



深圳市拓普微科技开发有限公司

SHENZHEN TOPWAY TECHNOLOGY CO., LTD.

LMT035ENAFWA

LCD Module User Manual

Prepared by: Linli Date: 2020-03-18	Checked by: Date:	Approved by: Date:
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Rev.	Descriptions	Release Date
0.1	- Preliminary Draft release	2020-03-18

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1 General Specifications

Feature		Spec
Display Spec.	Size	3.5 inch
	Resolution	320(RGB)x240
	Interface	RGB 24 bit
	Color Depth	16.7MK
	Technology Type	a-Si
	Pixel pitch(mm)	0.219x0.219
	Pixel Configuration	R.G.B Vertical Stripe
	Surface Treatment	Glare
	Viewing Direction	Full View
	Gray Scale Inversion Direction	Full View
Mechanical Characteristics	LCM (W x H x D) (mm)	76.8x63.8x3.3
	Active Area(mm)	70.08x52.56
	Driver IC	ST7272-G4
	With /Without TSP	Without TSP
	LED Numbers	6LEDs

Note 1:Requirements on Environmental Protection:

RoHS Note 2: LCM weight tolerance:± 5%

Note 3: The main FPC and plastic frame can fulfill UL94-V0

2 Input/Output Terminals

2.1 TFT LCD Panel

No	Symbol	I/O	Description	Comment
1~2	VBL-	P	CATHODE OF BACKLIGHT LED	
3~4	VBL+	P	ANODE OF BACKLIGHT LED	
5	NC	-	NC	
6	/RESET	I	SYSTEM Reset pin.internal pull high	
7	CSB	I	Chip select pin of serial interface.internal pull high	
8	SCL	I	Clock pin of serial interface。 Internal pull high	
9~10	SDA	I/O	Serial communication data input and output.	
11~18	B7~B0	I/O	BLUE DATA	
19~26	G7~G0	I/O	GREEN DATA	
27~34	R7~R0	I/O	RED DATA	
35	DCLK	I	Dot-clock signal and oscillator source.	
36	HSYNC	I	Line synchronization siganl	
37	VSYNC	I	Frame synchronization siganl	
38	ENB	I	Diaplay enable pin from controller	
39~40	VDD(ANALOG)	P	Power supply for analog circuit. Power supply for digital I/O pins.	
41~42	NC	-	NC	
43	NC(YU)	-	NC(Touch panel Y up line)	
44	NC(XR)		NC(Touch panel X right line)	
45	NC(XD)		NC(Touch panel Y down line)	
46	NC(XL)		NC(Touch panel X left line)	
47	SHUT	I	Diaplay shut down pin to put the drive into sleep mode. A sharp falling edge must be provided to such pin when IC power on. Internal pull low -Connect to VDDIO for sleep mode. -Connect to VSS for normal operating mode.	
48	NC	-	NC	
49~50	VSS	-P	System ground pin of the IC	

Note 1: I——Input, O——Output, P——Power/Ground,

Table 2.1 Terminal pin assignment

3 Absolute Maximum Ratings

3.1 Driving TFT LCD Panel

Ta =25℃

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VDD	--	4.0	V	
Back Light Forward Current	I _{LED}	--	25	mA	For each LED
Back Light Forward Current Voltage	V _{LED}	--	18.6	V	
Operating Temperature	Top	-20	70	℃	
Storage Temperature	Tst	-30	80	℃	
Relative Humidity Note1	RH	--	90	%	Note2
Absolute Humidity	AH	--	≤70	g/m ³	Ta>70℃

Note1: Ta means the ambient temperature.

It is necessary to limit the relative humidity to the specified temperature range.

Condensation on the module is not allowed.

Note2: Ta≤60℃: 90% RH MAX (96HRS MAX)

Ta≤60℃: ABSOLUTE HUMIDITY MUST BE LOWER THAN THE HUMIDITY OF 90%RH AT
60℃ (96HRS MAX)

4 Electrical Characteristics

4.1 Driving TFT LCD Panel

GND=0V, Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Supply Voltage	VDD	3.0	3.3	3.6	V	
Logic Signal Voltage	VCC	3.0	3.3	3.6		
Input Signal Voltage	Low Level	V _{IL}	--	—	0.3* VCC	V
	High Level	V _{IH}	0.7* VCC	—	--	V
Output Signal Voltage	Low Level (VOL)	I _{OL} =+1.0mA	DGND	—	DGND+0.4	V
	High Level (VOH)	I _{OH} =-1.0mA	VDDI-0.4	—	VDDI	V
operating current	Analog operating current	I _{DD}	-	20	30	mA
	Digital operating current	I _{CC}	-	1	2	mA

4.2 Backlight Unit

Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	IF	—	20	25	mA	Note 4
Forward Current Voltage	VF	—	18	18.6	V	Note 1,2
Backlight Power Consumption	WBL	—	360	465	mW	For total LEDs
LED lifetime	L	30000	40000	—	Hours	Note1,2,3,4



Note1: The LED driving condition is defined for each LED module (1 LED Serial, 1 LED Parallel).

