



Microtips

TECHNOLOGY

Model No: MTD0390BZR

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Record of Revision

Date	Revision No.	Summary
2017-05-29	1.0	Rev 1.0 was issued
2018-08-27	2.0	Change driver IC model; Modify luminance; Modify Chromaticity; Modify Backlight Characteristics; Change Command/AC timing.

1. Scope

This data sheet is to introduce the specification of MTD0390BZR active matrix TFT module. It is composed of a color TFT-LCD panel, driver IC, FPC and a backlight unit. The 3.9" display area contains 480x(RGB)x128 pixels.

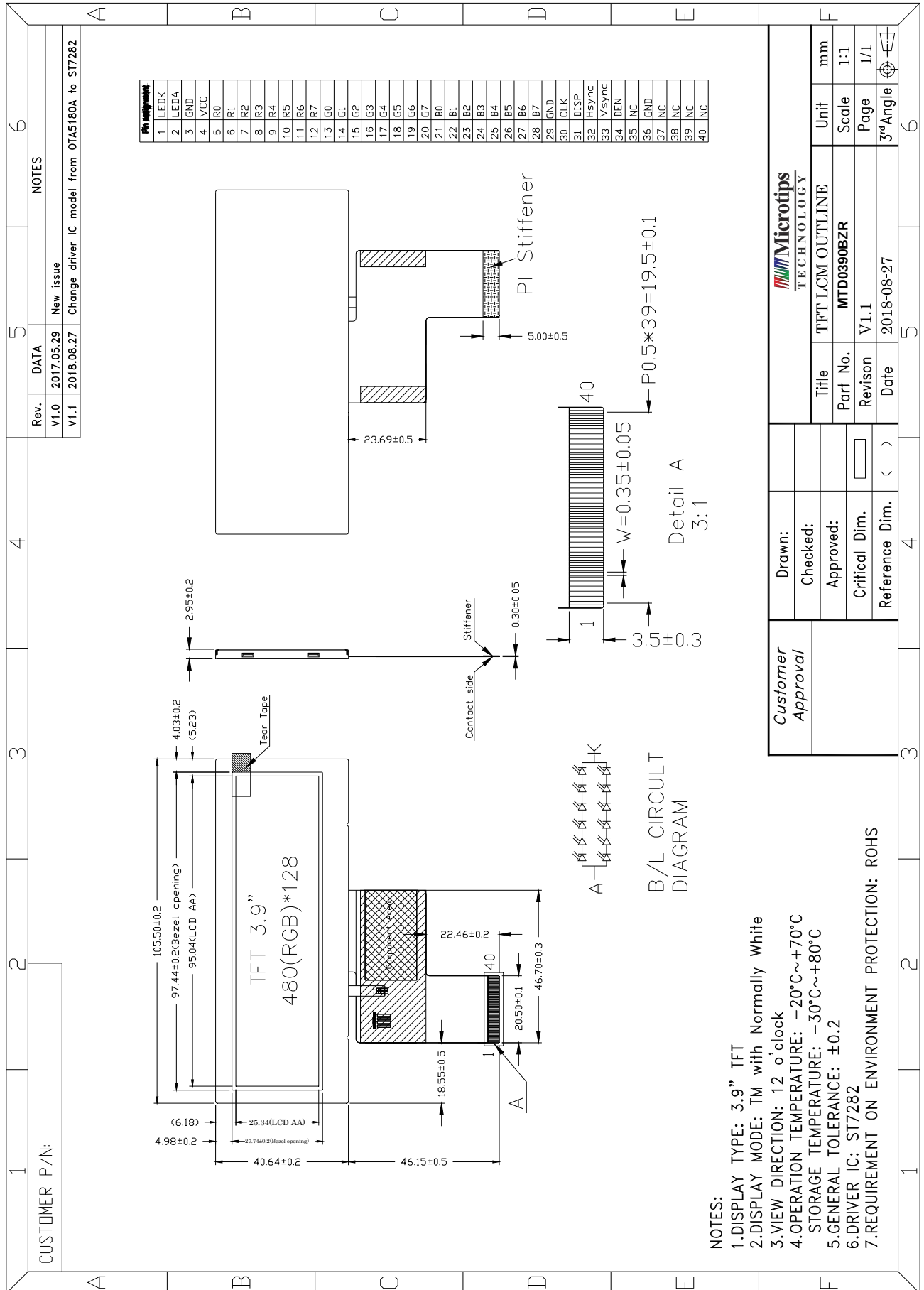
2. Application

Digital equipments which need color display, mobile phone, mobile navigator/video systems.

