



**MODEL NO. :** TM050QDH01

**ISSUED DATE:** 2011-04-07

**VERSION :** Ver 2.1

- Preliminary Specification
- Final Product Specification

Customer : \_\_\_\_\_

Approved by	Notes

SHANGHAI TIANMA Confirmed :

Prepared by	Checked by	Approved by

This technical specification is subjected to change without notice



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## 1 General Specifications

Feature		Spec
<b>Display Spec.</b>	Size	5.0 inch
	Resolution	640(RGB) x 480
	Interface	RGB 18 bit with TCON+SPI
	Color Depth	262K
	Technology Type	a-Si TFT
	Pixel Pitch (mm)	0.1587x0.1587
	Pixel Configuration	R.G.B Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Anti-Glare (3H)
	Viewing Direction	6 o'clock
	Gray Scale Inversion Direction	12 o'clock
<b>Mechanical Characteristics</b>	LCM (W x H x D) (mm)	117.35x88.43x7.9
	Active Area(mm)	101.568 x 76.176
	With /Without TSP	Without TSP
	Weight (g)	82.2(+/-5%)
	LED Numbers	15 LEDs
<b>Electronic</b>	Driver IC	NT39403Bx2+NT39207x1

Note 1: Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.

Note 2: Requirements on Environmental Protection: Q/S0002

Note 3: LCM weight tolerance : +/- 5%



## 2 Input/Output Terminals

### 2.1 CN1 of FPC

Matching connector: FH19S-40S-0.5SH (Hirose)

Pin	Symbol	I/O	Description	Remark
1	VLED	P	Power for LED Circuit	
2	VLED	P	Power for LED Circuit	
3	VLED	P	Power for LED Circuit	
4	DIM	I	Dimmer Control for Backlight (PWM)	
5	LEDGND	P	Ground for LED Circuit	
6	LEDGND	P	Ground for LED Circuit	
7	LEDGND	P	Ground for LED Circuit	
8	GND	P	Ground	
9	VDD	P	Power Supply	
10	VDD	P	Power Supply	
11	GND	P	Ground	
12	R0	I	Red Data (LSB)	
13	R1	I	Red Data	
14	R2	I	Red Data	
15	R3	I	Red Data	
16	R4	I	Red Data	
17	R5	I	Red Data (MSB)	
18	GND	P	Ground	
19	G0	I	Green Data (LSB)	
20	G1	I	Green Data	
21	G2	I	Green Data	
22	G3	I	Green Data	
23	G4	I	Green Data	
24	G5	I	Green Data (MSB)	
25	GND	P	Ground	
26	B0	I	Blue Data (LSB)	
27	B1	I	Blue Data	
28	B2	I	Blue Data	

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29	B3	I	Blue Data	
30	B4	I	Blue Data	
31	B5	I	Blue Data (MSB)	
32	GND	P	Ground	
33	DCLK	I	Pixel Clock	
34	HSYNC	I	Horizontal Sync Signal	
35	VSYNC	I	Vertical Sync Signal	
36	DE	I	Data Enable	
37	GND	P	Ground	
38	SPENA	I	Serial Port Data Enable	
39	SPCK	I	Serial Port Clock	
40	SPDA	I/O	Serial Port Data Input/Output	

Note 1: I/O definition:

I----Input      O---Output      P----Power(Ground)



### 3 Absolute Maximum Ratings

#### 3.1 Driving TFT LCD Panel

Ta = 25°C

Item	Symbol	Min	Max	Unit	Remark
Power Voltage	VDD	-0.50	5.0	V	
	VLED	-0.3	7.0	V	
Input signal Voltage	Vin	GND	VDD	V	Note1
Operating Temperature	TOPR	-20	70	°C	
Storage Temperature	TSTG	-20	70	°C	

Note1: Signals include R0~R5, G0~G5, B0~B5, DCLK, HSYNC, VSYNC, DE, SPENA, SPCK, SPDA.

Table 3.1 absolute maximum rating

### 4 Electrical Characteristics

#### 4.1 Driving TFT LCD Panel

VDD=3.3V,GND=0V, Ta = 25°C

Item	Symbol	Min	Typ	Max	Unit	Remark	
POWER Supply Voltage	VDD	3.00	3.30	3.60	V		
Input Signal Voltage	Low Level	VIL	GND	-	0.2xVDD	V	Note2
	High Level	VIH	0.8xVDD	-	VDD	V	
Output Signal Voltage	Low Level	VIL	GND	-	0.2xVDD	V	Note2
	High Level	VIH	0.8xVDD	-	VDD	V	
Current of VDD Power supply	IVDD	-	200	300	mA	Note3	
Power consumption of VDD	WVDD	-	660	1080	mW		

Note2: Input Signals include DCLK,R0~R5,G0~G5,B0~B5, HSYNC, VSYNC, DE, SPENA, SPCK,SPDA. Output Signals include SPDA.

Note3: To test the current dissipation, use "all Black Pattern".

Table 3.2 LCD module electrical characteristics



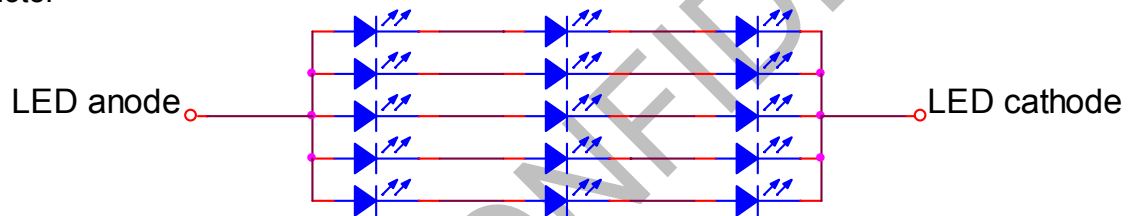
## 4.2 Driving Backlight

LEDGND=GND=0V, Ta = 25°C

Item	Symbol	Min	Typ	Max	Unit	Remark
POWER of LED backlight	VLED	-	9.75	10.35	V	
Current of VLED	IVLED	-	100	-	mA	
Power Consumption	W <sub>BL</sub>	-	975	-	mW	
Operating Life Time	--	-	50,000	-	Hrs	
DIM Signal Voltage	Low Level	V <sub>L</sub>	-	-	0.4	V
	High Level	V <sub>H</sub>	2	-	-	V
DIM Signal frequency	f <sub>DIM</sub>	20		40	KHZ	
DIM Signal duty	-	0	-	100	%	

Table 4.3 LED backlight characteristics

Note:

