MODEL NO. : TM035KDH04

ISSUED DATE: 2011-05-08

VERSION : Ver2.0

☐ 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

Table of Contents

Record of Revision

Rev	Issued Date	Description	Editor
1.0	May,15,2008	Rev 1.0 was issued	Xu Yun
1.1	Jan,20,2009	Modify the model name from TS035KAAVD05-00 to TM035KDH04. Update the Input Signal Voltage.	Lei Peng
2.0	May 8, 2011	Update the power on/off sequence, chromaticity and brightness	Jin Zhao

General Specifications

Feature		Spec
Display Spec.	Size	3.5inch
	Resolution	320(RGB) X 240
	Interface	RGB/CCIR656/601
	Color Depth	16.7M dithering
	Technology type	a-si TFT
	Pixel pitch (mm)	0.219 x 0.219
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Clear type (3H)
	Viewing Direction	12 o'clock
	Gray Scale Inversion Direction	6 o'clock
Mechanical Characteristics	DIM.(mm)	76.90 x 63.90 x 2.80
	Active Area(mm)	70.08 x 52.56
	With /Without TSP	Without TSP
	LED Numbers	6 LEDs Serial
Electronic	Driver IC	NT39016D

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: RoHS

2 Input/Output Terminals

2.1 TFT LCD Panel

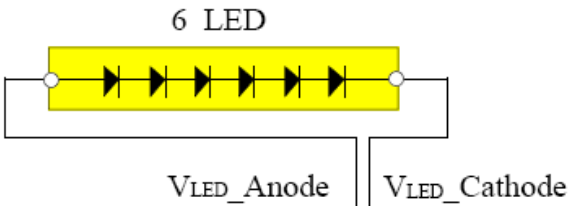
Recommend connector: Kyocera elco: 6240 serials

No	Symbol	I/O	Description	Remark
1,2	LED_Cathode	I	LED_Cathode	Note 2-1
3,4	LED_Anode	I	LED_Anode	Note 2-1
5	NC	-	No Connect	
6	RESET	I	Reset	
7	NC	-	No Connect	
8	YU	I	Y_Up	Not used
9	XR	I	X_Right	Not used
10	YD	I	Y_Bottom	Not used
11	XL	I	X_Left	Not used
12	D00	I	Data 00	Note 2-2
13	D01	I	Data 01	Note 2-2
14	D02	I	Data 02	Note 2-2
15	D03	I	Data 03	Note 2-2
16	D04	I	Data 04	Note 2-2
17	D05	I	Data 05	Note 2-2
18	D06	I	Data 06	Note 2-2
19	D07	I	Data 07	Note 2-2
20	D08	I	Data 08	Note 2-2
21	D09	I	Data 09	Note 2-2
22	D10	I	Data 10	Note 2-2
23	D11	I	Data 11	Note 2-2
24	D12	I	Data 12	Note 2-2
25	D13	I	Data 13	Note 2-2
26	D14	I	Data 14	Note 2-2
27	D15	I	Data 15	Note 2-2
28	D16	I	Data 16	Note 2-2
29	D17	I	Data 17	Note 2-2
30	D18	I	Data 18	Note 2-2
31	D19	I	Data 19	Note 2-2
32	D20	I	Data 20	Note 2-2
33	D21	I	Data 21	Note 2-2
34	D22	I	Data 22	Note 2-2
35	D23	I	Data 23	Note 2-2

36	HSYNC	I	Horizontal Synchronous Signal	
37	VSYNC	I	Vertical Synchronous Signal	
38	CLK	I	Data Clock	
39	NC	-	No Connect	
40	NC	-	No Connect	
41	VDD	P	power supply	
42	VDD	P	power supply	
43	SPENA	I	Serial port data enable signal	
44	NC	-	No Connect	
45	NC	-	No Connect	
46	NC	-	No Connect	
47	NC	-	No Connect	
48	NC	-	No Connect	
49	SPCK	I	SPI Serial Clock	
50	SPDA	I/O	SPI Serial Data Input/output	
51	NC	-	No Connect	
52	DEN	I	Data enabling signal	
53	GND	P	Ground	
54	GND	P	Ground	

I: input O: output P: power

Note 2-1: The figure below shows the connection of LED



Note 2-2:

Mode	D(23:16)	D(15:8)	D(7:0)	HSYNC	VSYNC	DEN
CCIR 656	D(23:16)	GND	GND	NC	NC	NC
CCIR 601	D(23:16)	GND	GND	HSYNC	VSYNC	NC
8 Bit RGB	D(23:16)	GND	GND	HSYNC	VSYNC	NC for HV mode
						DEN for DEN mode
24 Bit RGB	R(7:0)	G(7:0)	B(7:0)	HSYNC	VSYNC	NC for HV mode
						DEN for DEN mode

3 ABSOLUTE MAXIMUM RATINGS

Ta = 25℃

Item	Symbol	MIN	MAX	Unit	Remark
Power Supply Voltage	VDD	-0.3	5.0	V	
Back Light Forward Current	ILED		25	mA	One LED
Operating Temperature	T_{OPR}	-20	60	℃	
Storage Temperature	T_{STG}	-30	70	℃	

4 Electrical Characteristics

4.1. Driving TFT LCD Panel

GND=0V, Ta=25℃

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Power Supply Voltage		VDD	3.0	3.3	3.6	V	
Input Signal Voltage	Low Level	V_{IL}	0		0.2VCC	V	
	High Level	V_{IH}	0.8VCC		VCC	V	
(Panel+LSI) Power Consumption		Black Mode(60HZ)		35	50	mW	
		Standby Mode		0.1	0.15	mW	