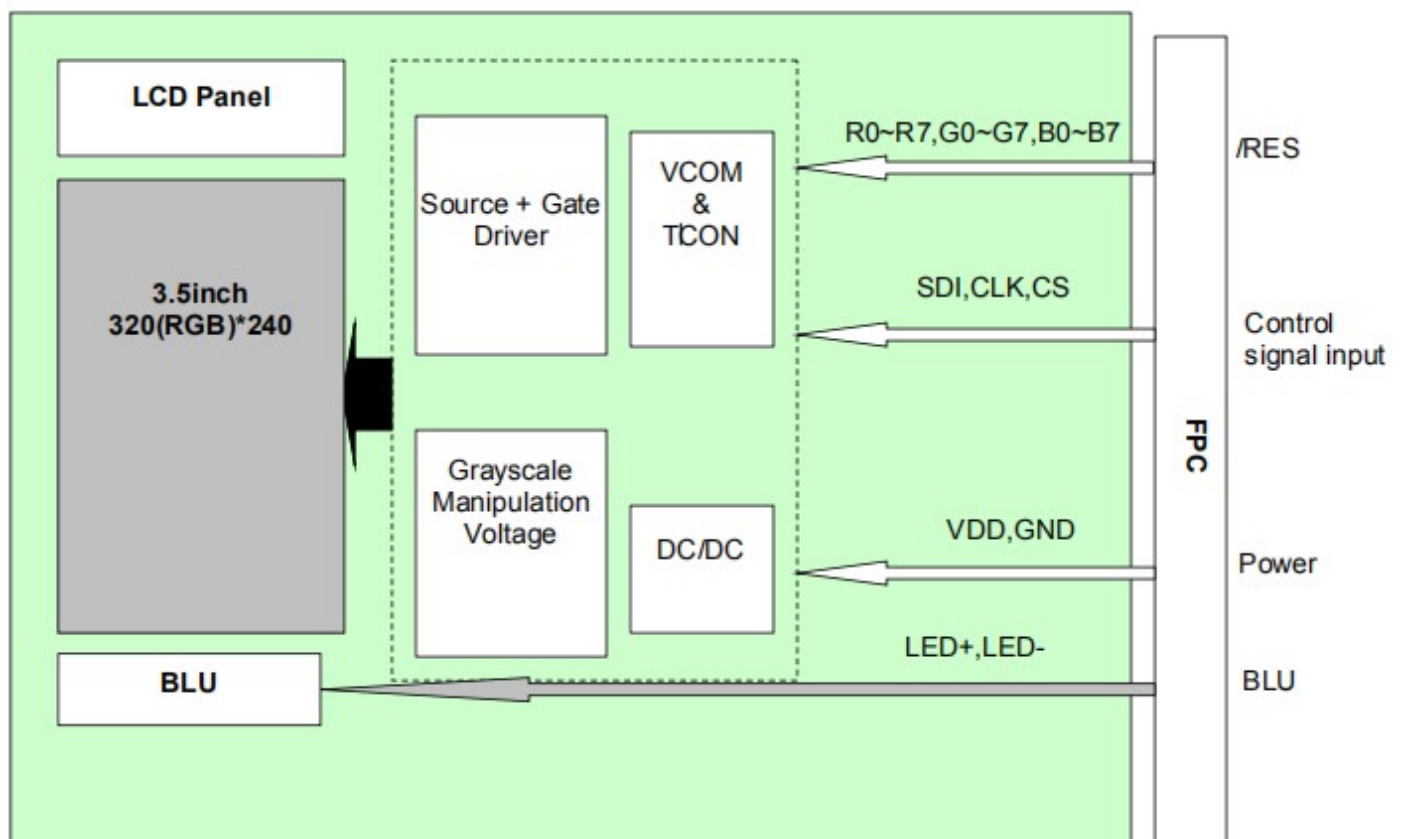
Note2: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note3: Optical performance should be evaluated at Ta=25℃ only. If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data. At the same time the luminance of Backlight would decrease under the high temperature.

Note4: The LED driving condition is defined for each LED module.

