



Microtips Technology

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TFT Module Specification

MODEL: MTD0350BER06RB-1

This module uses ROHS material

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Record of Revision

[illegible]

1. Scope

This data sheet is to introduce the specification of MTD0350BER06RB-1, active matrix TFT module. It is composed of a color TFT-LCD panel, driver IC, FPC and a backlight unit. The 3.5" display area contains 240(RGB) x 320 pixels.

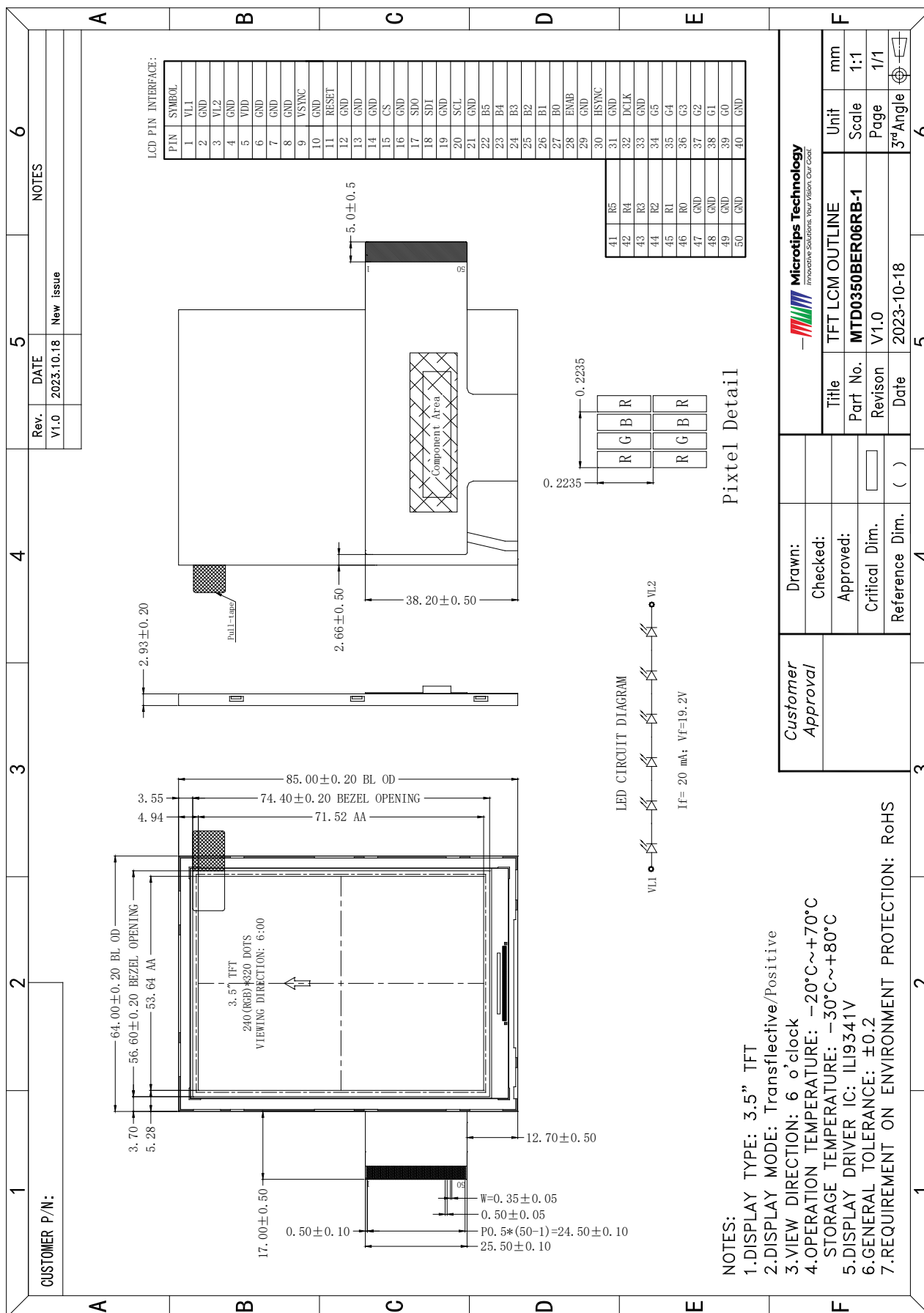
2. Application

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

3. General Information

Item	Contents	Unit
Size	3.5	inch
Resolution	240(RGB) x 320	/
Technology type	a-Si TFT	/
Interface	RGB+SPI	
Pixel pitch	0.2235 x 0.2235	mm
Pixel Configuration	R.G.B. Vertical Stripe	
Outline Dimension (W x H x D)	64.00 x 85.00 x 2.93	mm
Active Area	53.64 x 71.52	mm
Display Mode	Transflective/Positive	/
Backlight Type	LED	/
Display Driver IC	ILI9341V	/
Viewing Direction	6 o'clock	/