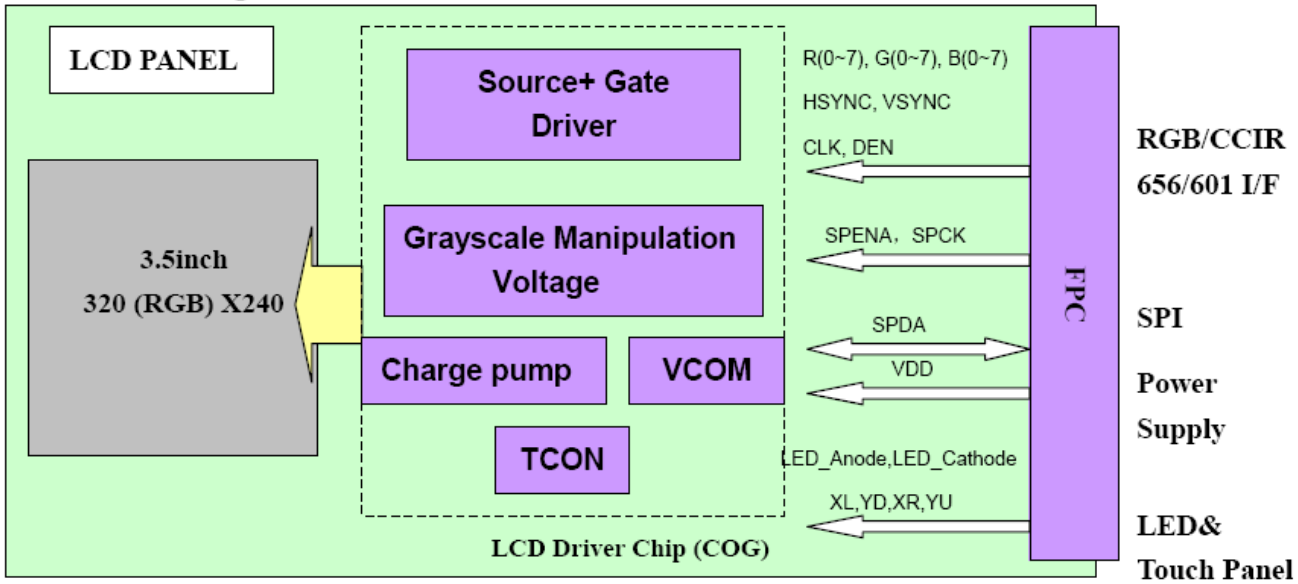
4.2 Driving Backlight

Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	--	20	25	mA	
Forward Current Voltage	V_F	16.8	19.2	21.6	V	
Backlight Power Consumption	W_{BL}	--	384	--	mW	