3. General Information

Item	Contents	Unit
Size	3.9	inch
Resolution	480 x (RGB) x 128	/
Interface	24-bit RGB interface	/
Technology type	a-Si TFT	/
Pixel pitch	0.198 x 0.198	mm
Pixel Configuration	R.G.B. Vertical Stripe	
Outline Dimension (W x H x D)	105.5 x 40.64 x 2.95	mm
Active Area	95.04 x 25.34	mm
Display Mode	Transmissive, Normally White	/
Viewing Direction	12 O'clock	/
Backlight Type	LED	/
Driver IC	ST7282	/
Weight	28	g

4. Outline Drawing



5. Interface signals

Pin No.	Symbol	Description	Remark
1	LEDK	Backlight Cathode	
2	LEDA	Backlight Anode	
3	GND	Ground	
4	VCC	Power source	
5	R0	Red data signal	
6	R1	Red data signal	
7	R2	Red data signal	
8	R3	Red data signal	
9	R4	Red data signal	
10	R5	Red data signal	
11	R6	Red data signal	
12	R7	Red data signal	
13	G0	Green data signal	
14	G1	Green data signal	
15	G2	Green data signal	
16	G3	Green data signal	
17	G4	Green data signal	
18	G5	Green data signal	
19	G6	Green data signal	
20	G7	Green data signal	
21	B0	Blue data signal	
22	B1	Blue data signal	
23	B2	Blue data signal	
24	B3	Blue data signal	
25	B4	Blue data signal	
26	B5	Blue data signal	
27	B6	Blue data signal	
28	B7	Blue data signal	
29	GND	Ground	
30	CLK	Clock signal to sample each data	
31	DISP	Display on/off signal DISP=" H": Display on DISP=" L": Display off	
32	HSYNC	Horizontal synchronizing signal	
33	VSNC	Vertical synchronizing signal	
34	DEN	Input data enable control	

35	NC	No connection	
36	GND	Ground	
37	NC	No connection	
38	NC	No connection	
39	NC	No connection	
40	NC	No connection	

6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

VSS=0V, Ta = 25°C

Parameter	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VCC	-0.3	4.5	V	

6.2. Environment Conditions

VSS=0V, Ta = 25°C

Item	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	TOPR	-20	70	°C	
Storage Temperature	TSTG	-30	80	°C	

Note 1: If Ta below 50°C, the maximal humidity is 90%RH, if Ta over 50°C, absolute humidity should be less than 60%RH.

Note 2: The response time will be extremely slow when the operating temperature is around -10°C , and the back ground will become darker at high temperature operating.

7. Electrical Specifications

7.1 Electrical characteristics

GND=0V, Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Power Supply Voltage	VCC	3.0	3.3	3.6	V	
Input Logic Voltage	VIL	GND	--	0.3*VCC	V	
	VIH	0.7*VCC	--	VCC	V	
Output Logic Voltage	VOL	GND	--	GND+0.4	V	
	VOH	VCC-0.4	--	VCC	V	
Current Consumption All Black	Logic	ICC+IIN	10	20	mA	
	Analog					

7.2 Backlight Characteristics

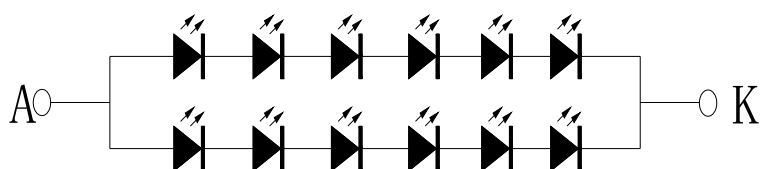
Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Voltage	VF	16.8	19.2	20.4	V	Ta=25 °C, IF=20mA/LED
Forward Current	IF	--	40	--	mA	Ta=25 °C, IF=20mA/LED
Power dissipation	PD	--	768	--	mW	
LED Life Time(25 °C)		--	30,000	--	Hr	
Drive method	Constant current					
LED Configuration	12 White LEDs (6 LEDs in one string and 2 groups in parallel)					

Note1 : LED life time defined as follows: The final brightness is at 70% of original brightness.