4. Outline Drawing



5. Interface signals

Pin No.	Symbol	Function
1	VL1	LED Backlight Anode
2	GND	Ground
3	VL2	LED Backlight Cathode
4	GND	Ground
5	VDD	Power supply for digital
6~8	GND	Ground
9	VSYNC	Vertical sync in RGB mode
10	GND	Ground
11	RESET	Reset pin (low active)
12~14	GND	Ground
15	CS	Chip select input (low enable)
16	GND	Ground
17	SDO	Serial data output
18	SDI	Serial data input
19	GND	Ground
20	SCL	Serial interface clock
21	GND	Ground
22~27	B5 ~ B0	Blue data bus
28	ENAB	Display enable pin from controller
29	GND	Ground
30	HSYNC	Horizontal sync in RGB mode
31	GND	Ground
32	DCLK	Pixel clock signal in RGB mode
33	GND	Ground
34~39	G5 ~ G0	Green data bus
40	GND	Ground
41~46	R5 ~ R0	Red data bus
47~50	GND	Ground

6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Item	Symbol	MIN	MAX	Unit	Remark
Power Supply Voltage	VDD	-0.3	4.5	V	

6.2. Environment Conditions

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

7. Electrical Specifications

7.1 Electrical characteristics

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Power Supply Voltage		VDD	2.5	2.8	3.3	V	
Input Leakage Current		-	-1	-	1	μA	
Input Signal Voltage	Low Level	VIL	GND	-	0.3*VDD	V	
	High Level	VIH	0.7*VDD	-	VDD	V	

7.2 LED Backlight

Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	IF	-	20	30	mA	
Forward Current Voltage	VF	16.8	19.2	20.4	V	
LED lifetime	-	30,000	50,000	-	Hrs	

Notes:

