC	--	
2	LEDK	Cathode of the backlight LED	P
3	NC	--	
4	LEDA	Anode of the backlight LED	P
5	NC	--	
6	VCI	Supply voltage (3.3V)	P
7	IOVCC	Supply voltage (1.65-3V)	P
8	NC	--	
9	RESET	Reset signal of the device.	I
10	GND	Ground	P
11	NC	--	
12	NC	--	
13	GND	Ground	P
14	MIPI_CLKP	Clock lane positive end input pin	I
15	MIPI_CLKN	Clock lane negative end input pin	I
16	GND	Ground	P
17	MIPI_D0P	Differential data positive signal pin	I
18	MIPI_D0N	Differential data negative signal pin	I
19	GND	Ground	P
20	GND	Ground	P

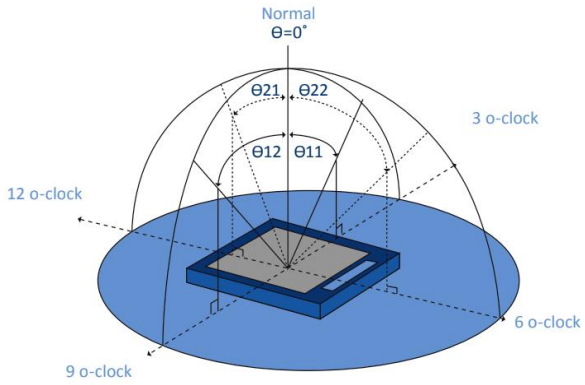
4. LCD Optical Characteristics

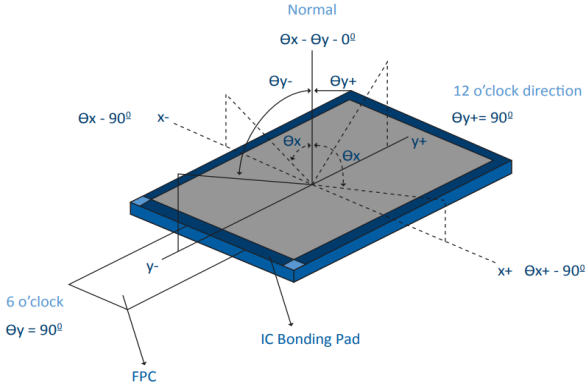
4.1 Optical Specifications

Item		Symbol	Condition	Min	Typ.	Max	Unit	Note
Transmittance		T%		--	4.3	--	%	
Contrast Ratio		CR	θ=0 Normal viewing angle	--	700	--	%	(2)
Response Time	Rising	TR+TF		--	30	--	ms	
	Falling							
Color Filter Chromaticity	White	W_X		--	0.309	--		(5)(6)
		W_Y		--	0.332	--		
	Red	R_X		--	0.660	--		
		R_Y		--	0.325	--		
	Green	G_X		--	0.277	--		
		G_Y		--	0.568	--		
	Blue	B_X		--	0.145	--		
		B_Y		--	0.072	--		
Viewing Angle	Hor.	ΘL	CR≥10	--	80	--	degree	(1)(6)
		ΘR		--	80	--		
	Ver.	ΘT		--	80	--		
		ΘB		--	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.



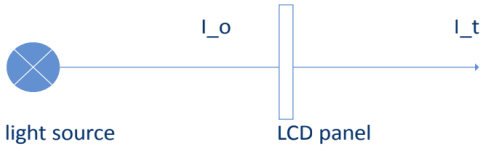


(2) Definition of Contrast Ratio (Cr): measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

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

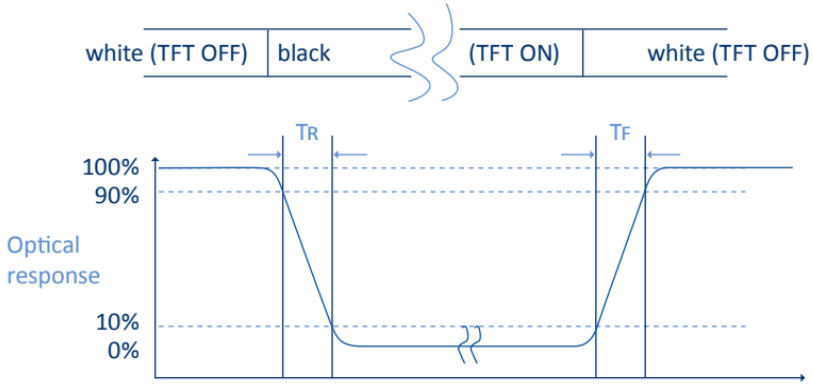
(3) Definition of transmittance (T%): The transmittance of the panel including the polarizers is measured with electrical driving. The equation for transmittance Tr is:

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



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.