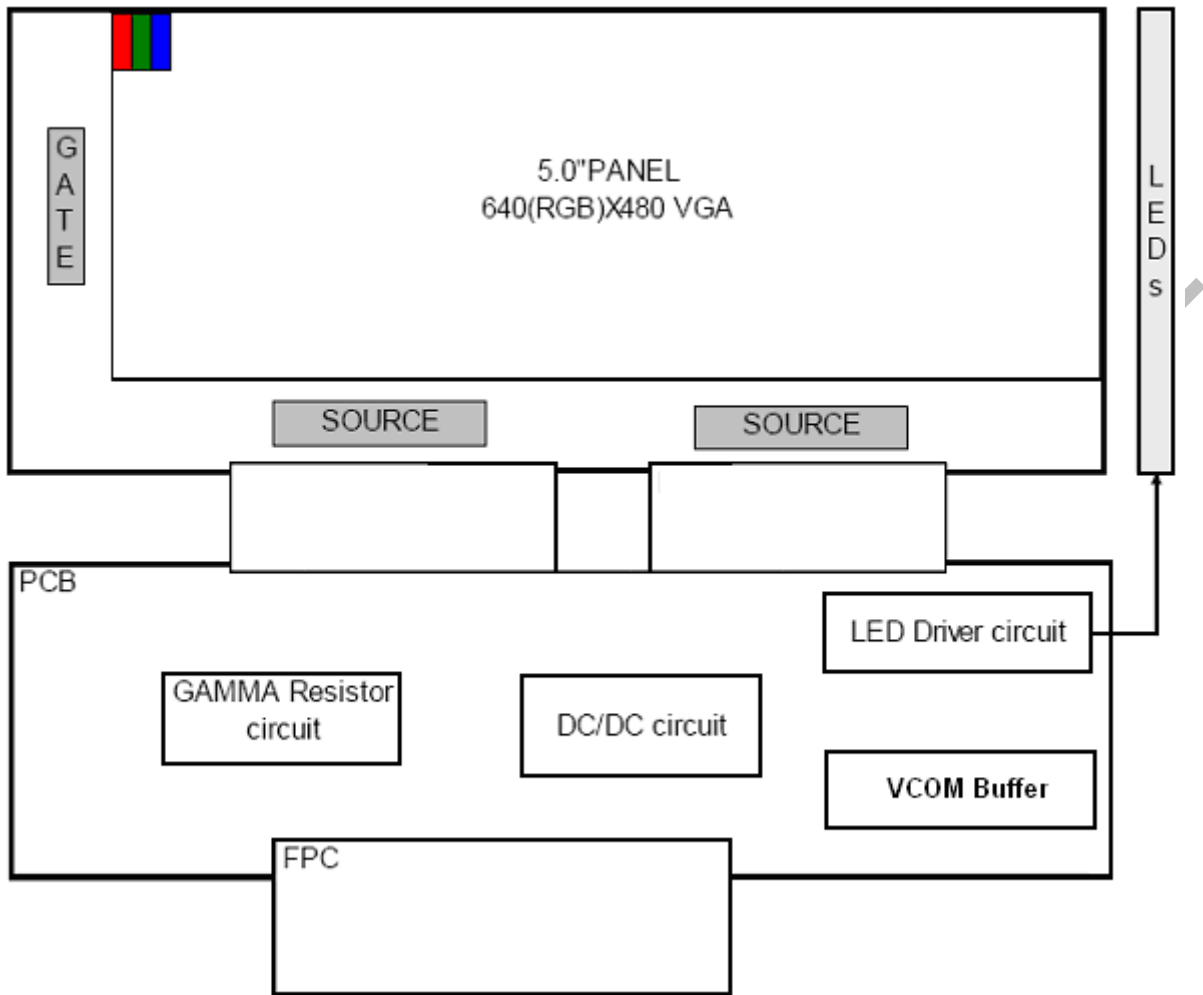


- 1) . The LED lifetime is defined as the module brightness decay 50% of original brightness at Ta=25 degree, VLED=5.0V.
- 2) . Environmental conditions such as sustained high operating temperatures, high humidity, operating conditions and other factors have an adverse effect on LED Lifetime. It is difficult to characterize LED lifetime for all the various operational, environmental and design permutations possible. Numerous environmental conditions such as ambient temperature, humidity and ventilation have impact on LED brightness decay. Brightness decay is also affected by control, thermal management, current levels, and other electrical design considerations.
- 3) . The SHTM typical value of LED Lifetime is estimated to be "50,000hrs" which is based on non-full life testing and our supplier's data. Full life testing for LEDs is impractical due to the long expected lifetime. Even with 24/7 operation, testing an LED for 50,000 hours would take 5.7 years, and such an endeavor is impractical because technology continues to develop and evolve so quickly, products would be obsolete by the time life testing is completed. Results based on actual usage environment may vary. This means that SHTM shall not be held liable for any problems related to LED life time that do not meet SHTM typical value from the use of SHTM's module.





4.3 Block Diagram





## 5 Timing Chart

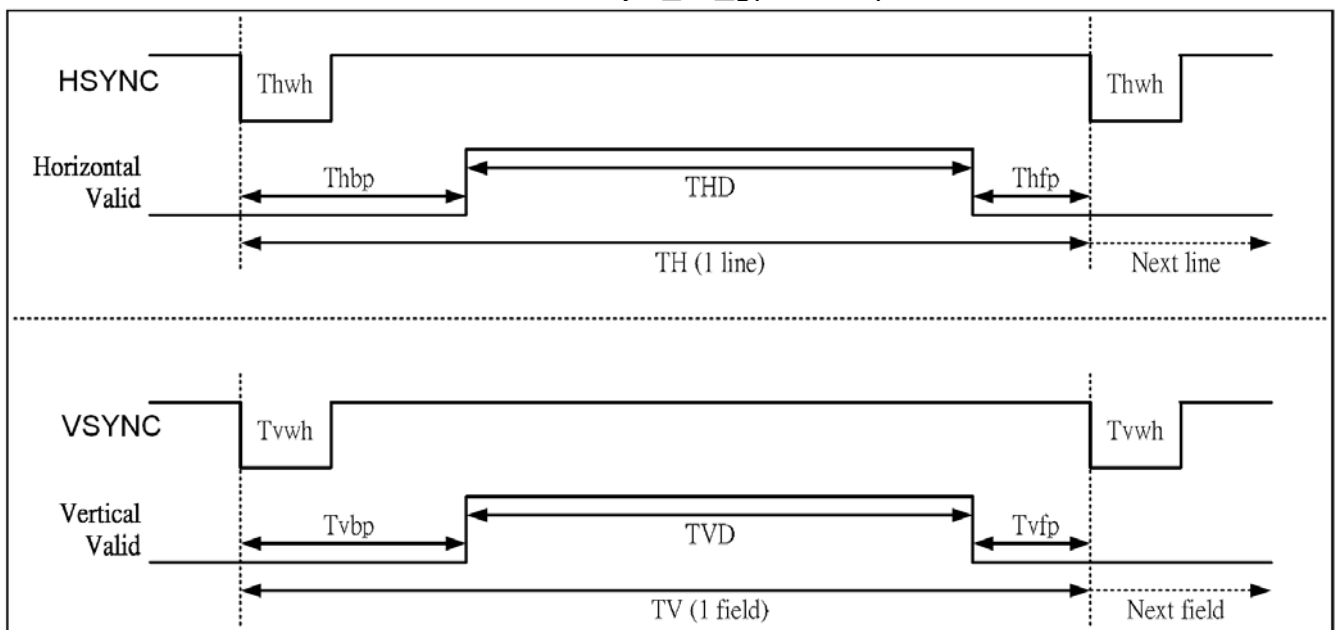
### 5.1 TCON (Embedded in Source IC) Input timing at HV mode