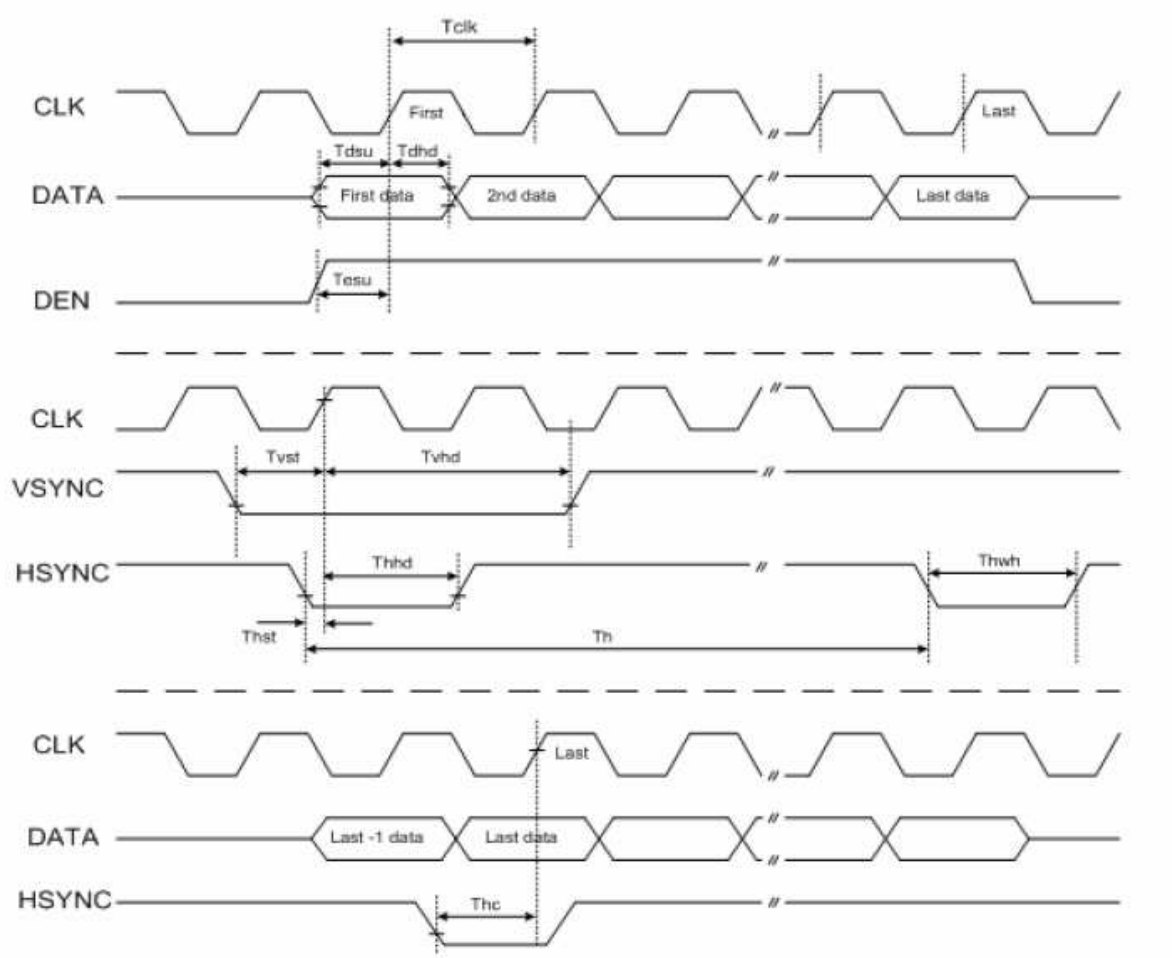
Block Diagram

LCD module diagram



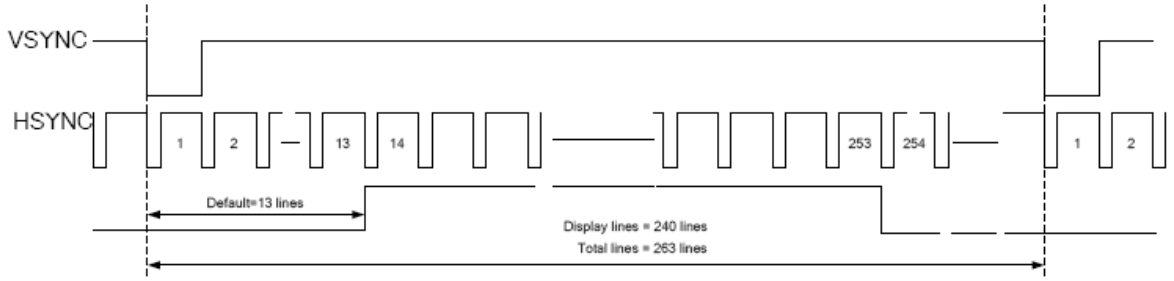
5 Timing Chart

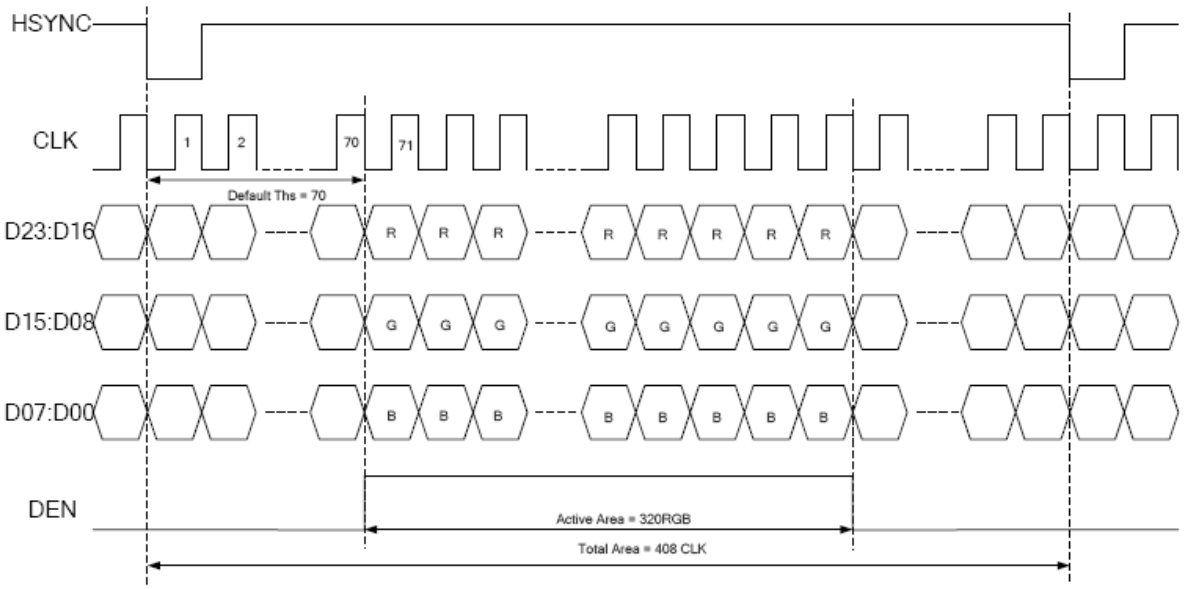
5.1 AC Electrical Characteristics (VDD=3.3V, GND= 0V,Ta=25℃)



Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK clock time	Tclk	-	-	35.7	ns	CLK=28MHz
CLK pulse duty	Tchw	40	50	60	%	Tclk
HSYNC to CLK	Thc	-	-	1	CLK	
HSYNC width	Thwh	1	-	-	CLK	
VSYNC width	Tvwh	1	-	-	Th	
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 set-up time	Tdsu	12	-	-	ns	D[23:00] to CLK
Data hold time	Tdhd	12	-	-	ns	D[23:00] to CLK
DEN setup time	Tesu	12	-	-	ns	DEN to CLK

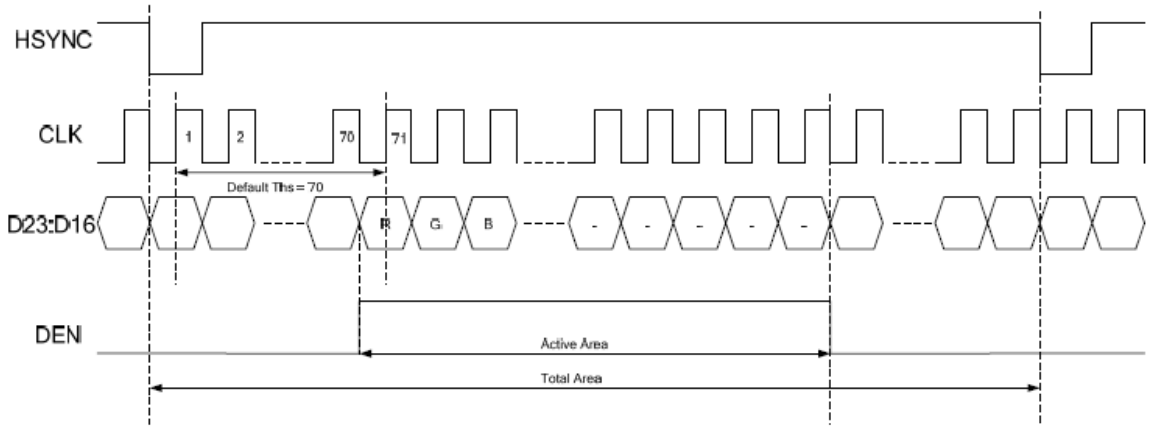
5.2 24 bit RGB mode for 320RGB x 240





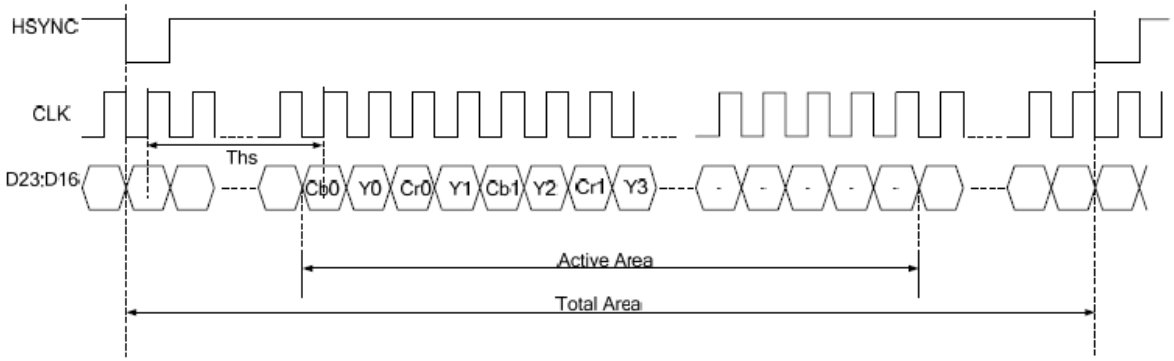
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK frequency	Fclk	-	6.4	-	MHz	VDD=3.0~3.6V
CLK cycle time	Tclk	-	156	-	ns	
Time that HSYNC to 1'st data input(NTSC)	Ths	40	70	255	CLK	

5.3 8 bit RGB mode for 320RGB x 240



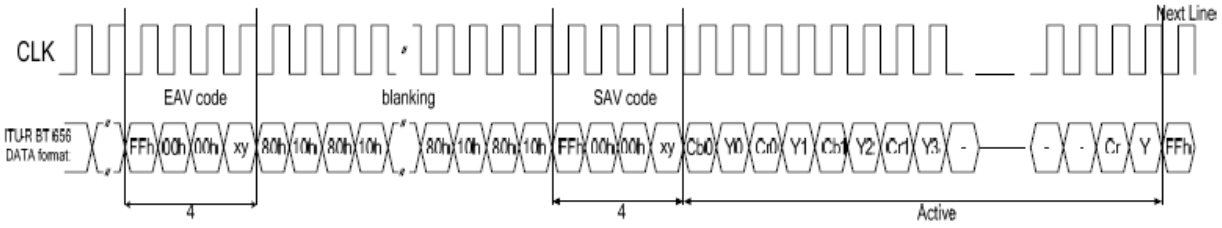
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK frequency	Fclk	-	27	-	MHz	VDD=3.0~3.6V
CLK cycle time	Tclk	-	37	-	ns	
Time that HSYNC to 1'st data input(NTSC)	Ths	35	70	255	CLK	