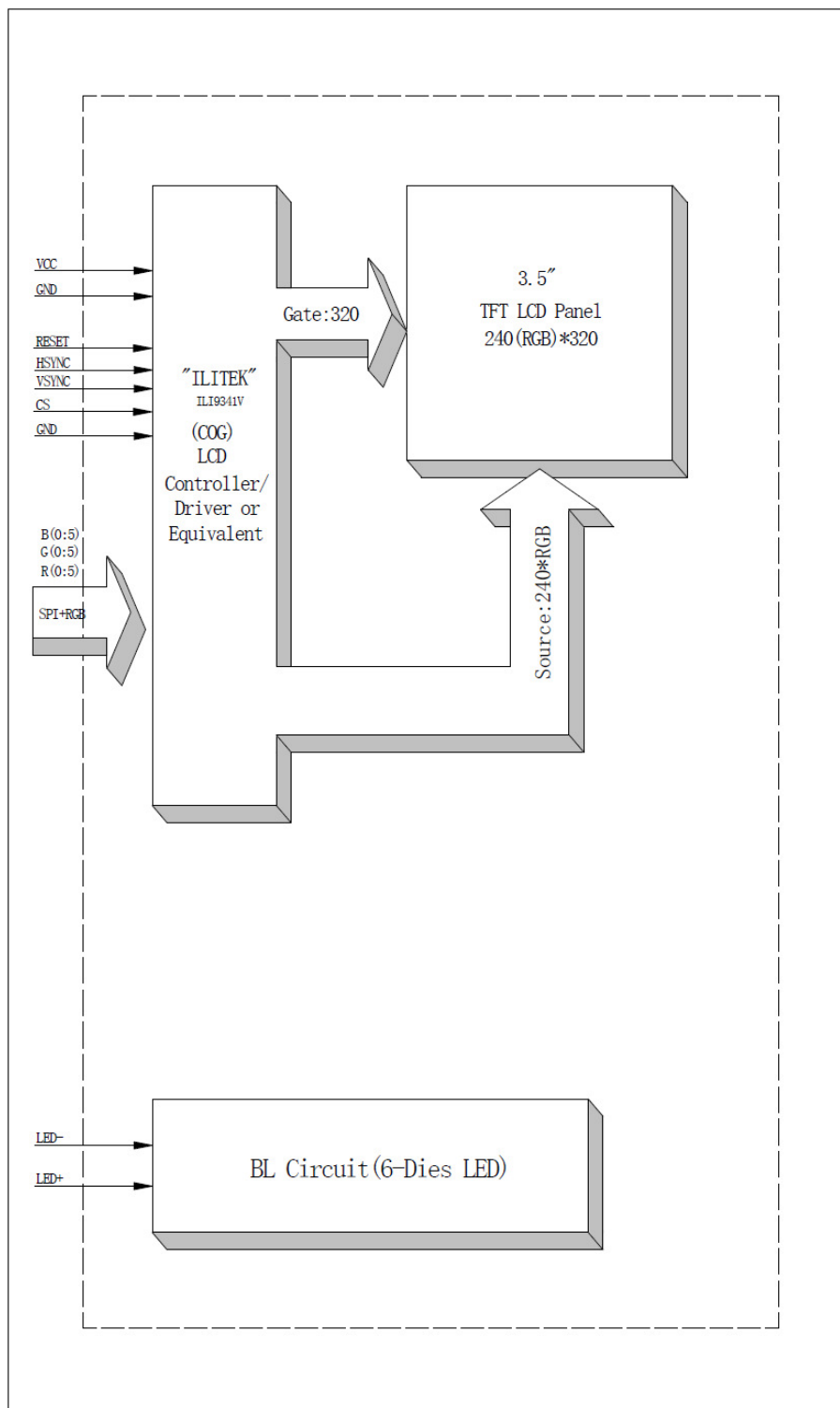
- The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25 °C and IL=20mA. The “LED life time” could be decreased if operating IL is larger than 20mA.