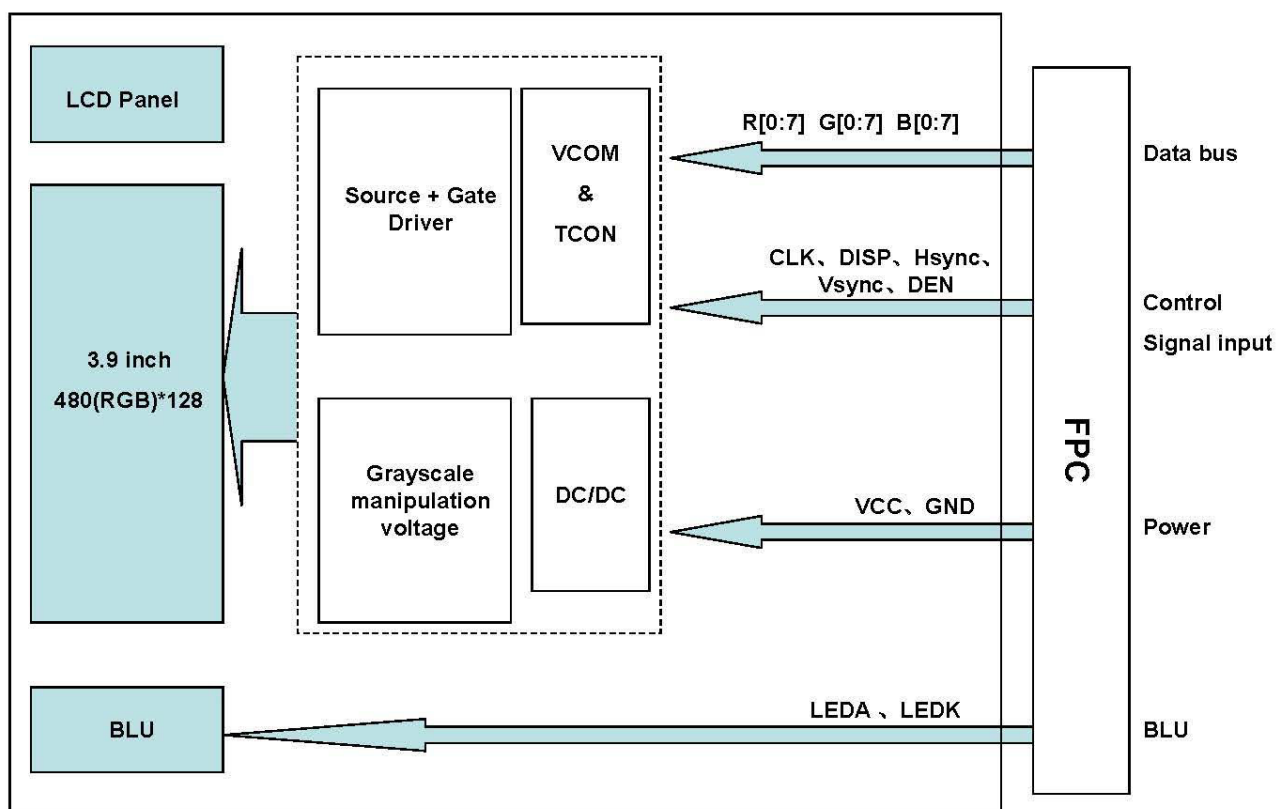
(Required constant current supply IF =20mA and

Environmental condition: 25°C ± 3°C, 60% ± 10%RH)