5.4 ITU-R BT 601



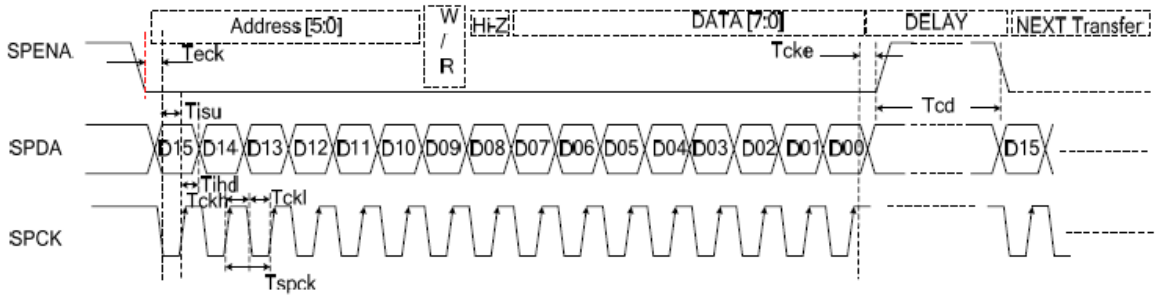
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK frequency	Fclk	-	24.54/27	-	MHz	VDD=3.0~3.6V
CLK cycle time	Tclk	-	40/37	-	ns	
Time from HSYNC to 1'st data input(PAL)	Ths	128	264	-	CLK	
Time from HSYNC to 1'st data input(NTSC)	Ths	128	244	-	CLK	

5.5 ITU-R BT 656



Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK frequency	Fclk	-	27	-	MHz	VDD=3.0~3.6V
CLK cycle time	Tclk	-	37	-	ns	
Time from EAV to 1'st data input(PAL)	Ths	128	288	-	CLK	
Time from EAV to 1'st data input (NTSC)	Ths	128	276	-	CLK	

5.6 3-Wire Serial Communication AC Timing



Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
SPCK cycle time	Tspck	320	-	-	ns	
SPCK pulse duty	Tscdut	40	50	60	%	
Serial data setup time	Tisu	120	-	-	ns	
Serial data hold time	Tihd	120	-	-	ns	
Serial clock high/low	Tssw	120	-	-	ns	
Chip select distinguish	Tcd	1	-	-	us	