4.3 Block Diagram

LCD module diagram



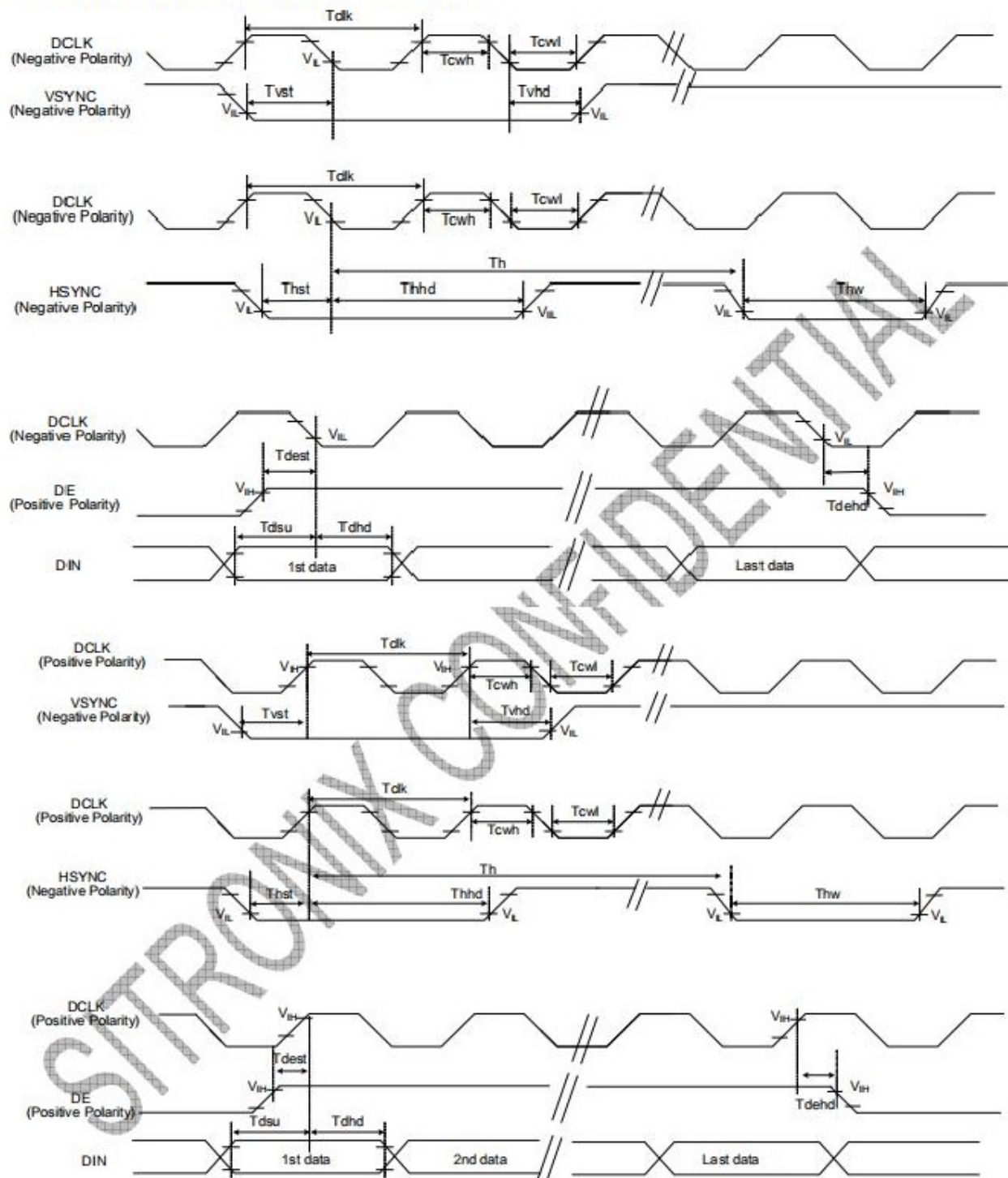
5 Timing Chart

5.1 INTERFACE TIMING

Note: Please refer to ST7272A datasheet for more details.