Note2: Backlighting circuit



7.3 Schematic of LCD module system



8. Command/AC Timing

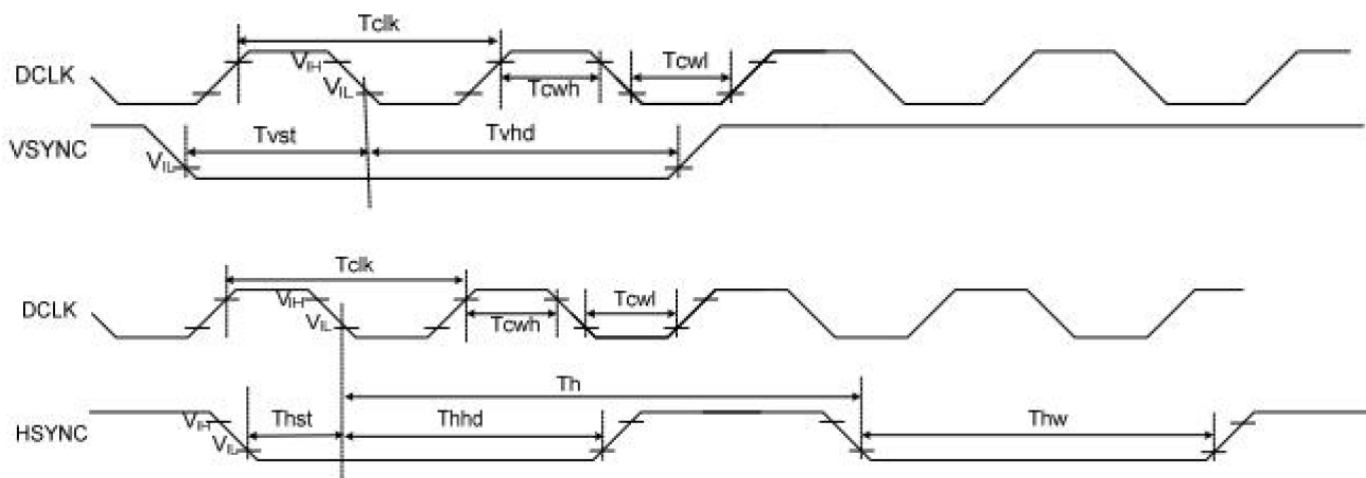
8.1 AC Characteristics

VDD=VDDI=3.3V, AGND=0V

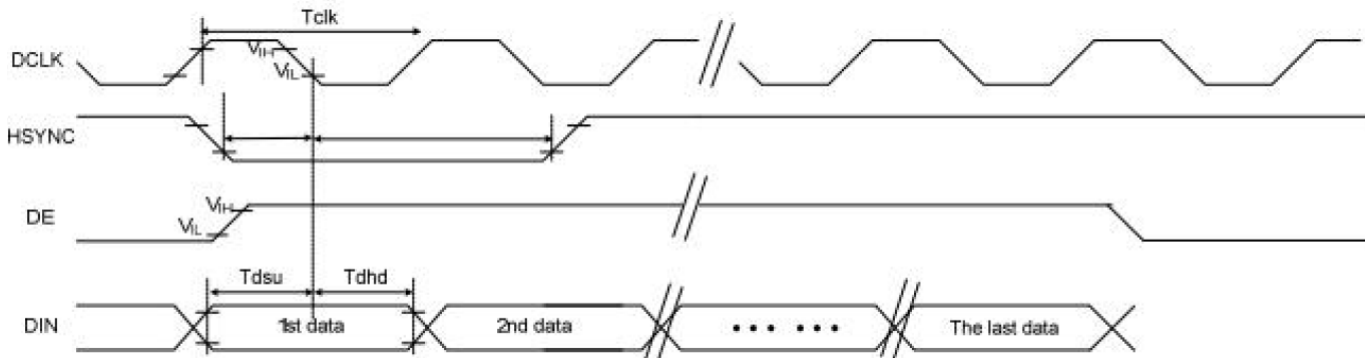
Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
System Operation Timing						
VDD power source slew time	tpor	-	-	20	ms	From 0V to 99% VDD
RGB pulse width	trstw	10	50	-	us	R=10Kohm, C=1uF
Input/ Output Timing						
CLK pulse duty	tcw	40	50	60	%	
HSYNC width	thw	1	-	-	DCLK	
HSYNC period	th	55	60	65	us	
VSYNC setup time	tvst	12	-	-	ns	
VSYNC hold time	tvhd	12	-	-	ns	
HSYNC setup time	thst	12	-	-	ns	
HSYNC hold time	thhd	12	-	-	ns	
Data setup time	tdsu	12	-	-	ns	
Data hold time	tdhd	12	-	-	ns	
SD output stable time	tst	-	-	12	us	Output settled within +20Mv Loading=6.8k+28.2pF
GD output rise and fall time	tgst	-	-	6	us	Output settled (5%-95%) Loading=4.7k+29.8pF