VDD=3.3V, GND=0V, Ta=25°C

Parameter	Symbol	Min	Typ	Max	Unit	Remark
DCLK	Fclk	-	25.2	30	MHz	Tclk=1/Fclk
	Tclk	33.3	39.7	-	ns	
HSYNC	TH	-	800	-	Tclk	
	THD	640	640	640	Tclk	
	Thwh	-	10	-	Tclk	
	Thbp	-	70	-	Tclk	
	Thfp	-	90	-	Tclk	
VSYNC	TV	-	525	-	TH	
	TVD	480	480	480	TH	
	Tvwh	-	2	-	TH	
	Tvbp	-	13	-	TH	
	Tvfp	-	32	-	TH	

Note: Above parameters are based on default setting without initial setting.

**Table 5.1 TCON input timing(HV mode)**



**Figure5.1 HV Mode Input Timing Diagram**



## 5.2 TCON (Embedded in Source IC) Input timing at HV mode

VDD=3.3V, GND=0V, Ta=25°C

Parameter		Symbol	Min	Typ	Max	Unit	Remark
Dclk frequency		Fclk	-	25.2	30	MHz	Tclk=1/Fclk
Horizontal section	Horizontal total	TH	688	800	1405	Tclk	
	Horizontal blanking	THC	48	160	765	Tclk	
	Valid Data Width	THD	640	640	640	Tclk	
Vertical section	Frame rate	-	-	60	-	Hz	
	Vertical total	TV	486	525	735	TH	
	Vertical blanking	TVC	6	45	255	TH	
	Valid Data Width	TVD	480	480	480	TH	

Table 5.2 TCON input timing (DE mode)