- LED power consumption: 384mW (Typical).

LED CIRCUIT DIAGRAM



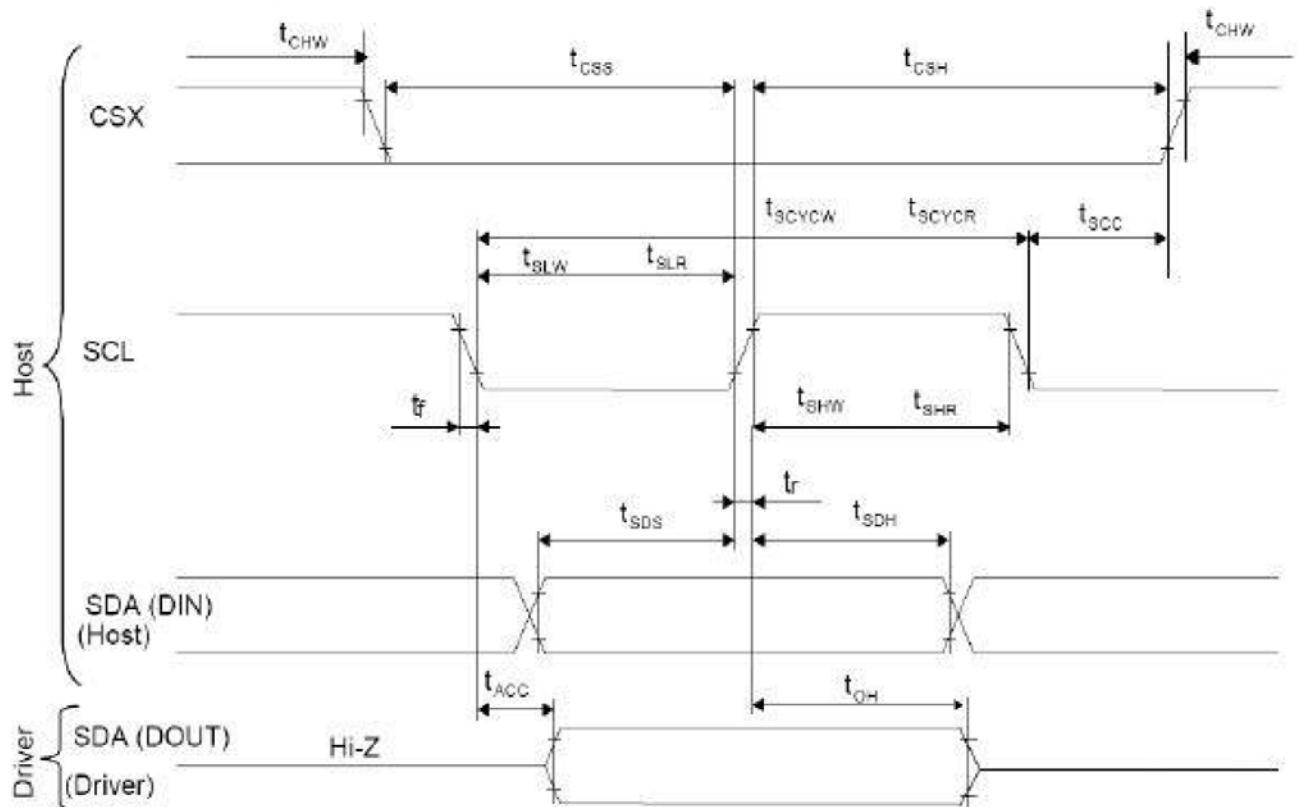
$I_f = 20 \text{ mA}$; $V_f = 19.2 \text{ V}$