8.2 AC Timing Diagram

8.2.1 Clock and Data Input Timing Diagram



8.2..2 SYNC-DE Mode

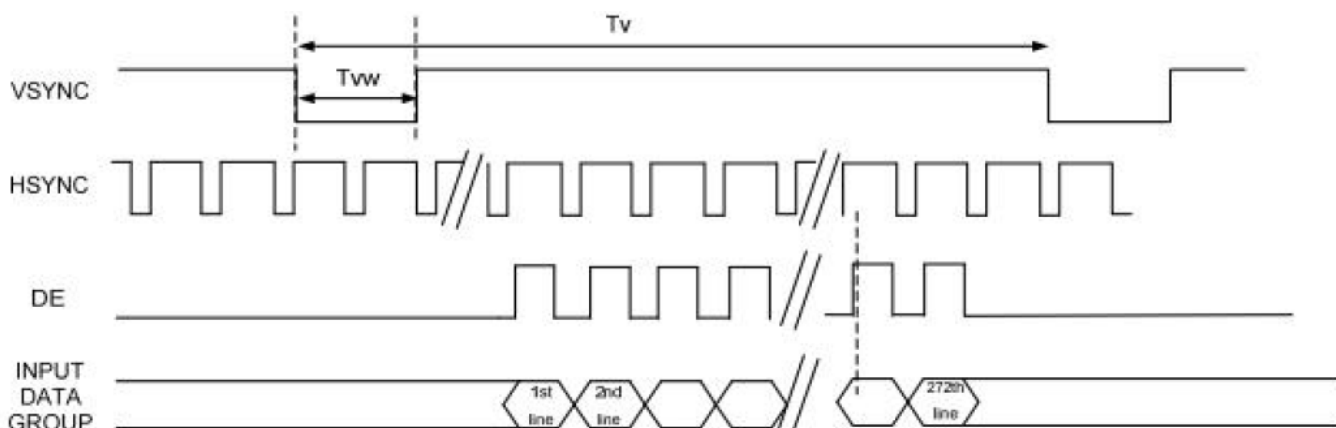


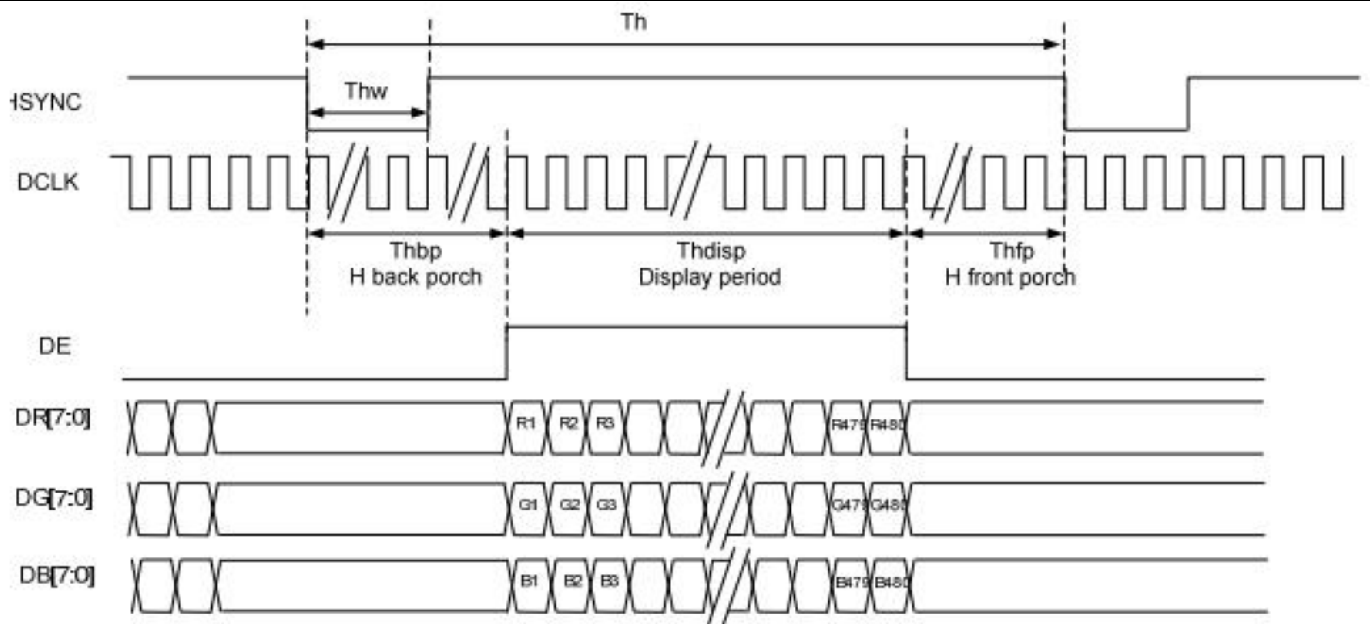
8.3 Input Data Format

8.3.1 Parallel RGB Input Timing Table

Item		System	Min.	Typ.	Max.	Unit	Conditions
DCLK Frequency		fclk	8	9	12	MHz	
DCLK Period		tclk	83	111	125	ns	
Hsync	Period Time	th	485	531	-	DCLK	
	Display Period	thdisp	-	480	-	DCLK	
	Back Porch	thbp	3	43	-	DCLK	By H_BLANKING setting
	Front Porch	thfp	2	8	-	DCLK	
	Pulse Width	thw	2	4	-	DCLK	
Vsync	Period Time	tv	276	292	-	H	
	Display Period	tvdisp	-	272	-	H	
	Back Porch	tvbp	1	12	-	H	By V_BLANKING setting
	Front Porch	tvfp	2	8	-	H	
	Pulse Width	tw	2	4	-	H	