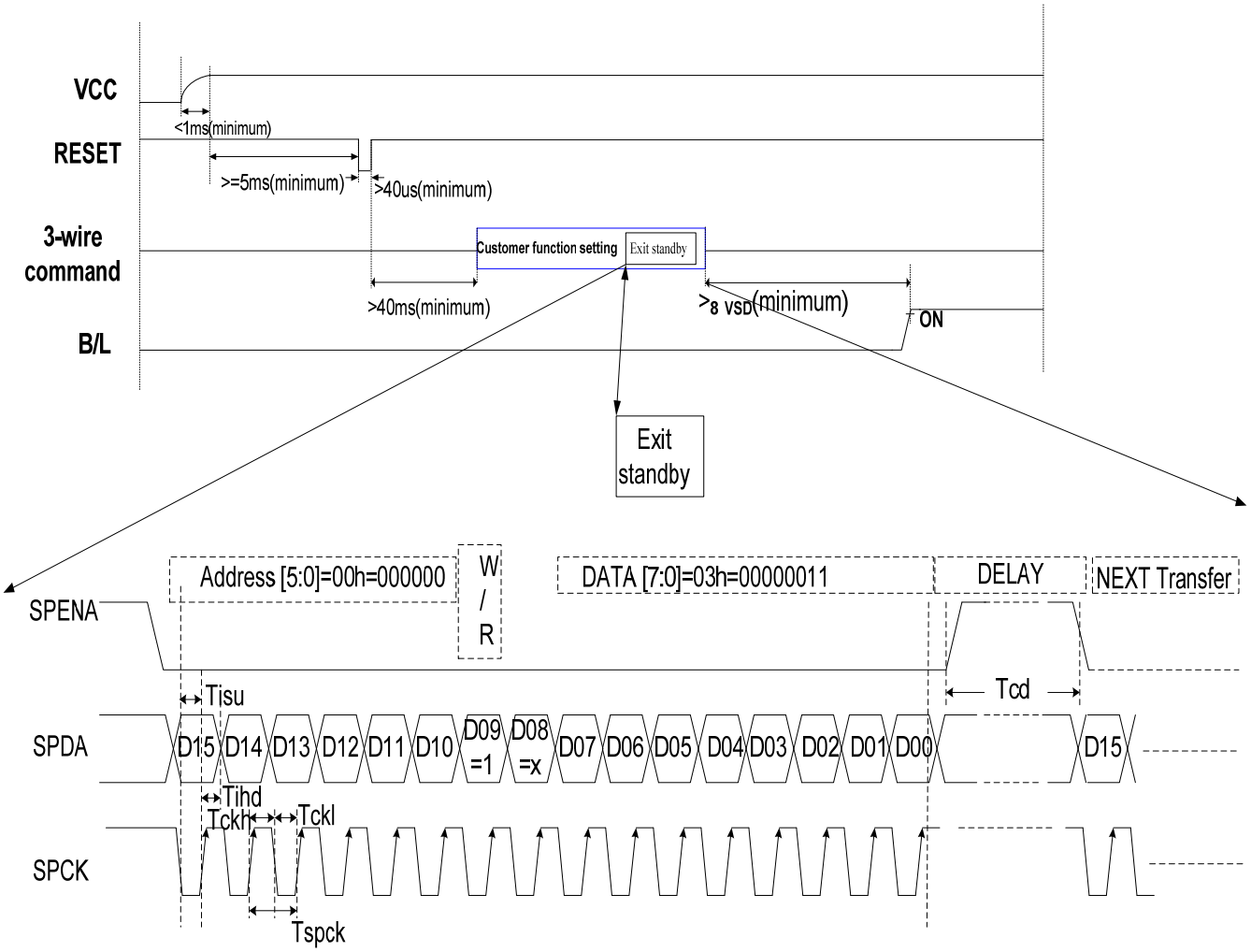
5.7 3-Wire Control Registers List

3-Wire Register		Register Description		
D[15:10]	Name	Init	R/W	Function Description
000000b	R00	07h	R/W	System control register
000001b	R01	00h	R/W	Timing Controller function register
000010b	R02	03h	R/W	Operation control register
000011b	R03	CCh	R/W	Input data Format control register
000100b	R04	46h	R/W	Source Timing delay control register
000101b	R05	0Dh	R/W	Gate Timing delay control register
000110b	R06	00h	R/W	Reserved
000111b	R07	00h	R/W	Internal function control register
001000b	R08	08h	R/W	RGB Contrast control register
001001b	R09	40h	R/W	RGB Brightness control register
001010b	R0A	88h	R/W	Hue / Saturation control register
001011b	R0B	88h	R/W	R / B Sub-Contrast control register
001100b	R0C	20h	R/W	R Sub-Brightness control register
001101b	R0D	20h	R/W	B Sub-Brightness control register
001110b	R0E	10h	R/W	VCOMDC Level control register
001111b	R0F	A4h	R/W	VCOMAC Level control register
010000b	R10	04h	R/W	VGAM2 Level control register
010001b	R11	24h	R/W	VGAM3/4 Level control register
010010b	R12	24h	R/W	VGAM5/6 Level control register
011110b	R1E	00h	R/W	Reserved
100000b	R20	00h	R/W	Wide and narrow display mode control register

Note 5-1:

R03: c4h:ITU-R BT 656 Mode
c2h:ITU-R BT 601 Mode
c8h:8 bit RGB Mode(HV Mode)
c9h:8 bit RGB Mode(DE Mode)
cch(default):24 bit RGB Mode (HV mode)
cdh:24 bit RGB Mode (DE mode)

5.8 Power on/off sequence



Note

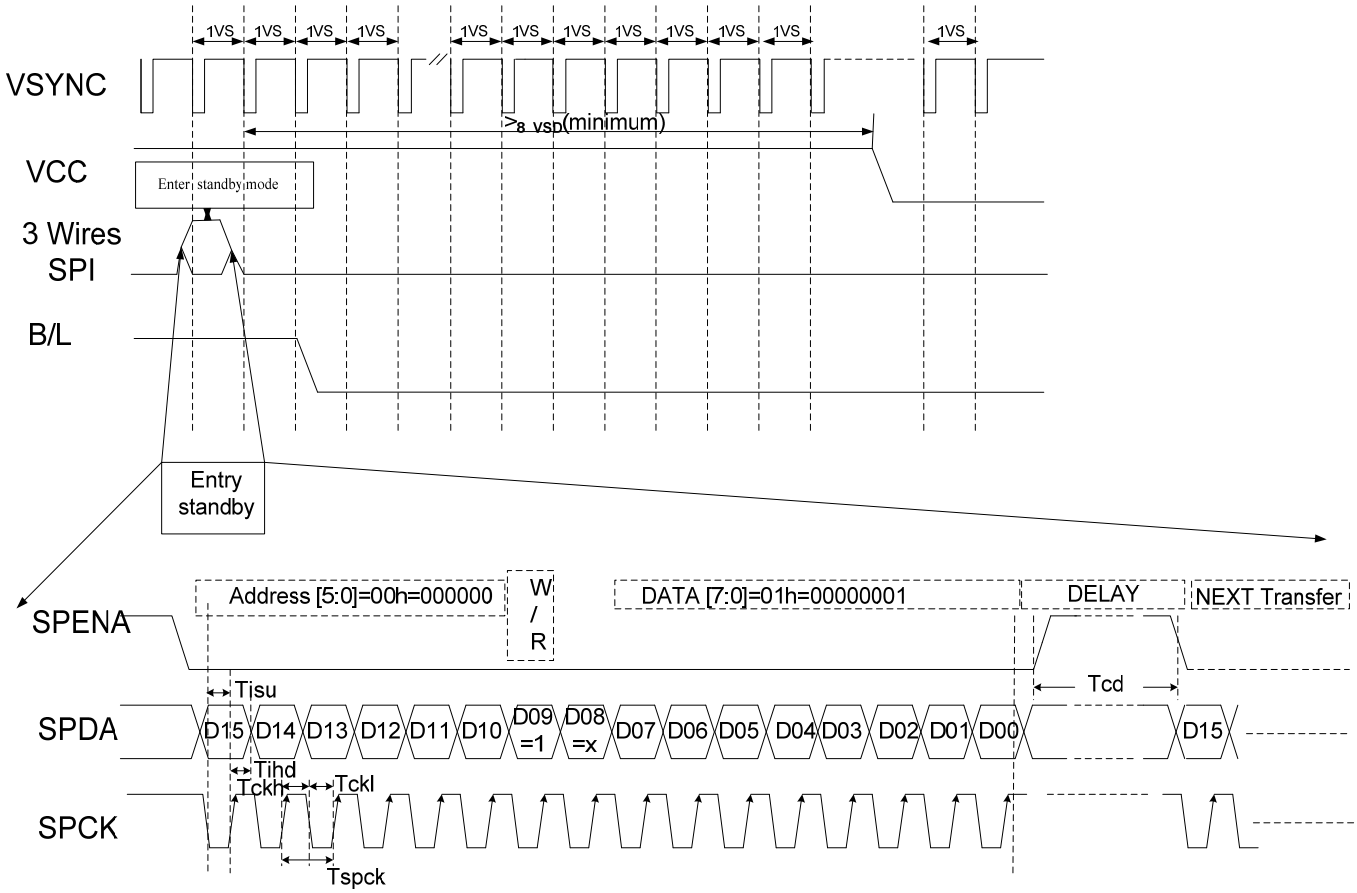
1. Please exit to Standby Mode through 3-wire command, detail sequence that exit to Standby Mode under power on mode presentation as below.

2.Exit to standby mode, you can write data “0x03” to register “R00”, D09=1 for writing data to register. D09=0 for reading data from register.

Under SPI write mode,D08=X , and ‘X’ means don’t care D08=‘1’ or ‘0’.

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Serial Clock	Tspck	320	-	-	ns	
SPCK Pulse Duty	Tscdut	40	50	60	%	
Serial Data Setup Time	Tisu	120	-	-	ns	
Serial Data Hold Time	Tihd	120	-	-	ns	
Serial Clock High/Low	Tssw	120	-	-	ns	Tckh or Tckl
Chip Select Distinguish	Tcd	1	-	-	us	

Power off Sequence



Note

1. 1VS=1VSYNC. Please entry Standby Mode through 3-wire command, detail sequence which enter Standby Mode under power off mode presentation as below.

2. Enter to standby mode, you can write data “0x01” to register “R00”, D09=1 for writing data to register. D09=0 for reading data from register.

Under SPI write mode,D08=X , and ‘X’ means don’t care D08=‘1’ or ‘0’.