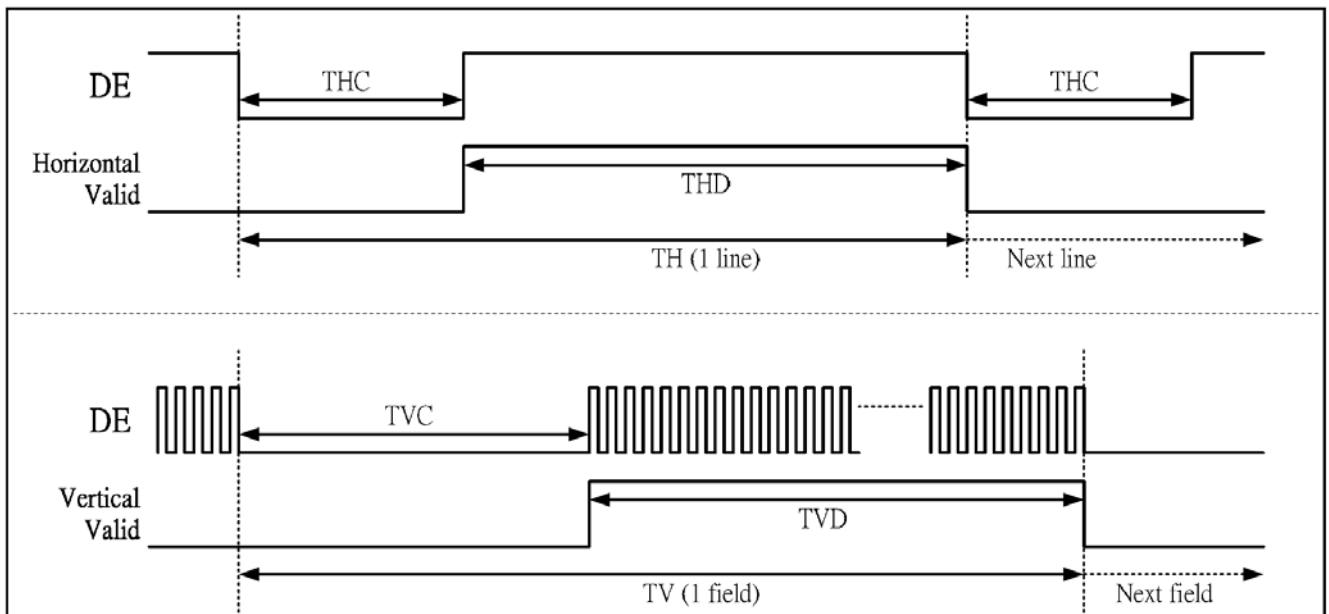


Figure 5.2 DE Mode Input Timing Diagram



5.3 RGB Input Data Format

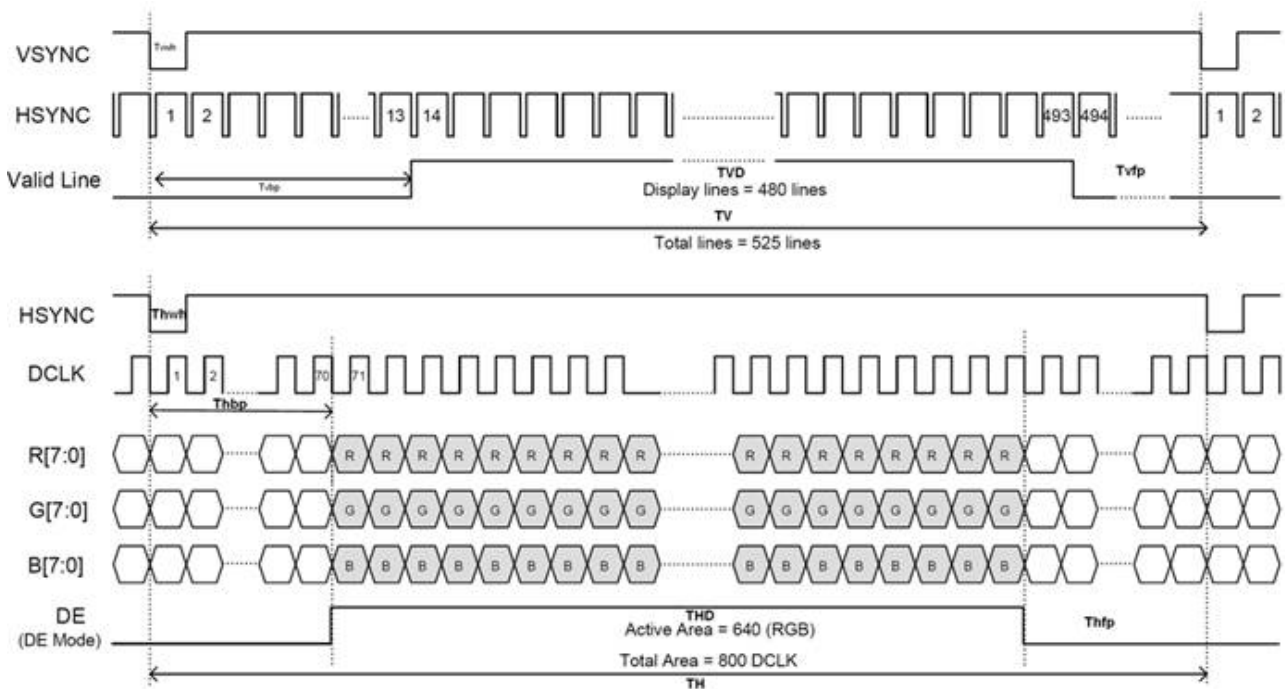


Figure 5.3 RGB input timing

5.4 Input signal AC timing

VDD=3.3V, GND=0V, Ta=25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK frequency	Fclk	-	25.2	30	MHz	$T_{clk}=1/F_{clk}$
DCLK duty cycle	Tcwh	40%	50%	60%	Tclk	
HSYNC to DCLK	Thc	-	-	1	Tclk	
HSYNC width	Thwh	1	-	-	Tclk	
HSYNC Period Time	Th	60	63.56	67	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 to DCLK
Data hold time	Tdhd	12	-	-	ns	Data to DCLK
DE setup time	Tesu	12	-	-	ns	DE to DCLK

Table 5.3 Input signal AC timing

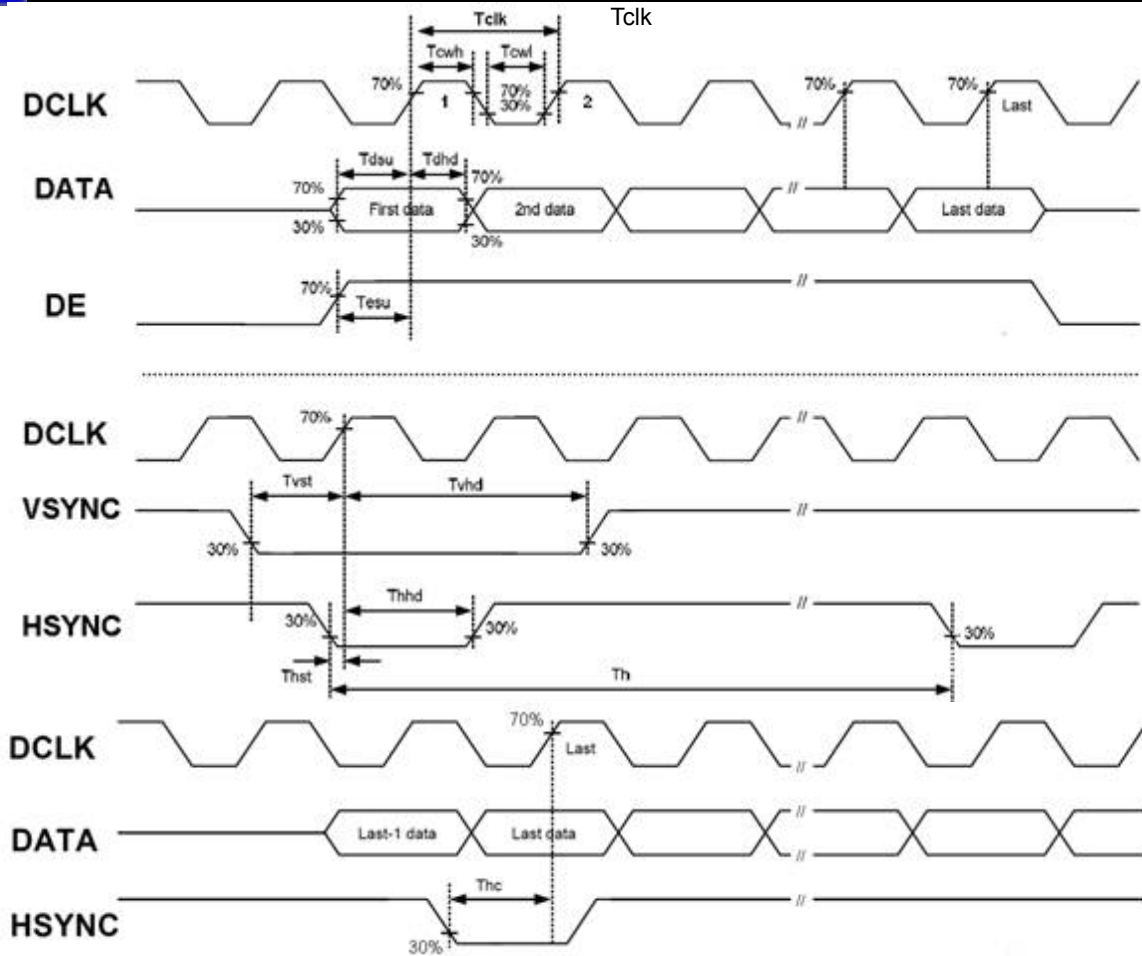


Figure 5.4 Input signal AC timing

### 5.5 SPI input timing setting

#### 5.5.1 3-Wire SPI Command Format

Bit	Description
D15-D10	Register Address
D9	W/R control bit. "1" for write
D8	Any data within this bit will be ignored during write mode
D7-D0	Data for the W/R operation to the address indicated by address phase