8.3.2 SYNC Mode Timing Diagram





9. Optical Specification

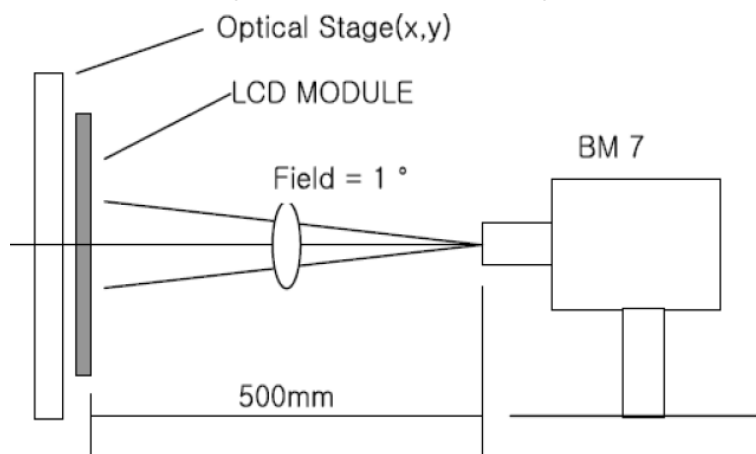
Ta=25°C

Item	Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio	CR	$\theta=0^\circ$	350	500	-		Note1 Note2
Response Time	Ton/ Toff	25°C	-	30	45	ms	Note1 Note3
View Angles	ΘT	$CR \geq 10$	55	70	-	Degree	Note 4
	ΘB		55	70	-		
	ΘL		55	70	-		
	ΘR		55	70	-		
Chromaticity	White	x	0.246	0.296	0.346		Note5, Note1
		y	0.306	0.356	0.406		
	Red	x	0.571	0.621	0.671		
		y	0.315	0.365	0.415		
	Green	x	0.280	0.330	0.380		
		y	0.563	0.613	0.663		
	Blue	x	0.096	0.146	0.196		
		y	0.080	0.130	0.180		
NTSC	S		-	50	-	%	Note5
Luminance	Lv		600	760	-	cd/m ²	

Note 1: Definition of optical measurement system.

Temperature = 25°C(±3°C)

LED back-light: ON, Environment brightness < 150 lx

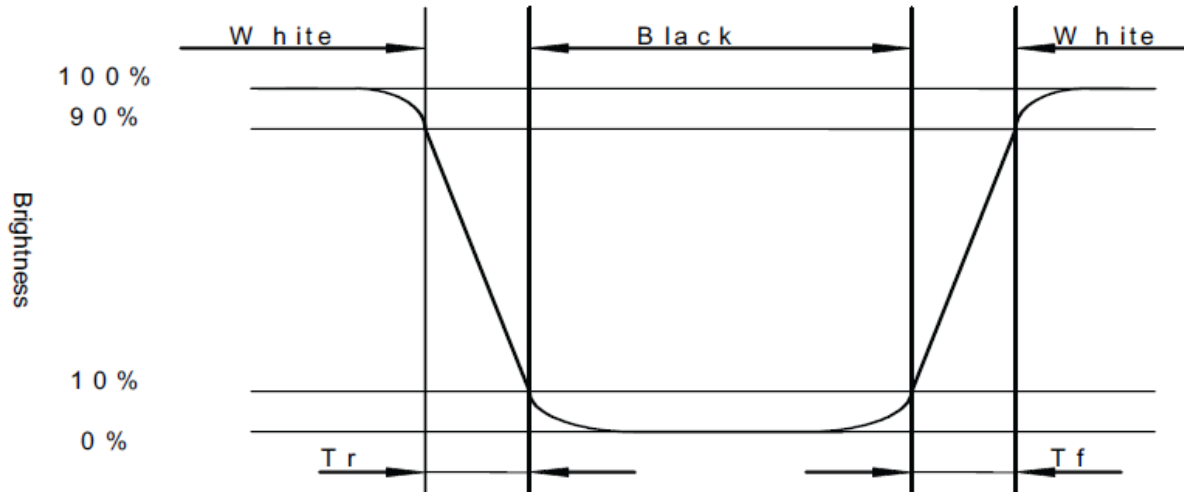


Note 2: Contrast ratio is defined as follow:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