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Serial clock	Tspck	320	-	-	ns	
SPCK pulse duty	Tscdut	40	50	60	%	
Serial data setup time	Tisu	120	-	-	ns	
Serial data hold time	Tihd	120	-	-	ns	
Serial clock high/low	Tssw	120	-	-	ns	Tckh or Tckl
Chip select distinguish	Tcd	1	-	-	us	

6 Optical Characteristics

6.1 Optical Specification

Ta=25℃

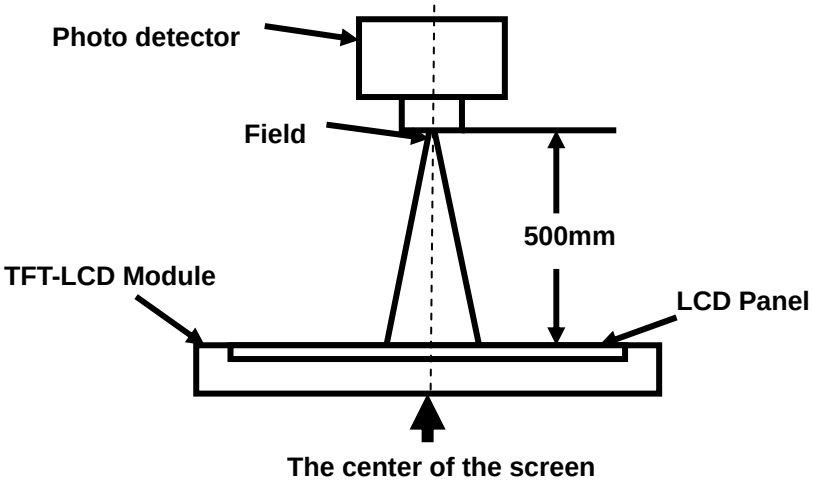
Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
View Angles		θT	CR≧10	50	60		Degree	Note 2
		θB		60	70			
		θL		60	70			
		θR		60	70			
Contrast Ratio		CR	θ=0°	400	500			Note1,3
Response Time		Ton	25℃		25	40	ms	Note1,4
		Toff						
Chromaticity	White	x	Backlight is on.	0.230	0.280	0.330		Note1,5
		y		0.260	0.310	0.360		
	RED	x		0.530	0.580	0.630		
		y		0.270	0.320	0.370		
	GREEN	x		0.280	0.330	0.380		
		y		0.535	0.585	0.635		
	BLUE	x		0.100	0.150	0.200		
		y		0.050	0.100	0.150		
Uniformity		U		75	80		%	Note1,6
NTSC					50		%	Note 5
Luminance		L		350	420		cd/m^2	Note1,7

Test Conditions:

1. VDD=3.3V, I_L =20mA(Backlight current), the ambient temperature is 25℃.
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.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

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)。

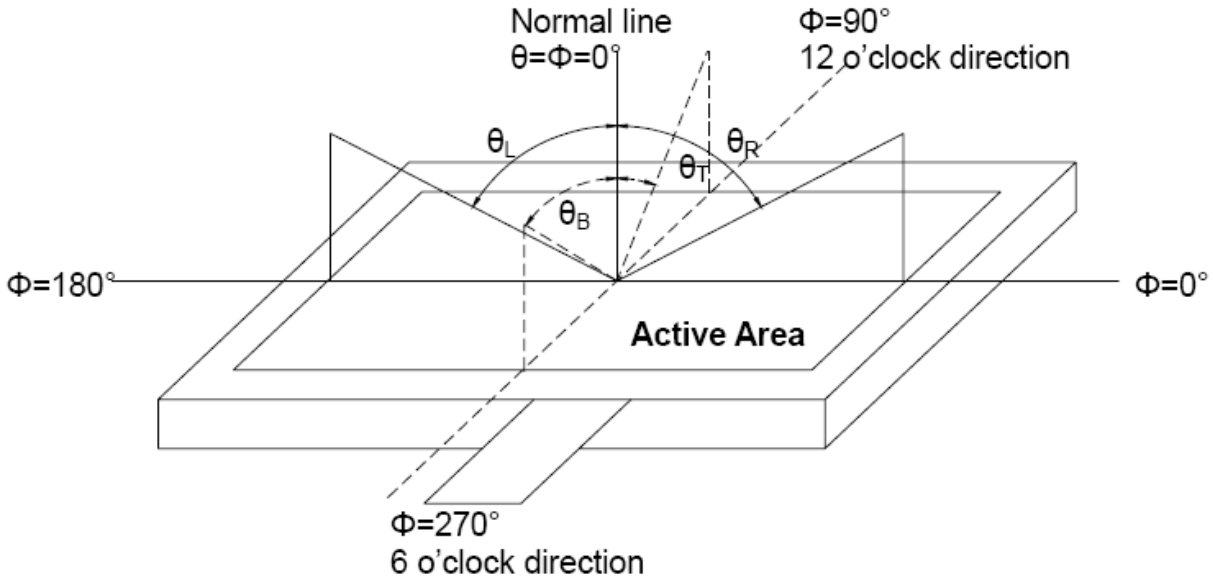


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

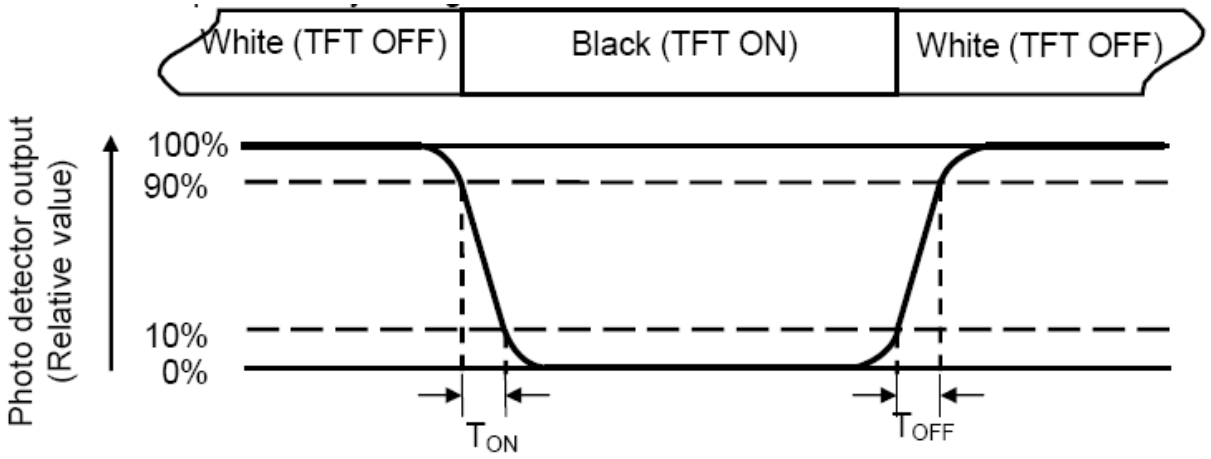
"White state ":The state is that the LCD is driven by $\mathbf{V}_{white}$.