Table 5.4 3-Wire SPI Command Format

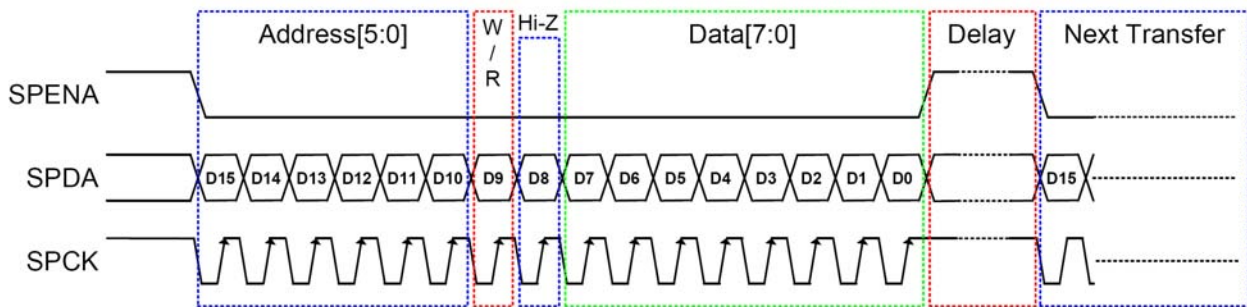


Figure 5.5 3-Wire SPI Command

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5.5.2 3-Wire SPI input timing

VDD=3.3V, GND=0V, Ta=25°C

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Serial Clock Period Time	Tspck	320	-	-	ns	
SPCK Pulse High Width	Tckh	120	-	-	ns	Tspck = Tckh + Tckl
SPCK Pulse Low Width	Tckl	120	-	-	ns	Tspck = Tckh + Tckl
Serial Data Setup Time	Tisu	120	-	-	ns	
Serial Data Hold Time	Tihd	120	-	-	ns	
SPENA Select Distinguish	Tcd	1	-	-	us	
SPENA to VSYNC	Tcv	1	-	-	us	
SPENA to SPDA	Teck	0	-	640	ns	Within Tspck x 2
SPDA to SPENA	Tcke	0	-	640	ns	Within Tspck x 2

Table 5.5 3-Wire SPI input timing

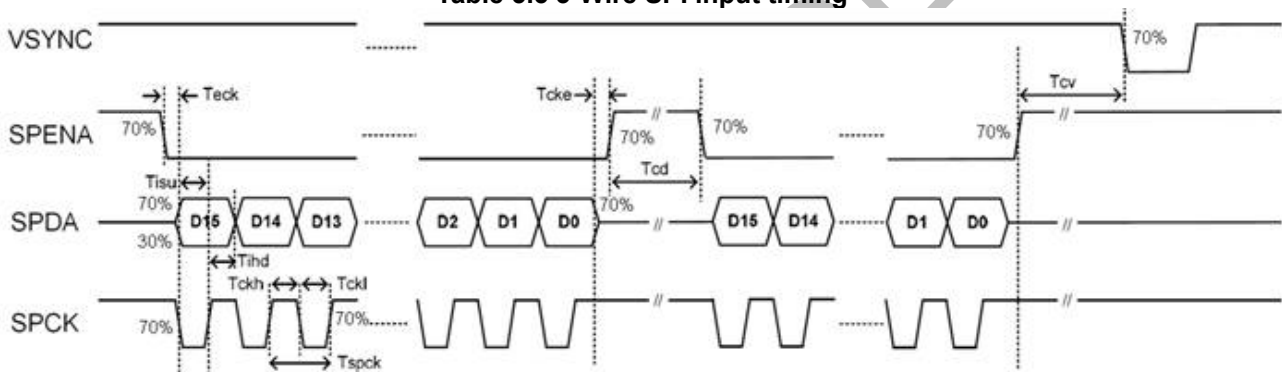


Figure 5.6 3-Wire SPI input timing

5.5.3 Initial code setting

	D15-D10	Register name	D7-D0 Value
For master IC	000000b	R00	07H
	000001b	R01	E2H
	000010b	R02	14H
	000011b	R03	CCH
	000100b	R04	28H
	000101b	R05	06H
	000111b	R07	32H
	001000b	R08	08H
	001001b	R09	40H
	001010b	R0A	88H
	001011b	R0B	88H

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	001100b	R0C	20H
	001101b	R0D	20H
For slave IC	100000b	R00	07H
	100001b	R01	E2H
	100010b	R02	14H
	100011b	R03	CCH
	100100b	R04	28H
	100101b	R05	06H
	100111b	R07	32H
	101000b	R08	08H
	101001b	R09	40H
	101010b	R0A	88H
	101011b	R0B	88H
	101100b	R0C	20H
	101101b	R0D	20H

Figure 5.7 Initial code setting



5.6 Power On/Off Sequence

Item	Symbol	Min	Typ	Max	Unit	Remark
VDD 3.3V to signal starting	Tp1	5	-	50	ms	
Signal starting to backlight on	Tp2	150	-	-	ms	
Signal off to VDD 0V	Tp3	5	-	50	ms	
Backlight off to signal off	Tp4	150	-	-	ms	

Table 6.1 POWER ON/OFF SEQUENCE

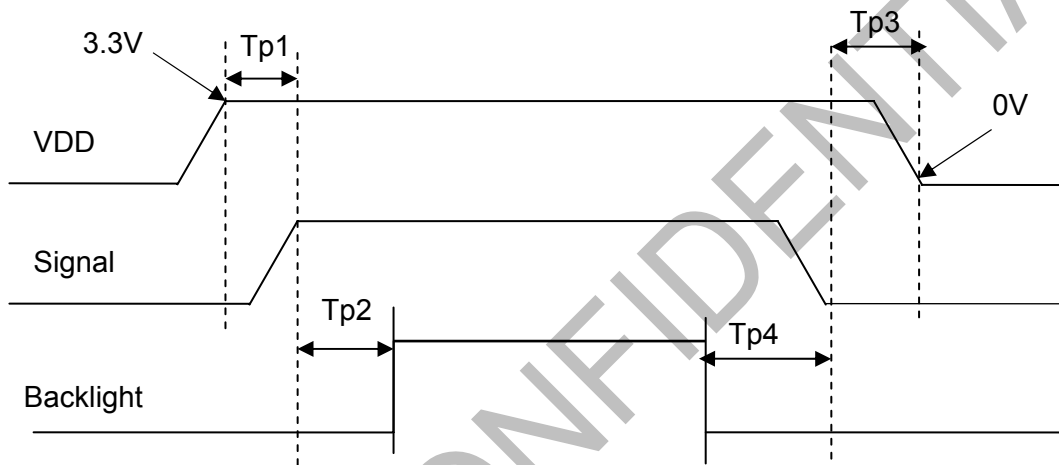


Figure 6.1 Interface power on/off sequence





## 6 Optical Characteristics

### 6.1 Optical Specification

Ta=25°C

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	$\theta T$	$CR \cong 10$	60	70	-	Degree	Note 2
	$\theta B$		50	60	-		
	$\theta L$		60	70	-		
	$\theta R$		60	70	-		
Contrast Ratio	CR	$\theta=0^\circ$	400	500	-		Note1 Note3
Response Time	$T_{ON}$	25°C	-	20	35	ms	Note1 Note4
	$T_{OFF}$						
Chromaticity	White	x	0.256	0.306	0.356		Note5, Note1
		y	0.266	0.316	0.366		
	Red	x	0.520	0.570	0.620		
		y	0.290	0.340	0.390		
	Green	x	0.290	0.340	0.390		
		y	0.525	0.575	0.625		
	Blue	x	0.097	0.147	0.197		
		y	0.040	0.090	0.140		
Uniformity	U		75	80	-	%	Note1 Note6
NTSC			46	50	-	%	Note 5
Luminance	L		250	350	-	cd/m <sup>2</sup>	Note1 Note7