5.1.1 interface I

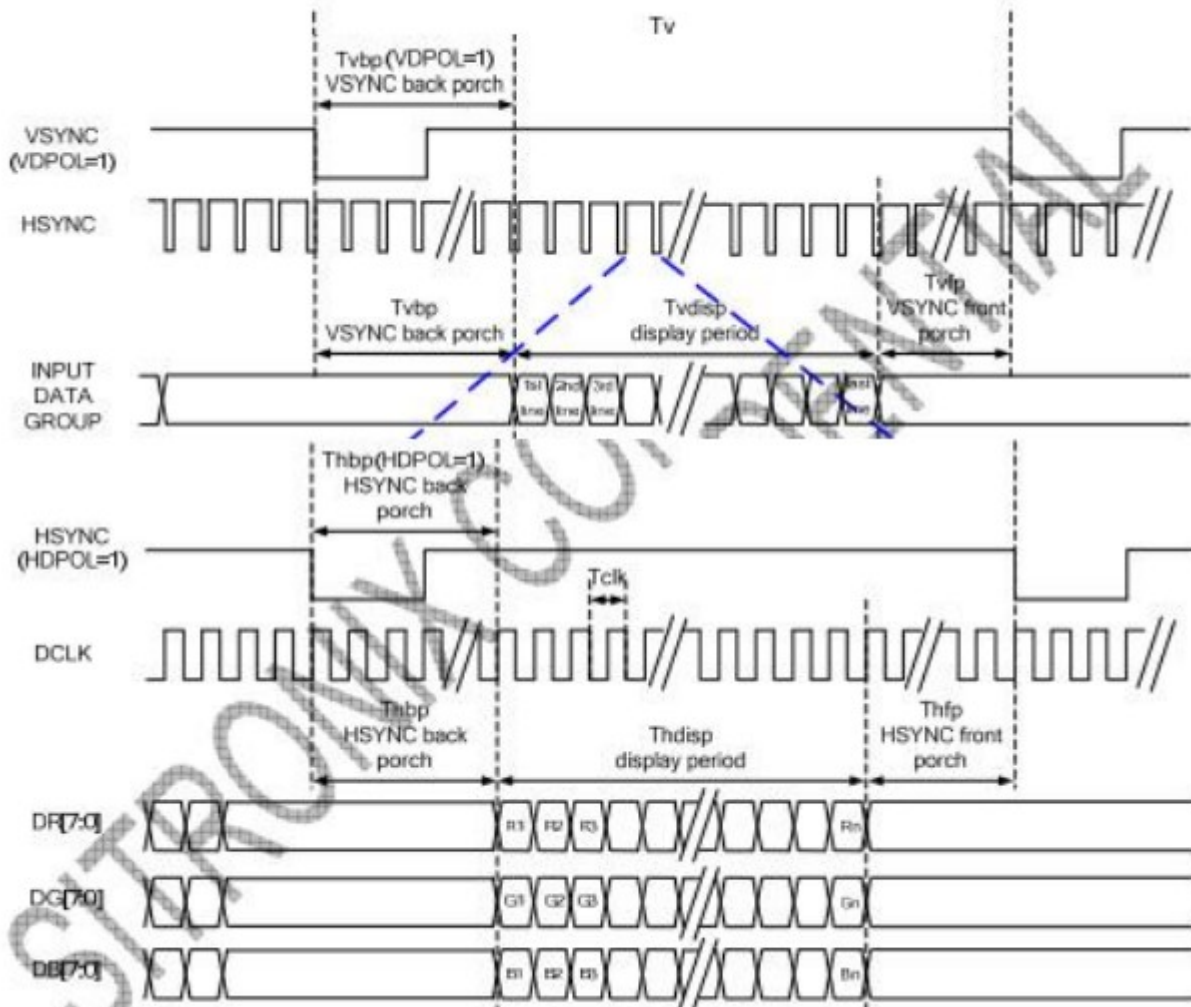
9.3.4 System Bus Timing for RGB Interface



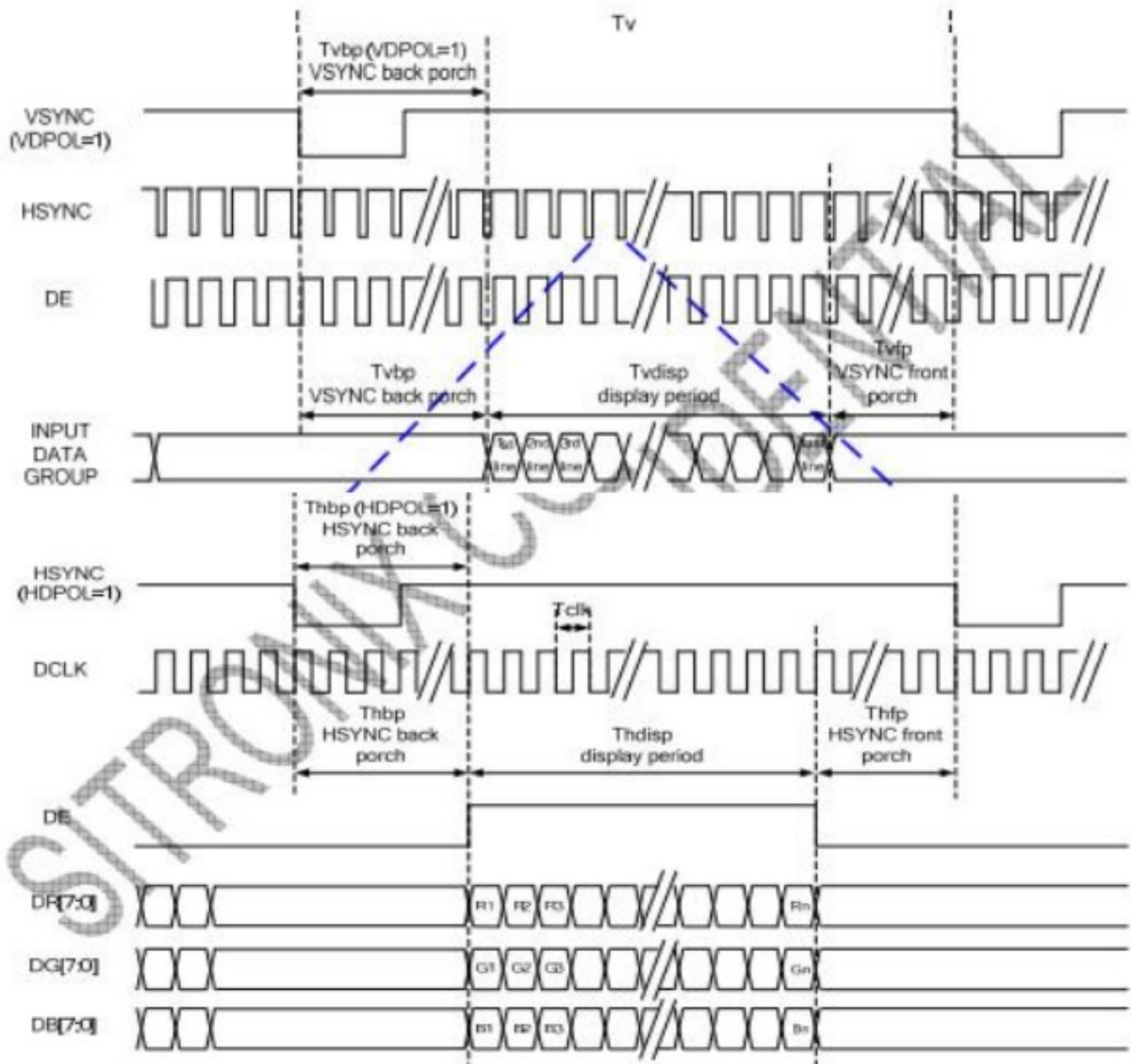
Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK Pulse Duty	Tclk	40	50	60	%	
HSYNC Width	Thw	2	-	-	DCLK	
HSYNC Period	Th	55	60	65	us	
VSYNC Setup Time	Tvst	12	-	-	ns	
VSYNC Hold Time	Tvhd	12	-	-	ns	
HSYNC Setup Time	Thst	12	-	-	ns	
HSYNC Hold Time	Thhd	12	-	-	ns	
Data Setup Time	Tdsu	12	-	-	ns	
Data Hold Time	Tdhd	12	-	-	ns	
DE Setup Time	Tdest	12	-	-	ns	
DE Hold Time	Tdehd	12	-	-	ns	