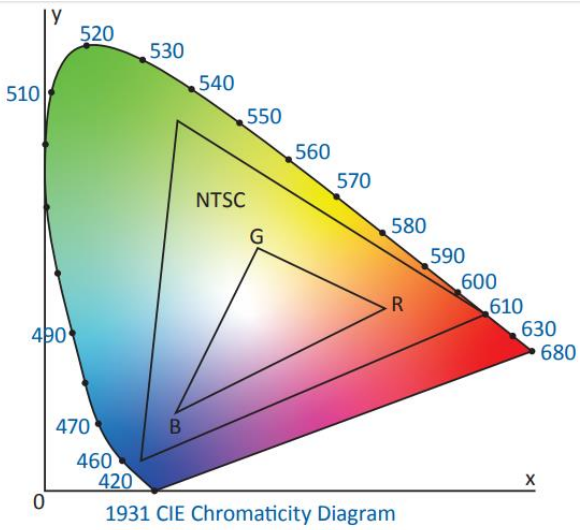
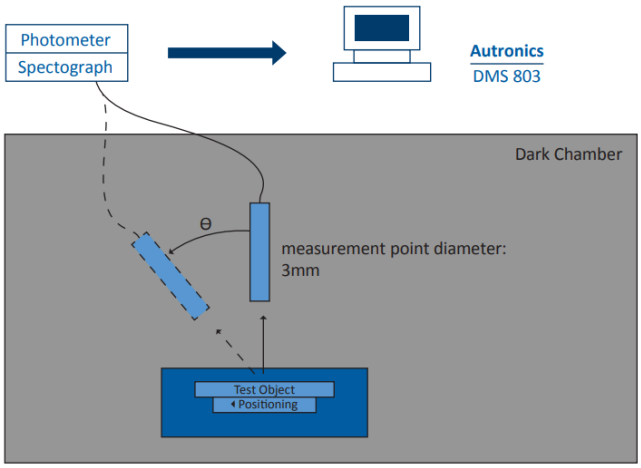


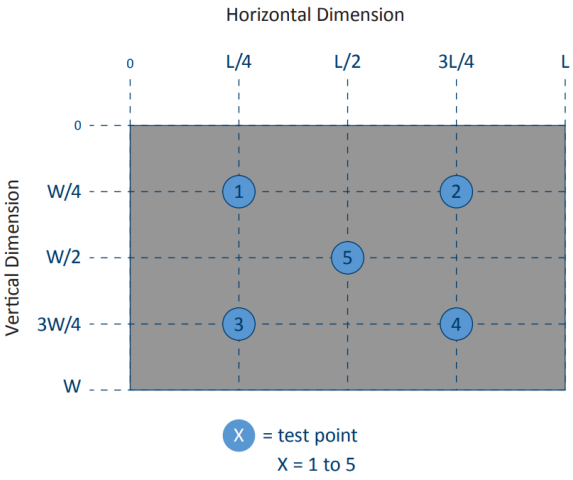
Fig. 1931 CIE chromacity diagram

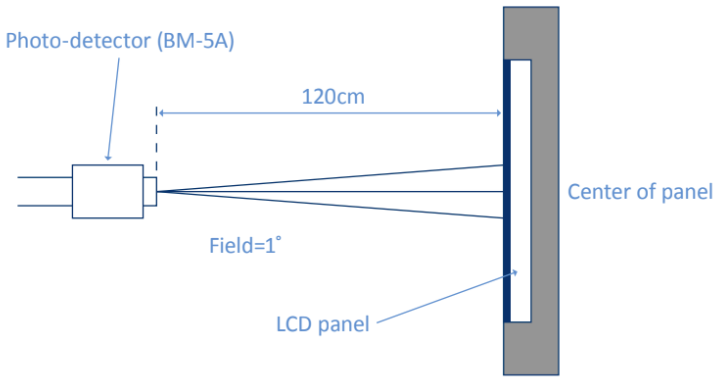
Color gamut: $S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$

(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
Supply Voltage for Logic Circuit	IOVCC	-0.3	3.3	V
Supply Voltage for Analog Circuit	VCI	-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	2.8	3.3	V	
Digital Interface Supply Voltage	IOVCC	1.65	1.8	3.3	V	
Normal Mode Current Consumption	ICC	--	--	15	mA	VCC=2.8V

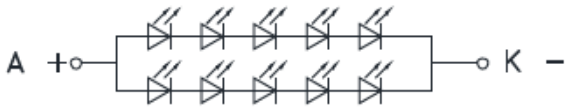
5.3 LED Backlight Characteristics

The backlight system is edge lighting type with 10 chips LED.