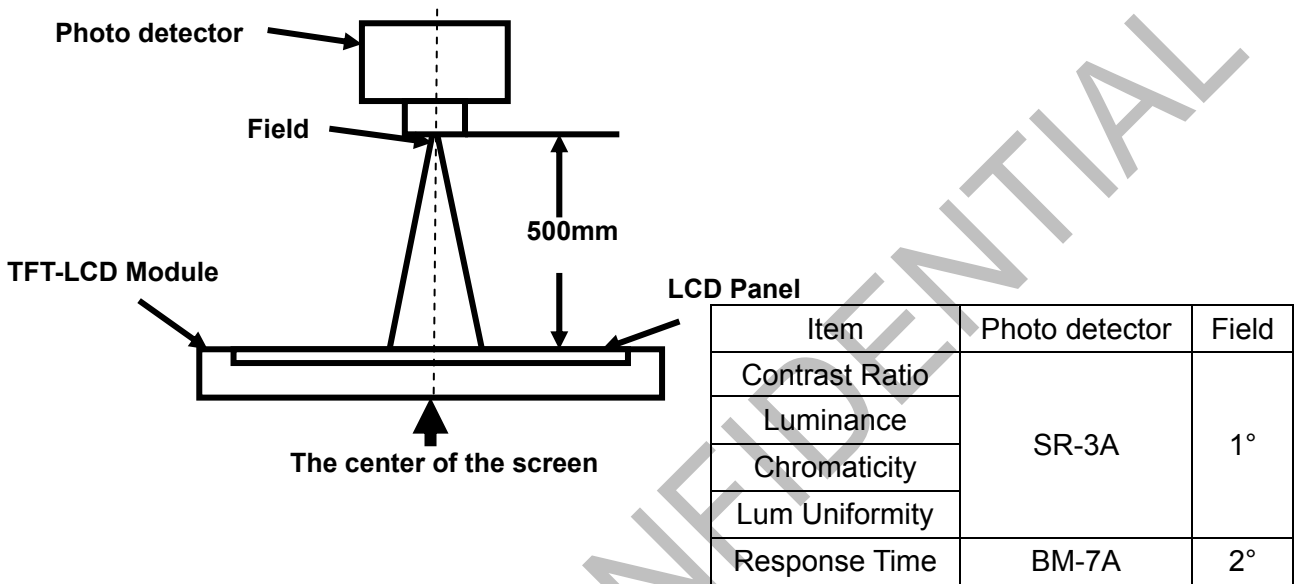
Test Conditions:

1.  $V_{LED} = 5V$ ,  $I_{LED} = 240mA$  (Backlight current), the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.



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 by CONOSCOPE(ergo-80).

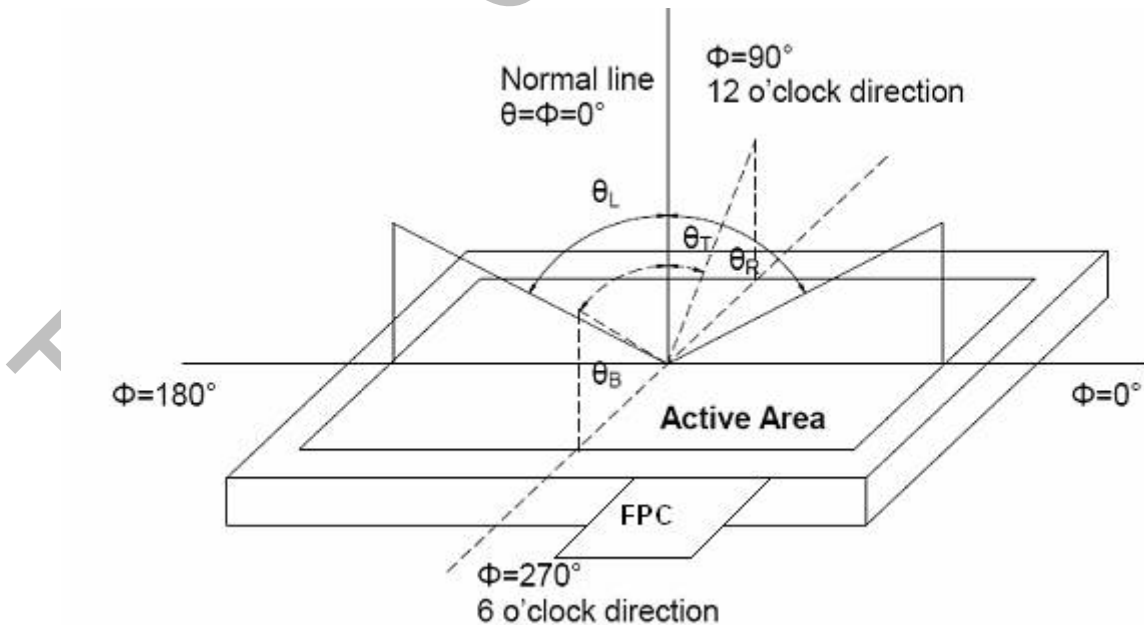


Fig. 1 Definition of viewing angle



Note 3: Definition of contrast ratio

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

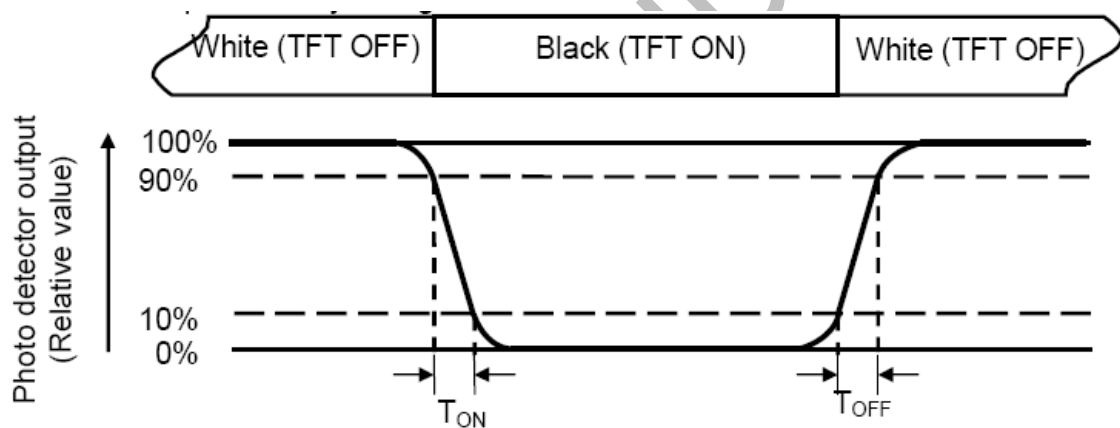
“White state “:The state is that the LCD should be driven by  $V_{\text{white}}$ .