7.3 RGB Interface

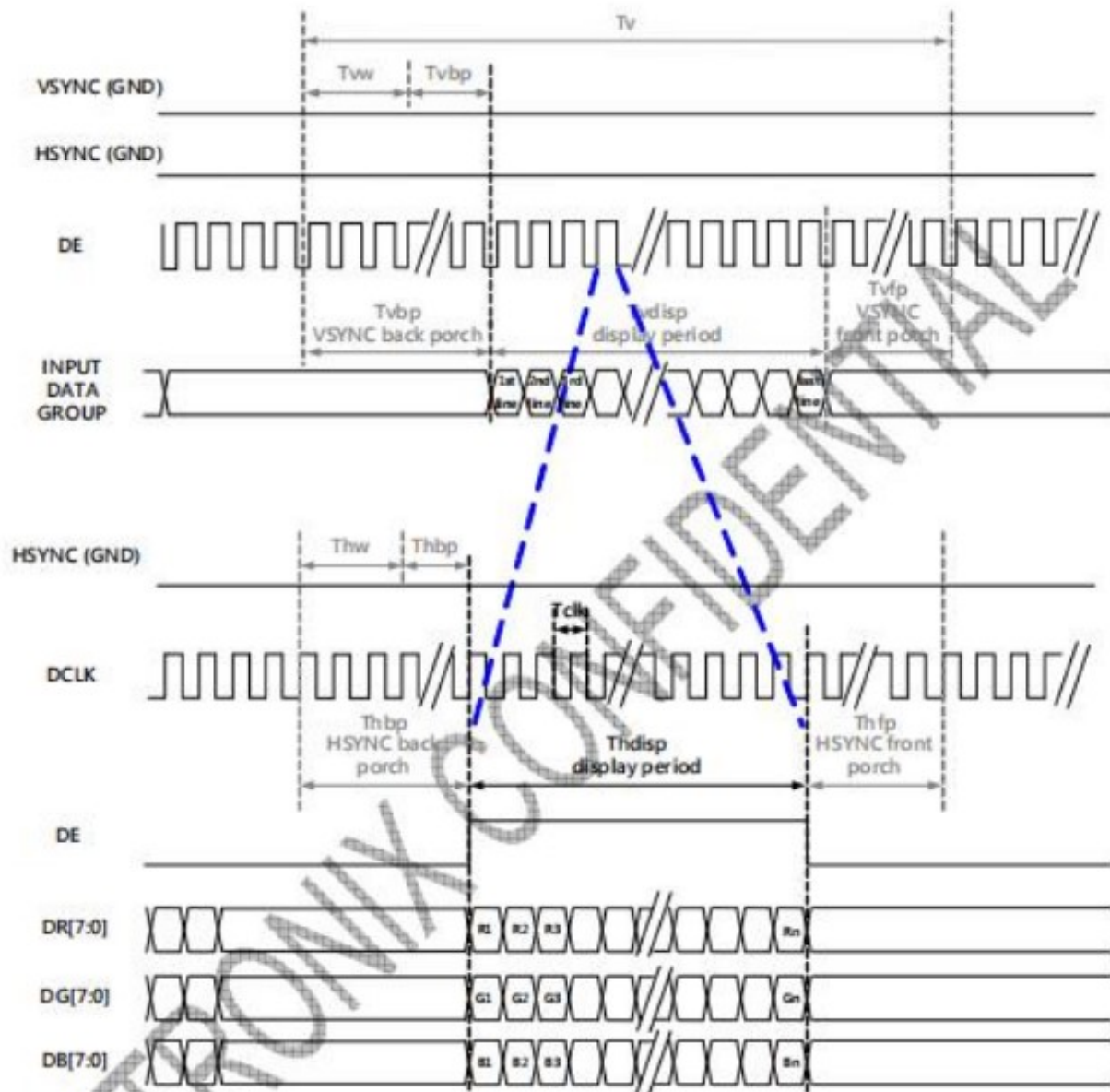
7.3.1 SYNC Mode



7.3.2 SYNC-DE Mode



7.3.3 DE Mode



RGB Mode Selection Table	DCLK	HSYNC	VSYNC	DE
SYNC - DE Mode	Input	Input	Input	Input
SYNC Mode	Input	Input	Input	GND
DE Mode	Input	GND	GND	Input

Note: "Input" means these signals are driven by host side.

7.3.4 Parallel 24-bit RGB Input Timing Table

Parallel 24-bit RGB Input Timing (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C)

Parallel 24-bit RGB Input Timing Table						
Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK Frequency	Fclk	5	6	8	MHz	
DCLK Period	Tclk	125	167	200	ns	
HSYNC	Period Time	Th	325	371	438	DCLK
	Display Period	Thdisp		320		DCLK
	Back Porch	Thbp	3	43	43	DCLK SYNC mode back porch control by H_BLANKING[7:0] setting Thbp= H_BLANKING[7:0]
	Front Porch	Thfp	2	8	75	DCLK
	Pulse Width	Thw	2	4	43	DCLK
VSYNC	Period Time	Tv	244	260	289	HSYNC
	Display Period	Tvdisp		240		HSYNC
	Back Porch	Tvbp	2	12	12	HSYNC SYNC mode back porch control by V_BLANKING[7:0] setting Tvbp= V_BLANKING[7:0]
	Front Porch	Tvfp	2	8	37	HSYNC
	Pulse Width	Tvw	2	4	12	HSYNC

Note: It is necessary to keep Tvbp=12 and Thbp=43 in sync mode. DE mode is unnecessary to keep it.

6 Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	θT	CR≥10	70	80	-	Degree	Note2,3,8
	θB		70	80	-		
	θL		70	80	-		
	θR		70	80	-		
Contrast Ratio	CR	θ=0°	640	800	-		Note 3
Response Time	T _r +T _F	θ=0°	-	30	40	msec	Note 4
Chromaticity	White	x	0.250	0.300	0.350		Note 1,5
		y	0.260	0.310	0.360		
	Red	x	0.574	0.624	0.674		Note 1,5
		y	0.308	0.358	0.408		
	Green	x	0.322	0.372	0.422		Note 1,5
		y	0.540	0.590	0.640		
	Blue	x	0.098	0.148	0.198		Note 1,5
		y	0.033	0.083	0.133		
Uniformity	U	Backlight is on	80	-	-	%	Note 6
Flicker	-		-	-	25	%	CA310
NTSC	-		-	60	-	%	Note 5
Luminance	L		450	500	-	cd/m ²	Note 7

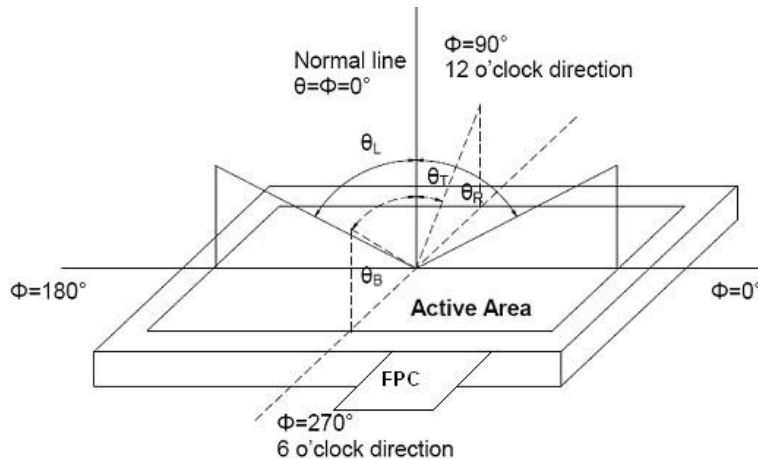
Test Conditions:

1. $I_F = 20\text{mA}$, and the ambient temperature is 25°C .
2. The test systems refer to Note 1 and Note 2.
3. Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.