7.3 Block Diagram



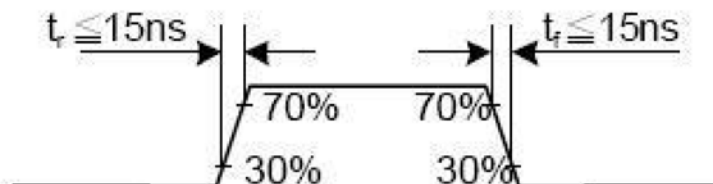
8. Command/AC Timing

8.1 3-Wire SPI Timing Diagram

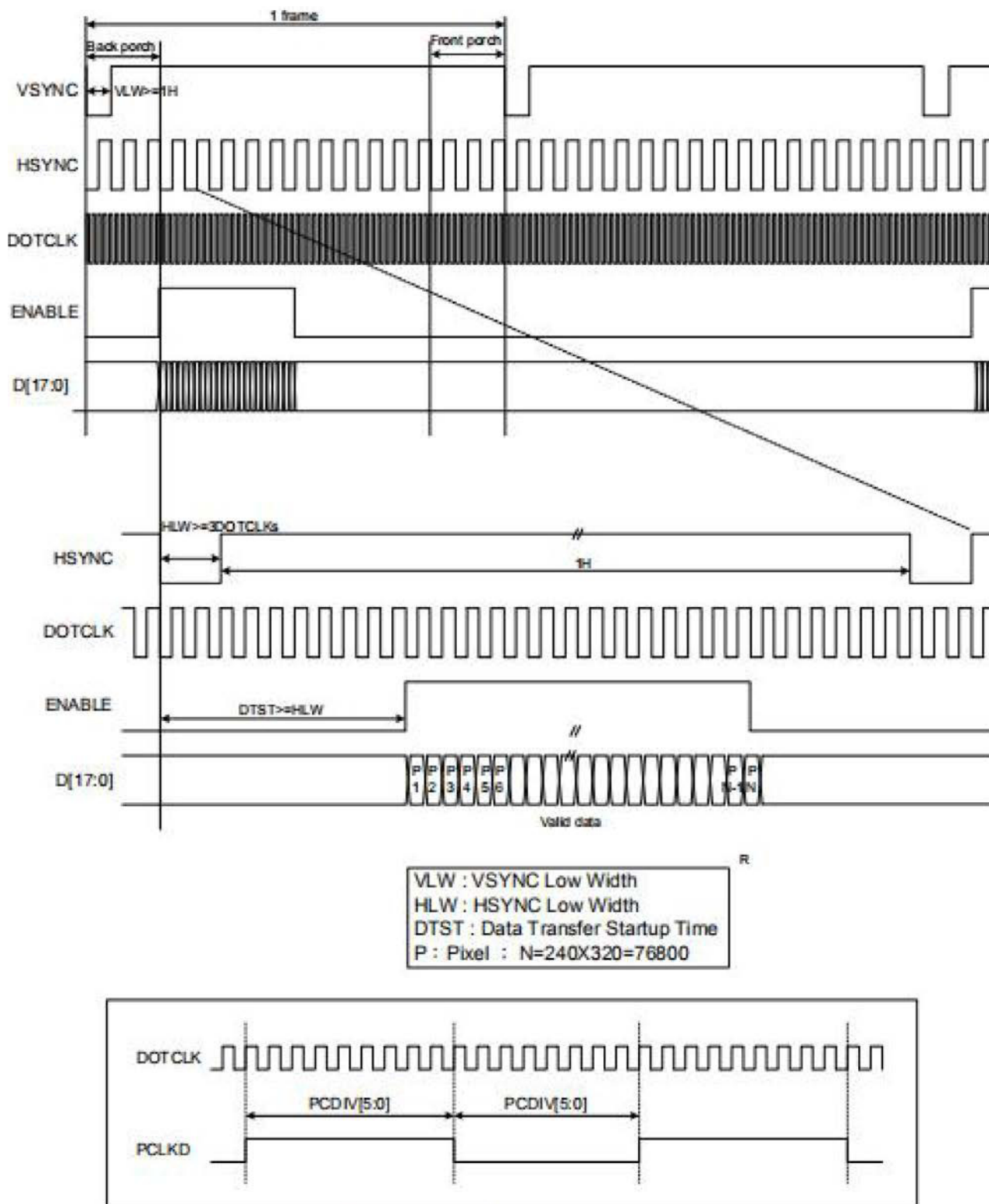


Ta=25°C, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, AGND=VSS=0V

Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL "H" Pulse Width (Write)	40	-	ns	
	tslw	SCL "L" Pulse Width (Write)	40	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
	tslr	SCL "L" Pulse Width (Read)	60	-	ns	
SDA / SDI (Input)	tsds	Data setup time (Write)	30	-	ns	
	tsdh	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns	
	toh	Output disable time (Read)	10	50	ns	
CSX	tsc	SCL-CSX	20	-	ns	
	tch	CSX "H" Pulse Width	40	-	ns	
	tcss	CSX-SCL Time	60	-	ns	
	tcs		65	-	ns	



8.2 RGB Timing Diagram



Notes:

1. The DE signal is not needed when RGB interface SYNC mode is selected.
2. VSPL='0', DPL='0' and EPL='0' of 'Interface Mode Control (B0h)' command.

Parameters	Symbols	Condition	Min.	Typ.	Max.	Units
Horizontal Synchronization	Hsync		2	10	16	DOTCLK
Horizontal Back Porch	HBP		2	20	24	DOTCLK
Horizontal Address	HAdr		-	240	-	DOTCLK
Horizontal Front Porch	HFP		2	10	16	DOTCLK
Vertical Synchronization	Vsync		1	2	4	Line
Vertical Back Porch	VBP		1	2	-	Line
Vertical Address	VAdr		-	320	-	Line
Vertical Front Porch	VFP		3	4	-	Line

Typical values are setting example when used with panel resolution 240 x 320 (QVGA), clock frequency 6.35MHz and frame.