“Black state”: The state is that the LCD should be driven by  $V_{\text{black}}$ .

$V_{\text{white}}$ : To be determined     $V_{\text{black}}$ : To be determined.

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 ( $T_{\text{ON}}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{\text{OFF}}$ ) 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.

$$\text{Luminance Uniformity}(U) = L_{\min} / L_{\max}$$

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

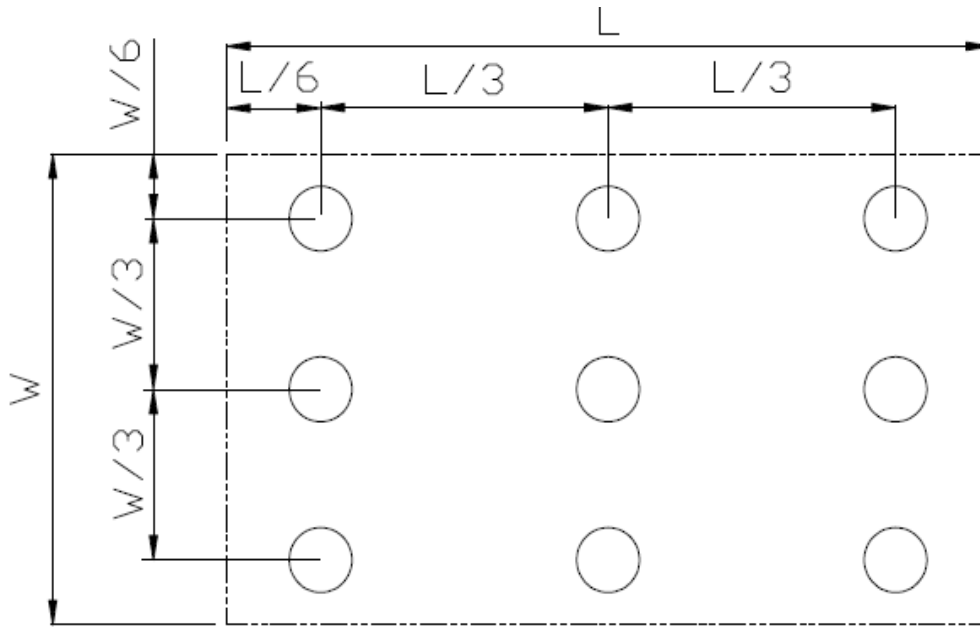


Fig. 2 Definition of uniformity

Lmax: The measured maximum luminance of all measurement position.

Lmin: The measured minimum luminance of all measurement position.

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°C, 240 hours	Follow Cisco's First Level Qualification for Display Modules
2	Low Temperature Operation	Ta = -20°C, 240 hours	Follow Cisco's First Level Qualification for Display Modules
3	High Temperature Storage	Ta = +70°C, 240 hours	Follow Cisco's First Level Qualification for Display Modules
4	Low Temperature Storage	Ta = -20°C, 240 hours	Follow Cisco's First Level Qualification for Display Modules
5	Operation at High Temperature and Humidity	Ta = +60°C, 90% RH, 240 hours	Follow Cisco's First Level Qualification for Display Modules
6	Temperature Cycle	-20±2 deg C. for 20 minutes followed by 25±2 deg C. for 5 minutes followed by 70±2 deg C. for 20 minutes A total of 6 cycles	Follow Cisco's First Level Qualification for Display Modules
7	ESD	Air discharge 6 times at: Voltage: 8 kV Resistance 330 Ohms Capacitance 150 pF	Follow Cisco's First Level Qualification for Display Modules
8	Vibration Test	Amplitude 2mm Direction X Y Z for 2 Hours Start at 10Hz followed by 100Hz followed by 10Hz	Follow Cisco's First Level Qualification for Display Modules
9	Mechanical Shock (Non Op)	Half Sine Wave 60G 6ms, ±X,±Y,±Z 3times for each direction	IEC60068-2-27 GB/T2423.5
10	Drop Test	Height 750 mm Drop test must be done 6 times Once corner each time, One flat sides each time	Follow Cisco's First Level Qualification for Display Modules

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

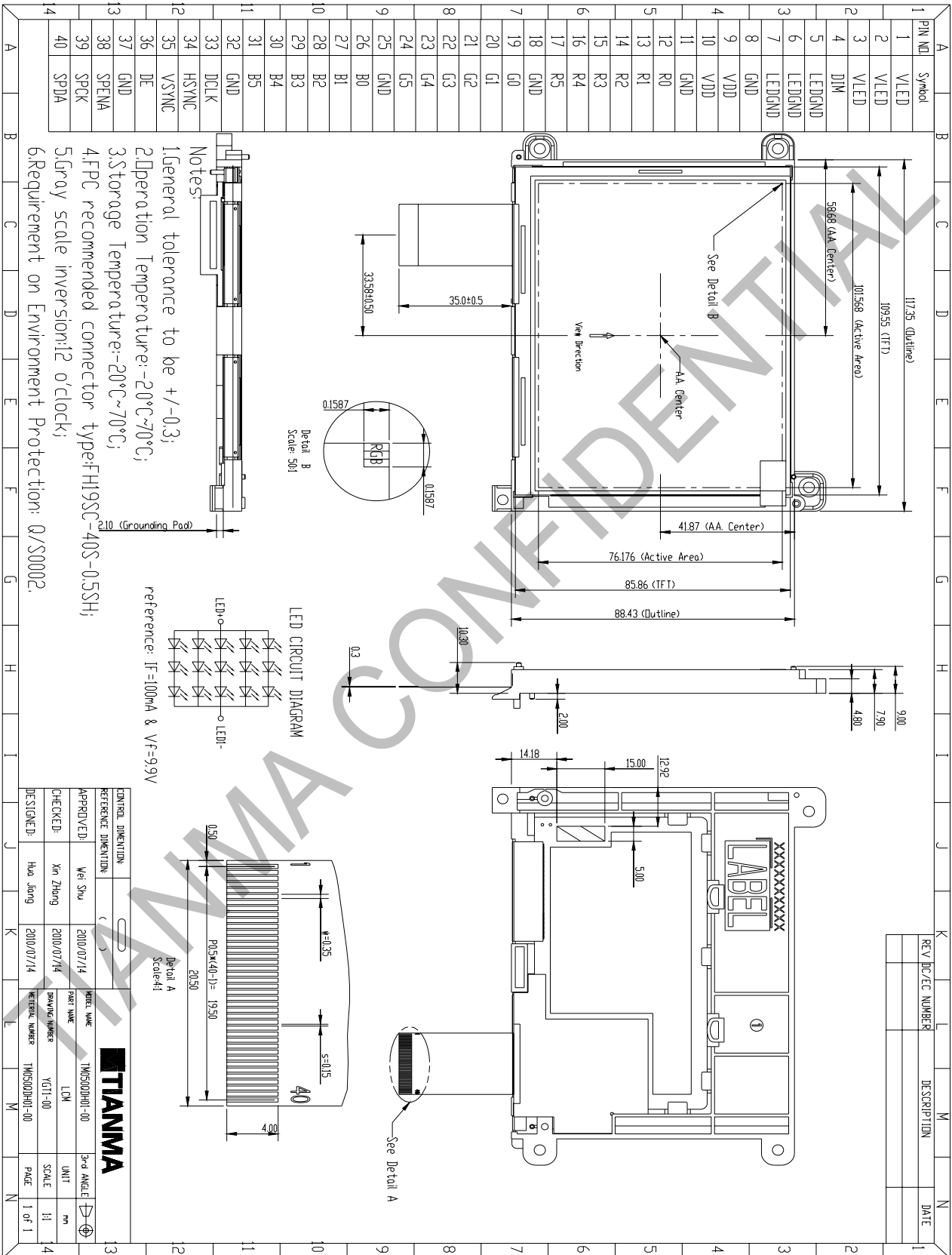
Note2: Ta is the ambient temperature of sample.