"Black state": The state is that the LCD is driven by $\mathbf{V}_{black}$.

$\mathbf{V}_{white}$: To be determined $\mathbf{V}_{black}$: 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 (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) 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) = L_{min}/ L_{max}

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

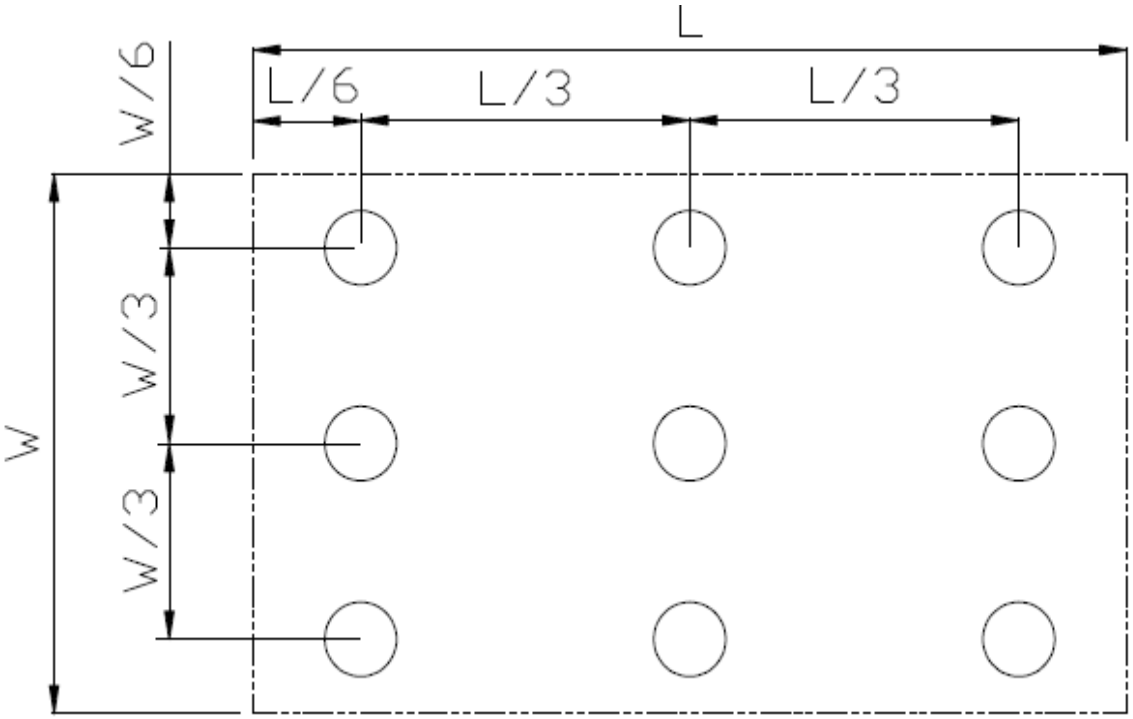


Fig. 2 Definition of uniformity

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

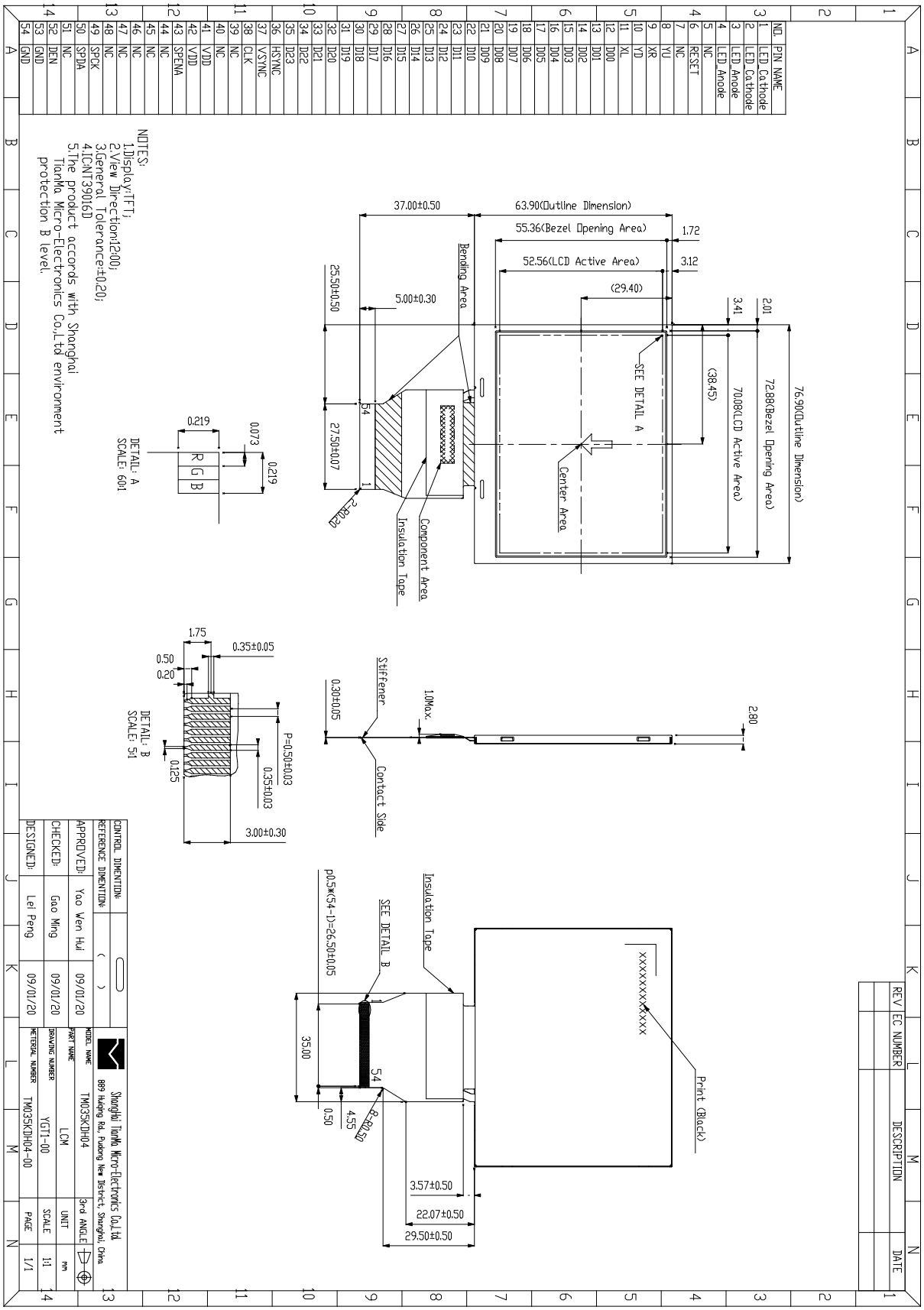
7 Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts=+60℃, 240hrs	Note1 IEC60068-2-2,GB2423.2—89
2	Low Temperature Operation	Ta=-20℃, 240hrs	Note 2, IEC60068-2-1 GB2423.1—89
3	High Temperature Storage	Ta=+70℃, 240hrs	IEC60068-2-2, GB2423.2—89
4	Low Temperature Storage	Ta=-30℃, 240hrs	IEC60068-2-1 GB2423.1—89
5	High Temperature & High Humidity （Non-Operation）	+60℃, 90% RH max,240 hours	IEC60068-2-3, GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30℃ 30 min~+70℃ 30 min, Change time:5min, 30 Cycle	Start with cold temperature, end with high temperature IEC60068-2-14,GB2423.22—87
7	Electro Static Discharge (operation)	C=150pF, R=330Ω， 5points/panel Air:±8KV，5times;Contact:±4KV，5 times; （Environment: 15℃～35℃， 30%～60%，86Kpa～106Kpa）	IEC61000-4-2 GB/T17626.2—1998
8	Vibration (non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z.(package condition)	IEC60068-2-6 GB/T2423.10—1995
9	Shock (non-operation)	60G 6ms, ±X,±Y,±Z 3times for each direction	IEC60068-2-27 GB/T2423.5—1995
10	Package Drop Test	Height:80 cm， 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8—1995