9. Optical Specification

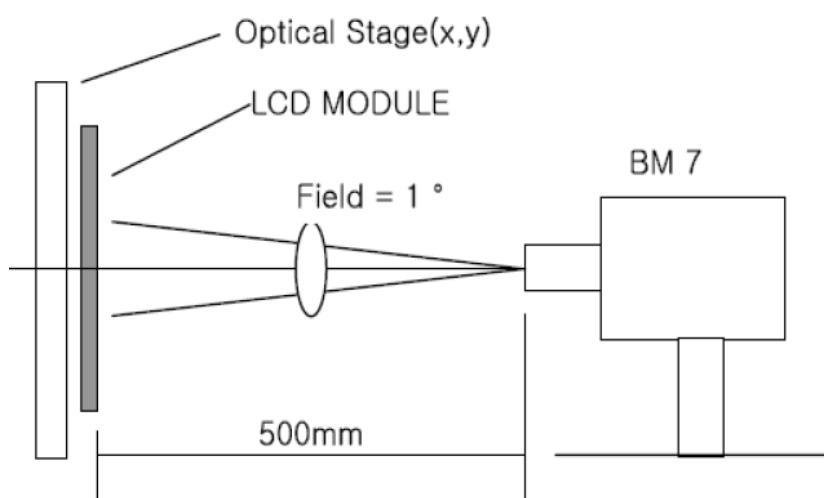
Ta=25°C

Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio		CR	$\theta=0^{\circ}$	100	150	-		Note1 Note2
Response Time		Tr+Tf	25℃	-	35	-	ms	Note1 Note3
View Angles		ΘT	CR≧10	-	60	-	Degree	Note 4
		ΘB		-	55	-		
		ΘL		-	60	-		
		ΘR		-	60	-		
Chromaticity	Red	x	Brightness is on	Typ-0.05	0.324	Typ+0.05		Note5, Note1
		y			0.372			
	Green	x			0.507			
		y			0.327			
	Blue	x			0.334			
		y			0.529			
	White	x			0.157			
		y			0.143			
Luminance		L		110	130	-	cd/m²	Note1 Note6
Uniformity		U		80	-	-	%	Note1 Note7

Note 1: Definition of optical measurement system.

Temperature = 25°C(±3°C)

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

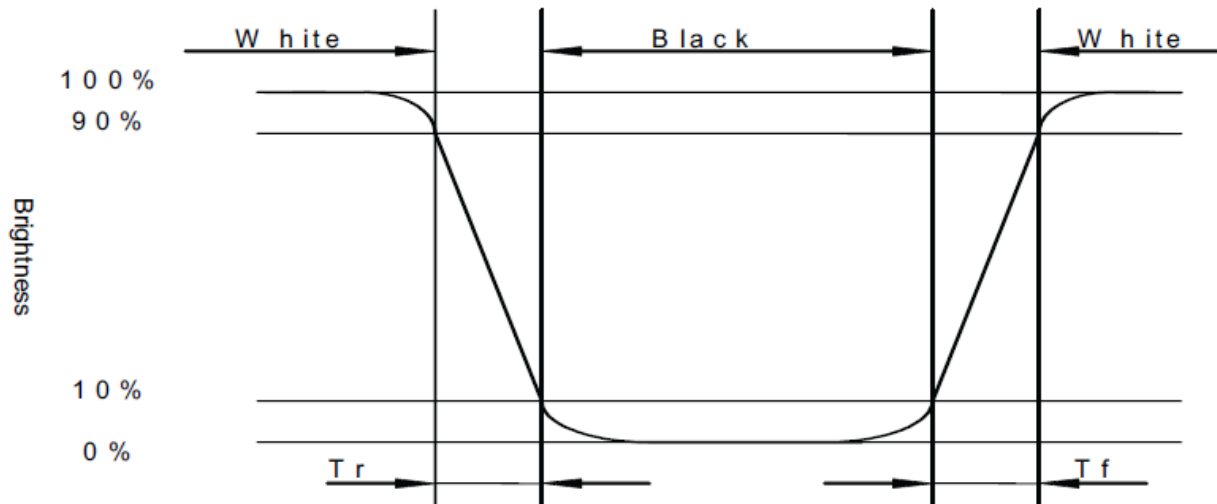


Note 2: Contrast ratio is defined as follow:

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

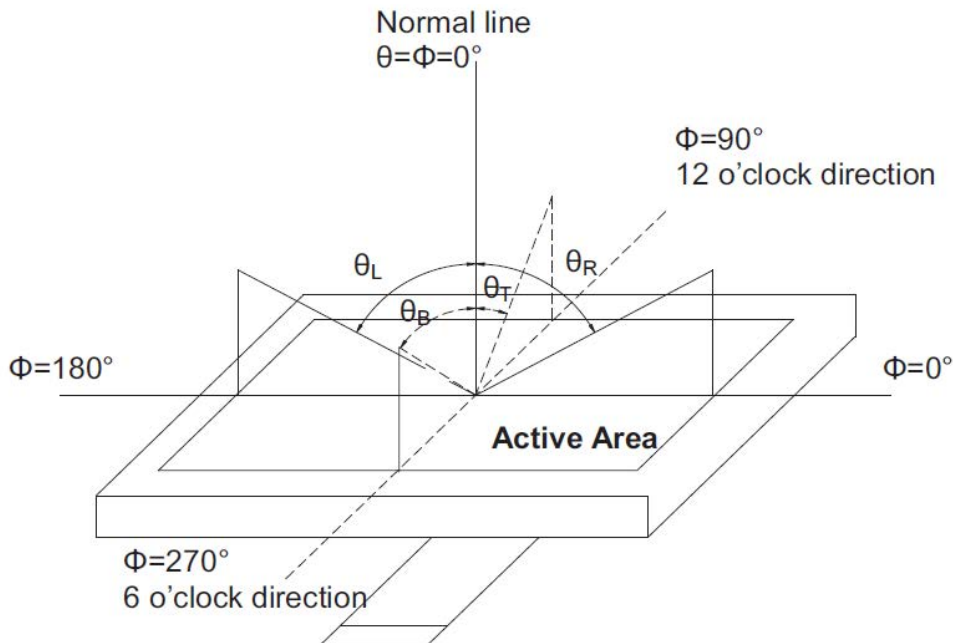
Note 3: Response time is defined as follow:

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).