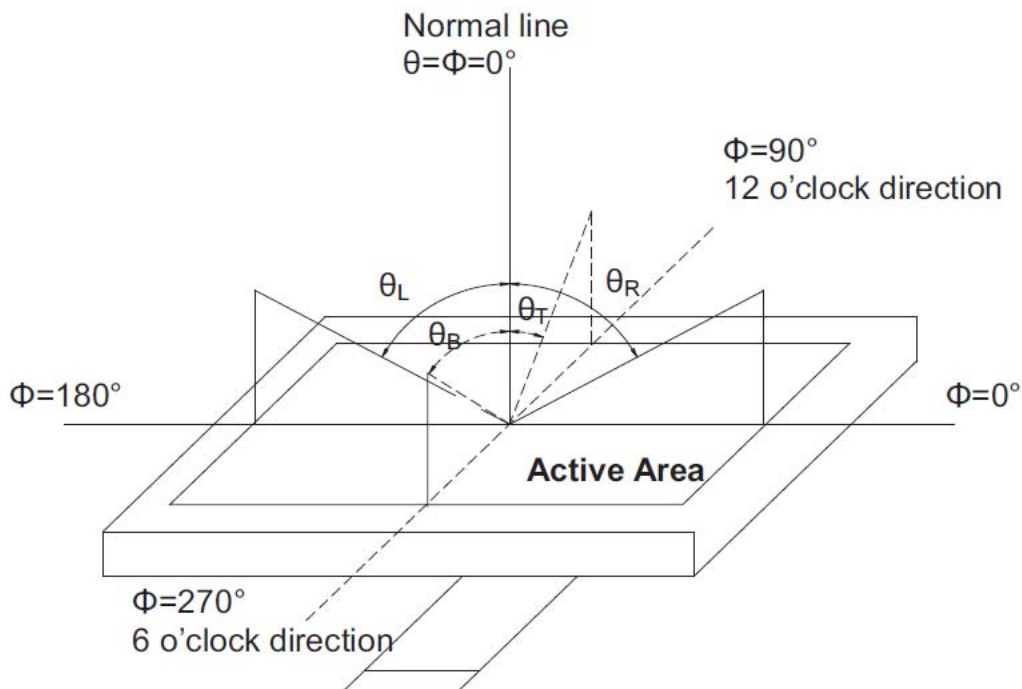
Note 3: Response time is defined as follow:

Response time is the time required for the display to transition from black to white (Rise Time, T_r) and from white to black (Decay Time, T_f).



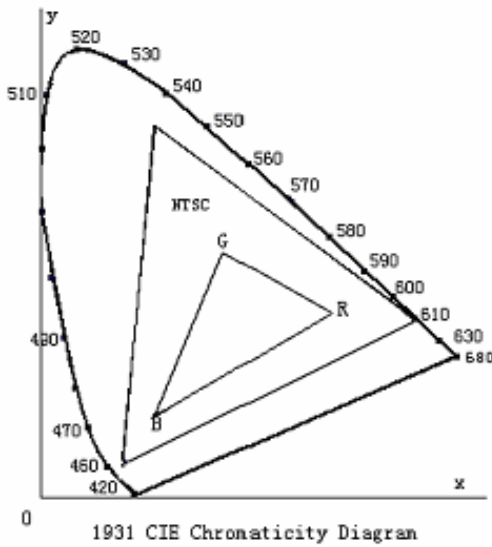
Note 4: Viewing angle range is defined as follow:

Viewing angle is measured at the center point of the LCD.



Note 5: Color chromaticity is defined as follow: (CIE1931)

Color coordinates measured at center point of LCD.



$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 6: Luminance is defined as follow:

Luminance is defined as the brightness of all pixels “White” at the center of display area on optimum contrast.

Note 7: Luminance Uniformity is defined as follow:

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Uniformity (U)} = \frac{\text{Minimum Luminance(brightness) in 9 points}}{\text{Maximum Luminance(brightness) in 9 points}}$$