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

Note2: Ta is the ambient temperature of sample.

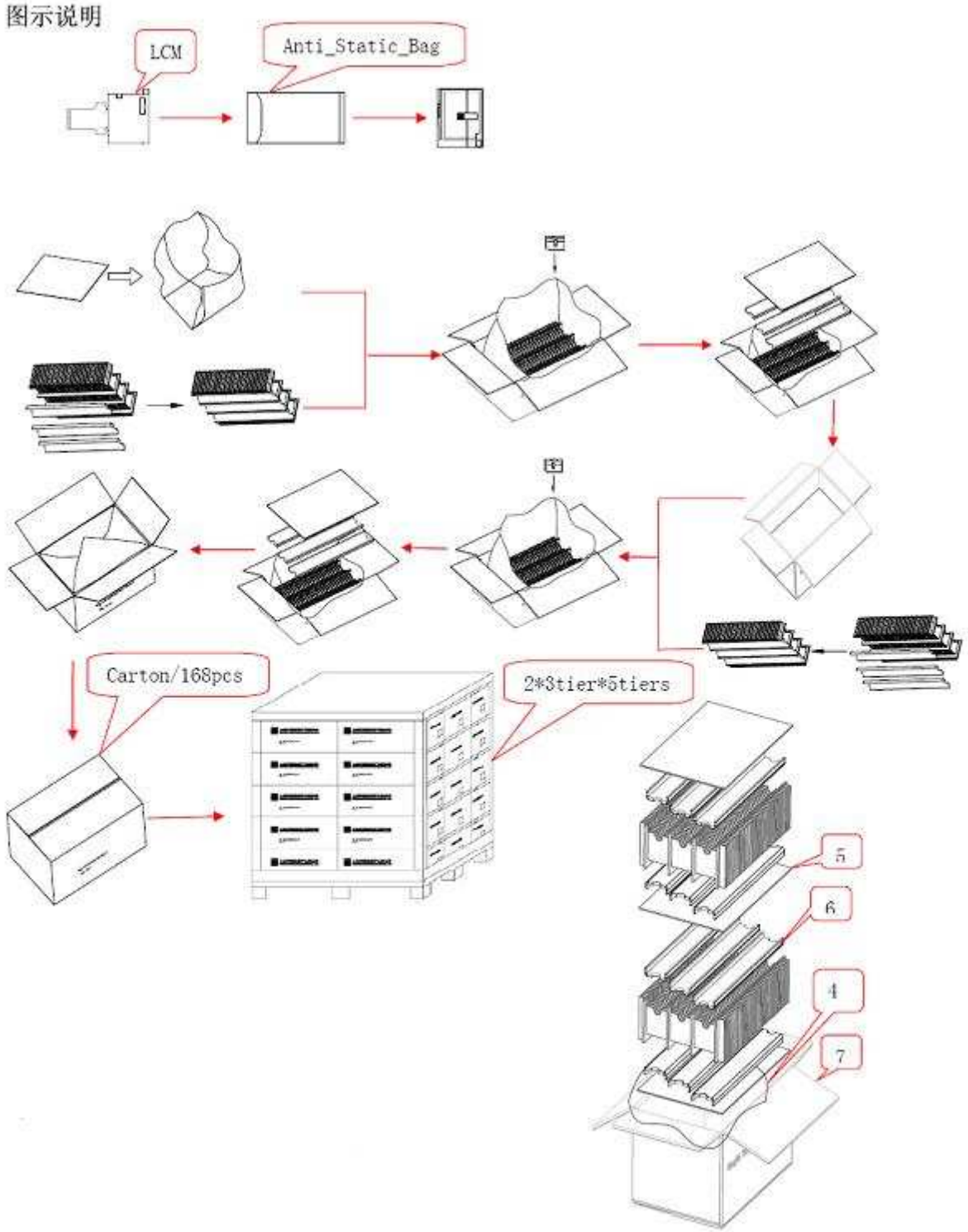
8 Mechanical Drawing



9 Packing Drawing

LCM quantity per Partition: 3rows x 28 pcs = 84 pcs

Total quantity in carton: 2 layers x 84 pcs per partition= 168 pcs



Packing Material Table

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM Module	TM035KDH04	76.90 x 63.90 x 2.80	0.03	168	
2	Partition_1	Corrugated Paper	513x333x106	0.782	2	
3.	Anti-Static Bag	PE	155x85x0.05	0.003	168	Anti-static Note 1.
4	Dust-Proof Bag	PE	700x530	0.060	1	
5	Partition_2	Corrugated Paper	505x332x4.00	0.095	3	
6	Corrugated Bar	Corrugated Paper	513x117x4	0.032	12	
7	Carton	Corrugated Paper	530x350x250	1.1000	1	
8	Total weight	8.937±5%kg				

Note 1:The resistance of Anti-Static Bag is 10^9～10^{11} ohm.

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.

a. Be sure to ground the body when handling the LCD Modules.

b. Tools required for assembly, such as soldering irons, must be properly ground.

c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

d. 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℃ ～ 40℃ 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.