Note 2: Definition of viewing angle range and measurement system.

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



Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

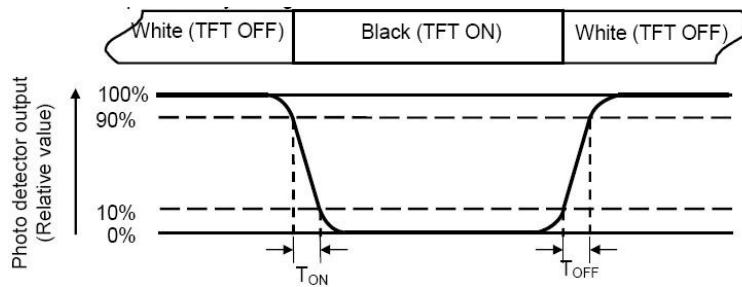
“White state”: The state is that the LCD should drive by V_{white} .

“Black state”: The state is that the LCD should drive by V_{black} .

V_{white} : TBD V V_{black} : TBD V.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of

LCD. Note 6: Definition of Luminance Uniformity

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

Luminance Uniformity (U) :

$$\text{UNIFORMITY:} \left[1 - \frac{\text{MAXIMUM BRIGHTNESS} - \text{MINIMUM BRIGHTNESS}}{\text{AVERAGE BRIGHTNESS}} \right] \times 100\%$$

L-----Active area length W----- Active area width

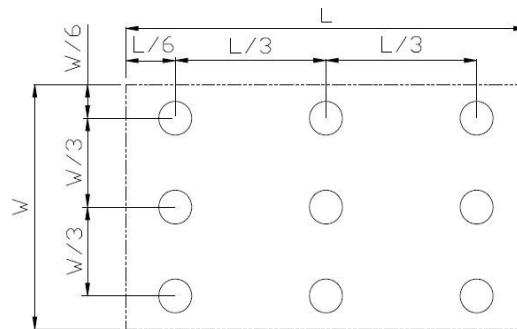
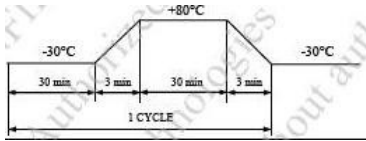


Fig. 2

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

7 Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts=+70℃, 240hrs	Note1 IEC60068-2-1,GB2423.2
2	Low Temperature Operation	Ta=-20℃, 240hrs	IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta=+80℃, 240hrs	IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta=-30℃, 240hrs	IEC60068-2-1 GB2423.1
5	High Temperature & High Humidity Storage	Ta=+60℃, 90% RH 240 hours	Note2 IEC60068-2-78 GB/T2423.3
6	Thermal Shock (Non-operation)	-30℃ 30 min~+80℃ 30 min,, 10 Cycles 	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22
7	Electro Static Discharge (NOT OPERATED)	C=150pF, R=330Ω, 1 Air:±12KV, Contact:±8KV,	IEC61000-4-2 GB/T17626.2
8	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.

Note3: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 4: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but doesn't guarantee all of the cosmetic specification.