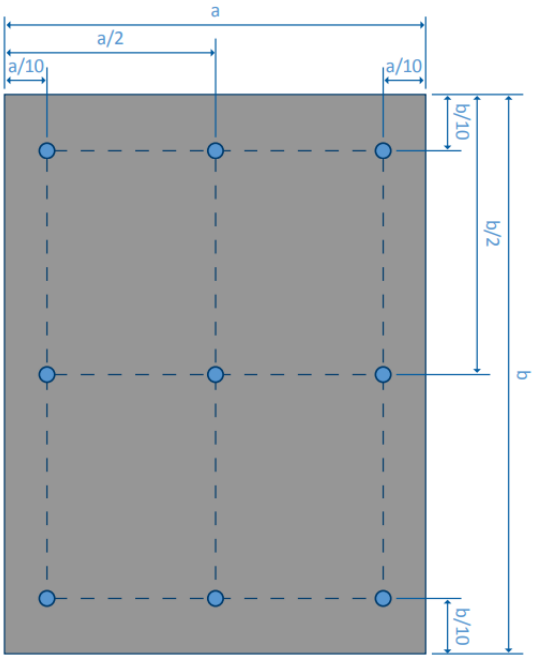
Item	Symbol	Min	Typ.	Max	Unit	Note
Forward Current	I_F	--	60	--	mA	
Forward Voltage	V_F	14	--	16.5	V	
LCM Luminance	LV	850	1000	--	cd/m2	Note 3
LED lifetime	Hr	50000	--	--	hour	Note1 & 2
Uniformity	AVg	80	--	--	%	Note 3

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.



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

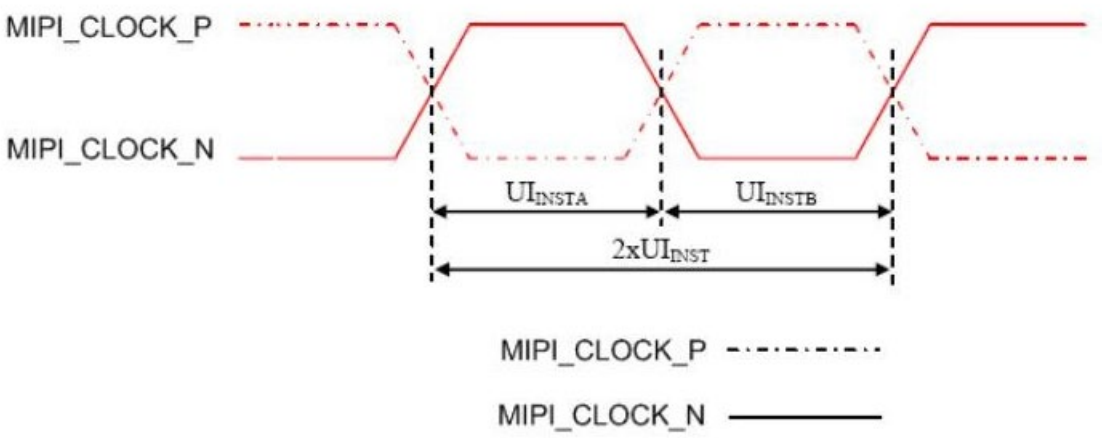


$$\text{Luminance} = \frac{\text{(Total Luminance of 9 points)}}{9}$$

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

6. Timing Characteristics of the DSI

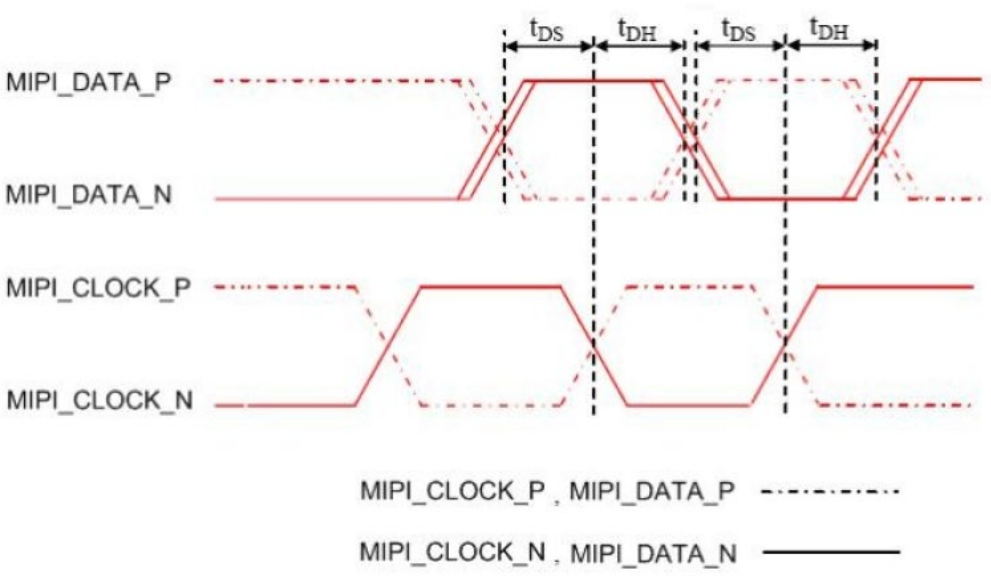
6.1 High Speed Mode – Clock Channel Timing