**MTBF: 50000Hrs sample NO. 20Pcs 504Hrs, 60°C 90%RH Note3**

Note3: Tianma had pass MTBF test at condition: sample NO. 20Pcs 1200Hrs, 70°C 70%RH



8 Mechanical Drawing

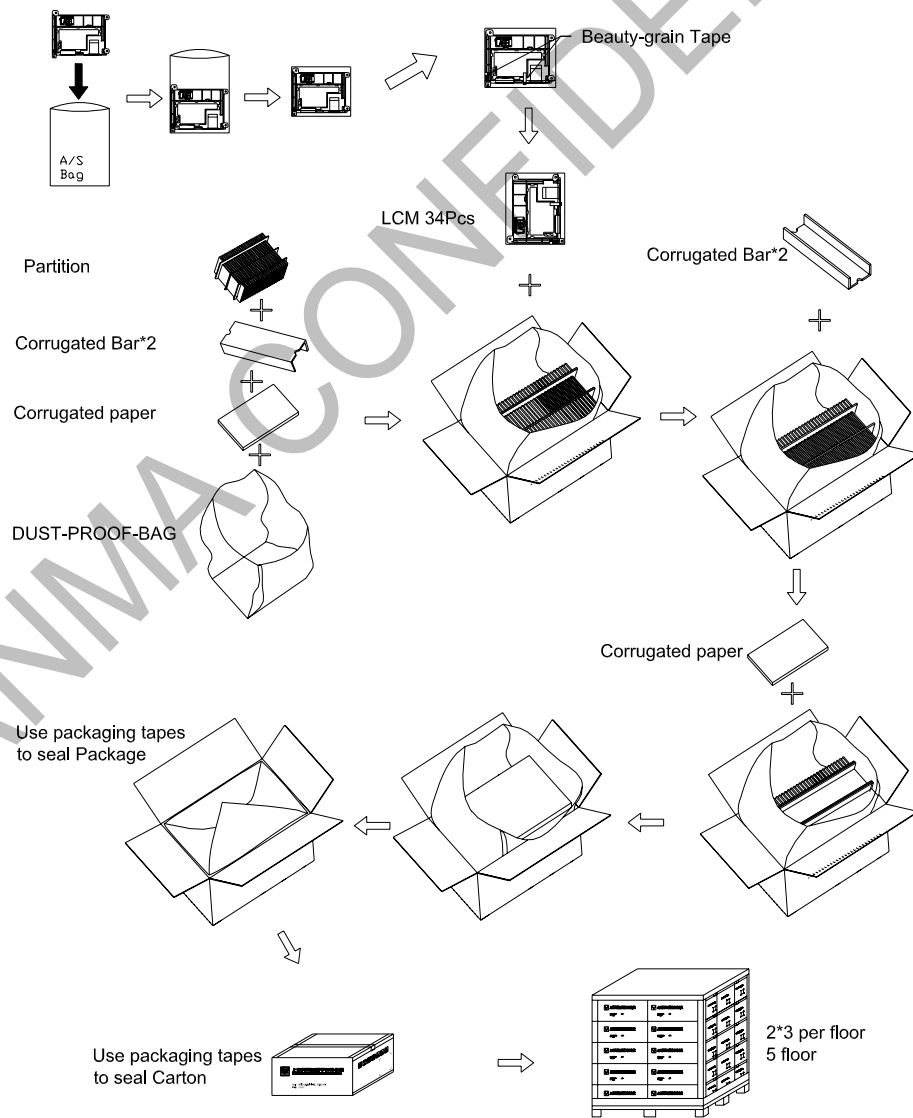


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### 9 Packing Drawing

No	Item	Model(Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark	
1	LCM module	TM050QDH01	117.35 ×88.43×7.9	0.0822	34		
2	Partion_1	Corrugated Paper	513X333X216	1.571	1		
3	Dust-proof Bag	PE	205X145X3	0.001	34		
4	Anti-static bag	PE	700X530	0.06	1	Anti-static	
5	Partion_2	Corrugated Paper	505X332X4.0	0.098	2		
6	Corrugated Bar	Corrugated Paper	513X105×33	0.057	4		
7	Carton	Corrugated Paper	530X350X250	1.12	1		
8	Total weight(Kg)	6.0038 Kg+5%					



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## 10 Precautions for Use of LCD Modules

### 10.1 Handling Precautions

- 10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 10.1.2 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.
- 10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 10.1.5 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:
- Water
  - Ketone
  - Aromatic solvents
- 10.1.6 Do not attempt to disassemble the LCD Module.
- 10.1.7 If the logic circuit power is off, do not apply the input signals.
- 10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
- 10.1.8.1 Be sure to ground the body when handling the LCD Modules.
- 10.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.
- 10.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
- 10.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

### 10.2 Storage precautions

- 10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 10.2.2 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°C ~ 40°C      Relatively humidity: ≤80%
- 10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

### 10.3 Transportation Precautions:

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.