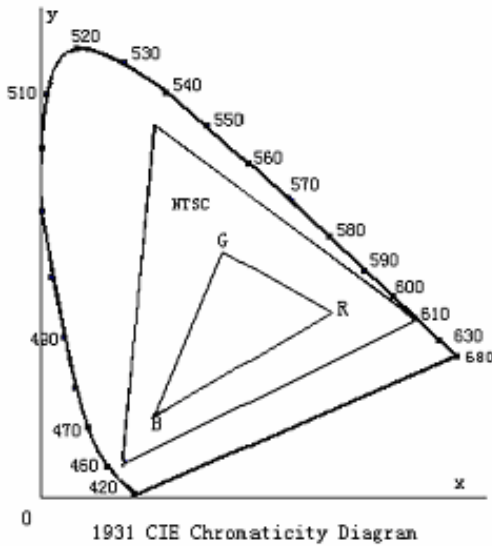
Note 4: Viewing angle range is defined as follow:

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.

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

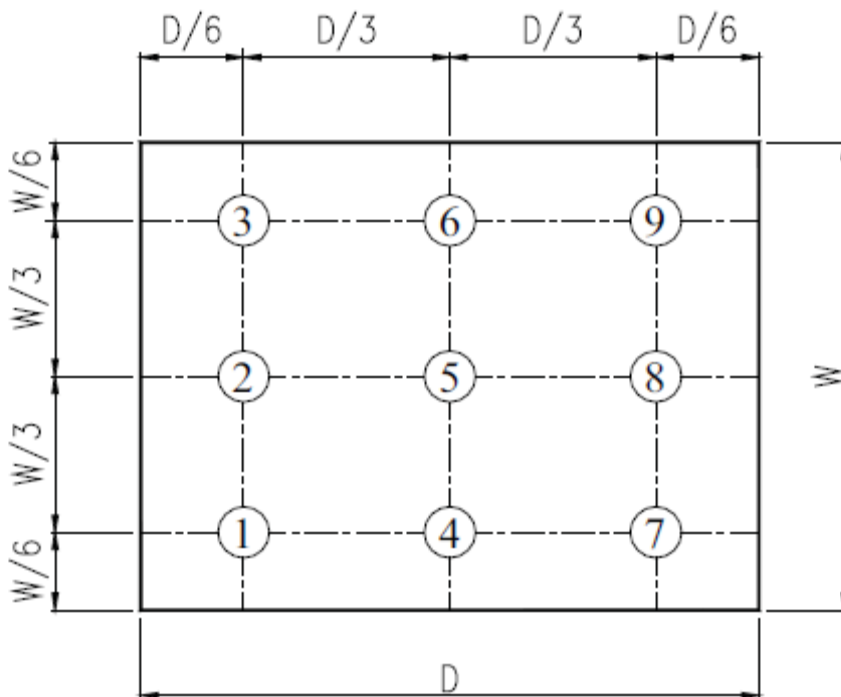


Fig. 2 Definition of uniformity

10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ta= +70℃, 240hrs	Per table in below
2	Low Temp Operation	Ta= -20℃, 240hrs	Per table in below
3	High Temp Storage	Ts= +80℃, 240hrs	Per table in below
4	Low Temp Storage	Ts= -30℃, 240hrs	Per table in below
5	High Temp & High Humidity Storage	Ts= +60℃, 90% RH, 240 hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-30℃ 30 min~+80℃ 30 min, Change time:5min, 10 Cycles	Per table in below
7	ESD (Operation)	C=150pF, R=330Ω, 5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times;	Per table in below
8	Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z.	Per table in below
9	Shock (Non-operation)	60G 6ms, ±X,±Y,±Z 3times, for each direction	Per table in below
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	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.