8 Precautions for Use of LCD Modules

8.1 Handling Precautions

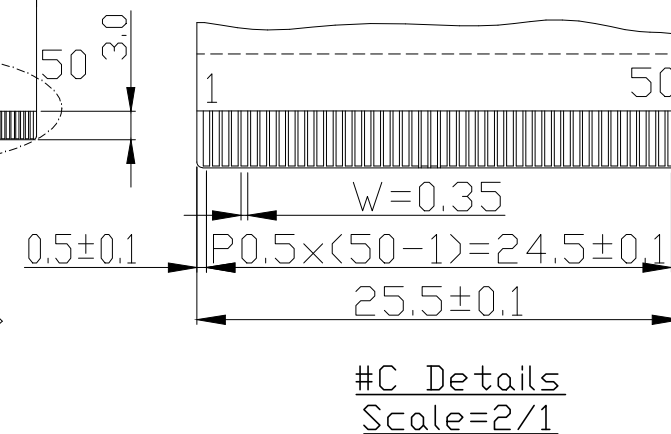
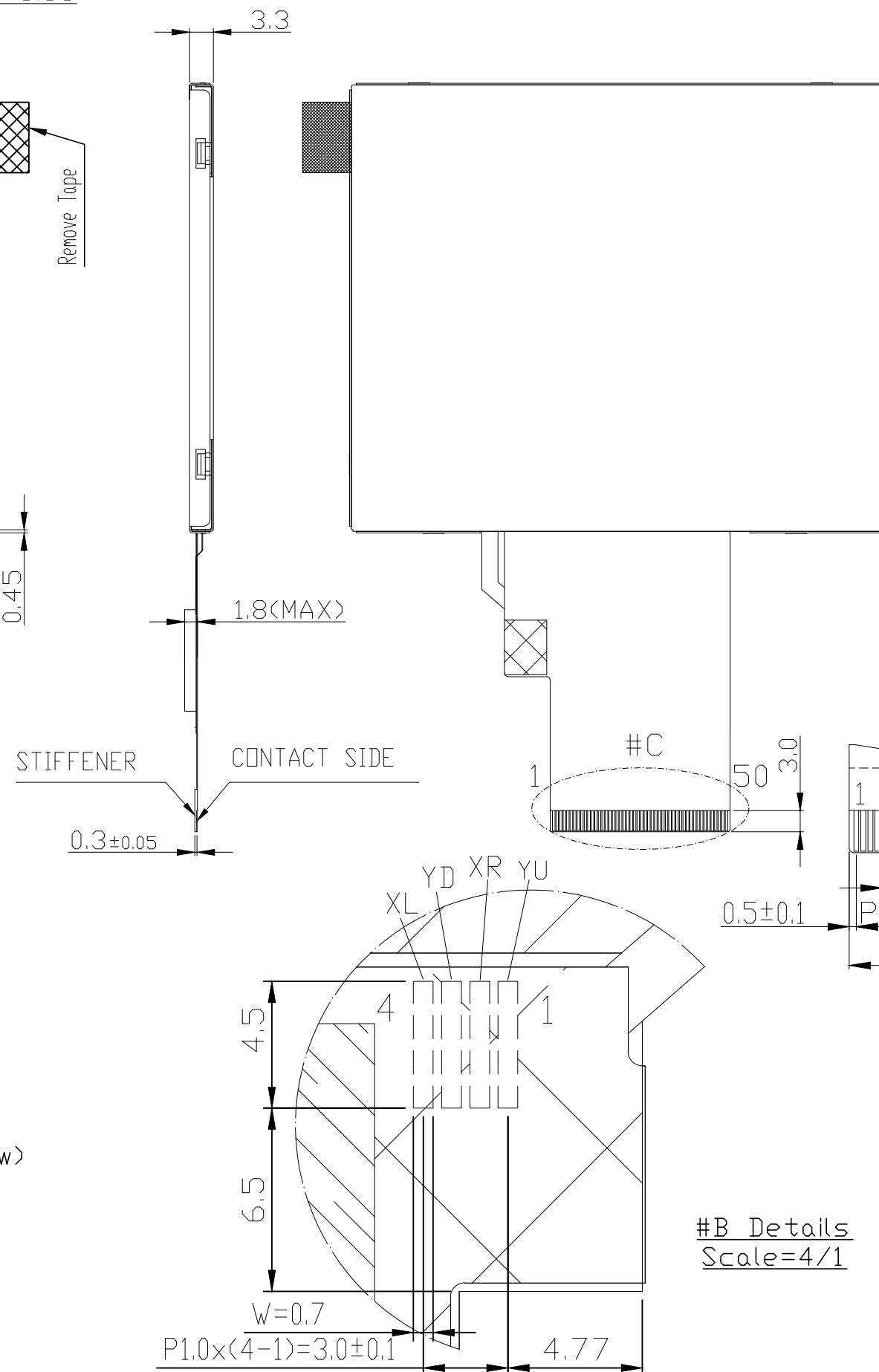
- 8.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 8.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- 8.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 8.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 8.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
- Isopropyl alcohol
 - Ethyl alcohol
- Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
- Ketone
 - Aromatic solvents
- 8.1.6 Do not attempt to disassemble the LCD Module.
- 8.1.7 If the logic circuit power is off, do not apply the input signals.
- 8.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
- 8.1.8.1 Be sure to ground the body when handling the LCD Modules.
- 8.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.
- 8.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
- 8.1.8.4 The LCD Module is coated with a film to protect the display surface. Be careful when peeling off this protective film since static electricity may be generated.

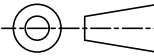
8.2 Storage precautions

- 8.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 8.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:
- Temperature : 0℃ ~ 40℃ Relatively humidity: ≤80%
- 8.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

8.3 Transportation Precautions

- 8.3.1 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshi



C				
B				
A				
Rev	Note			Date
Dwg Title LMT035ENAFWA Outline Dwg				
Dwg No. MK-006857-1-1			Date 2020-03-18	
Scale 6/5	Tol. ± 0.3	Unit mm	Paper Size A3	
Approved		Checked		Drawn Luo Lin

TOPWAY

- *1. LCD Display Type : TFT,Transmissive (Full View)
- *2. Pixel Arrangement : RGB-STRIPLE
- *3. Signal Interface : RGB_24bit
- *4. Color Depth : 16.7M Colors
- *5. Operating Voltage : 3.3V
- *6. Logic Voltage : 3.3V
- *7. Backlight : White LEDs
- *8. Backlight Supply : 20mA (VF=18.0V, TYP)
- *9. Recommended Connector : FH19SC-50S-0.5SH(HIROSE)
Or Equivalent
- *10. Operating Temperature : -20°C~70°C
- *11. Storage Temperature : -30°C~80°C