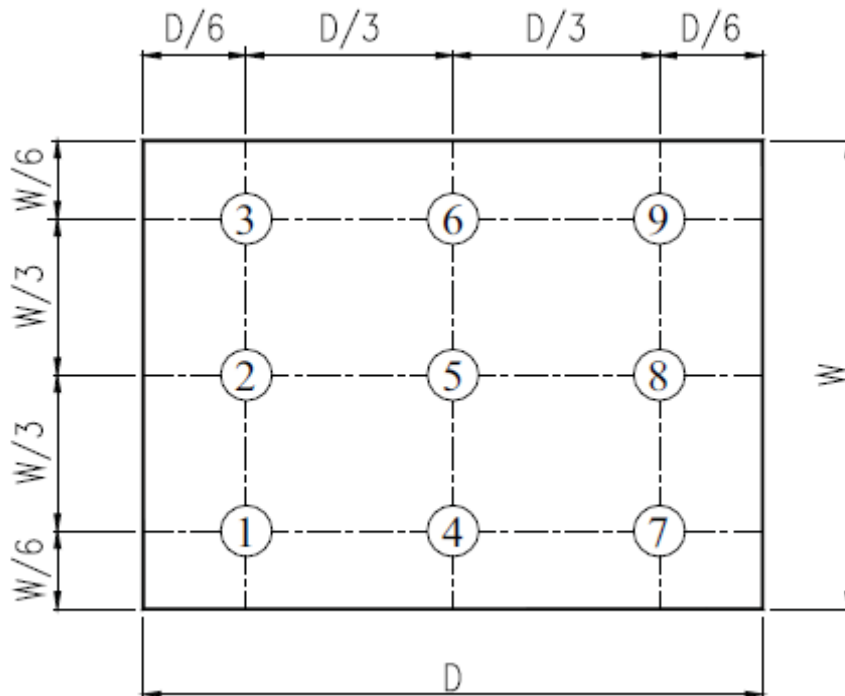


Fig. 2 Definition of uniformity

10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+70℃, 96hrs	Per table in below
2	Low Temp Operation	Ta=-20℃, 96hrs	Per table in below
3	High Temp Storage	Ta=+80℃, 96hrs	Per table in below
4	Low Temp Storage	Ta=-30℃, 96hrs	Per table in below
5	High Temperature & High Humidity Operation	Ta=+50℃, 90%RH, 96hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-20℃ 30 min~+70℃ 30 min, Change time:5min, 100 Cycles	Per table in below
7	ESD (Operation)	C=150pF, R=330Ω, 5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times; (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa)	Per table in below
8	Vibration (Non-operation)	Frequency range:10~55Hz, Amplitude:1 mm Sweep Time:11 mins Test Period: 6 Cycles for each direction of X,Y,Z	Per table in below
9	Shock (Non-operation)	100G 6ms, ±X,±Y,±Z 3times, for each direction	Per table in below

INSPECTION	CRITERION(after test)
Appearance	No Crack on the FPC, on the LCD Panel
Alignment of LCD Panel	No Bubbles in the LCD Panel No other Defects of Alignment in Active area
Electrical current	Within device specifications
Function / Display	No Broken Circuit, No Short Circuit or No Black line No Other Defects of Display

11. Precautions for Use of LCD Modules

11.1 Safety

The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

11.2 Handling

- A. The LCD and touch panel is made of plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
- B. Do not handle the product by holding the flexible pattern portion in order to assure the reliability
- C. Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.
- D. Provide a space so that the panel does not come into contact with other components.
- E. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.
- F. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.
- G. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.
- H. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

11.3 Static Electricity

- A. Ground soldering iron tips, tools and testers when they are in operation.
- B. Ground your body when handling the products.
- C. Power on the LCD module before applying the voltage to the input terminals.
- D. Do not apply voltage which exceeds the absolute maximum rating.
- E. Store the products in an anti-electrostatic bag or container.

11.4 Storage

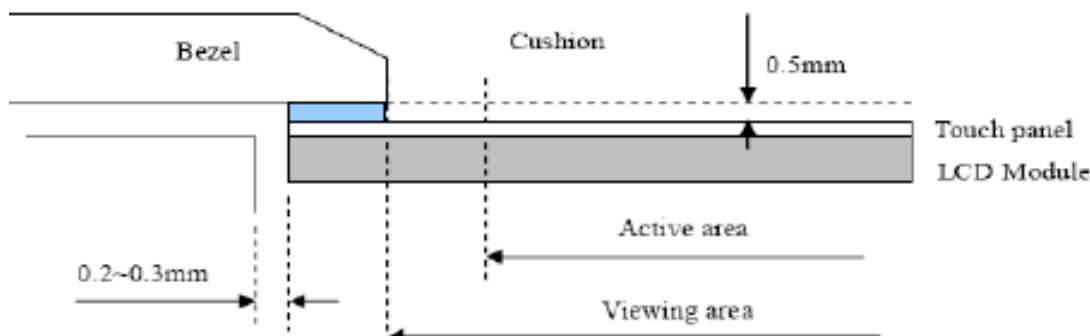
- A. Store the products in a dark place at $+25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.
- B. Storage in a clean environment, free from dust, active gas, and solvent.

11.5 Cleaning

- A. Do not wipe the touch panel with dry cloth, as it may cause scratch.
- B. Wipe off the stain on the product by using soft cloth moistened with ethanol. Do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

11.6 Cautions for installing and assembling

- A. Bezel edge must be positioned in the area between the Active area and View area. The bezel may press the touch screen and cause activation if the edge touches the active area. A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected activation if the gap is too narrow. There is a tolerance of 0.2 to 0.3mm for the outside dimensions of the touch panel and tail. A gap must be made to absorb the tolerance in the case and connector.
- B. In order to make the display assembly stable and firm, MT recommends to design some supporting at the display backside, especially for the display with tape-attached touch panel, such supporting is important and essential, or else, the display may drop-off from front after some period of time.
- C. Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.



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