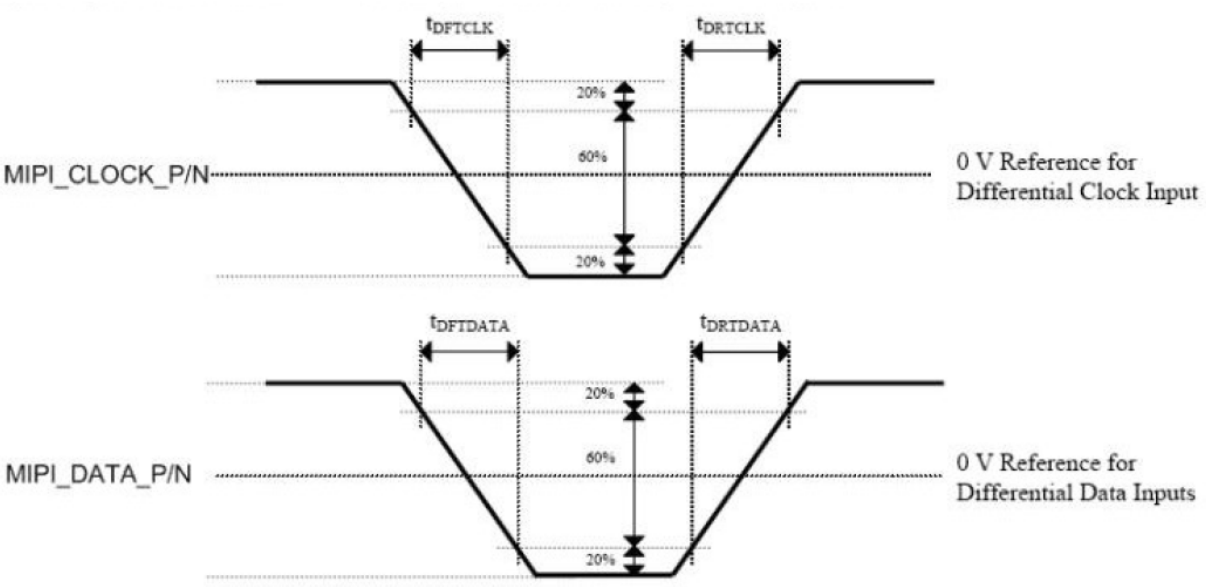
Parameter	Symbol	Condition	Min	Max	Unit
MIPI_CLOCK_P/N	2xUIINST	Double UI Instantaneous	4	25	ns
MIPI_CLOCK_P/N	UIINSTA, UIINSTB (1)	UI Instantaneous Half	2 (2)	12.5	ns

Note (1): UI=UIINSTA=UIINTB, (2) See Table for minimum value of 24 UI per pixel.

6.2 High Speed Mode – Data Clock Channel Timing



Parameter	Symbol	Condition	Min	Max	Unit
MIPI_CLOCK_P/N	tDS	Data to clock setup time	0.15xUI	--	ps
MIPI_CLOCK_P/N	tOH	Clock to data hold time	0.15xUI	--	ps



Parameter	Symbol	Condition	Min	Max	Unit
Differential rise time for clock	tDRTCLK	MIPI_CLOCK_P/N	-	900	ps
Differential rise time for data	tDRTDATA	MIPI_DATA_P/N	-	900	ps
Differential fall time for clock	tDFTCLK	MIPI_CLOCK_P/N	-	900	ps
Differential fall time for data	tDFTDATA	MIPI_DATA_P/N	-	900	ps

Note: The display module has to meet timing requirements, which are defined for the transmitter MCU on MIPI D-Phy standard.

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.