MODEL NO. : TM035KVHG01

ISSUED DATE: 2014-1-20

VERSION : 1.2

□Preliminary Specification
■Final Product Specification

Customer :

Approved by	Notes

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	2013-8-1	Preliminary spec release	Jin Zhao
1.1	2013-12-11	Update CTP surface to AF, update mechanical drawing	Jin Zhao
1.2	2014-1-20	Change IC from NT39016D to NV3035C, update RGB timing and initial code	Jin Zhao

1 Features

3.5 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module. This module is composed of a 3.5 inch TFT-LCD panel, a driver circuit, FPC backlight unit and a capacitive TP.

This 3.5'' TFT-LCD module is designed for industrial and other electronic products which require high quality flat panel displays.

This module follows RoHS.

2 General Specifications

Item	Feature	Spec	Unit	Note
TFT LCD Module	Size	3.5	inch	
	LCD Resolution	320(RGB) x 240	--	
	Interface	TFT LCD: RGB24bits/CCIR66/601	--	
		CTP:I2C		
	Color Depth	16.7M	--	
	LCD Technology Type	a-Si TFT	--	
	Pixel Pitch	0.219x0.219	mm	
	Pixel Configuration	R.G.B. Vertical Stripe	--	
	LCD display Mode	TM with Normally White	--	
	Surface Treatment	CTP: AF, 4H hardness	--	
		LCD Up Polarizer: Clear Type		
	Viewing Direction	12 o'clock	--	
	Gray Scale Inversion Direction	6 o'clock	--	
	Active Area	TFT LCD: 70.08(W)x52.56(H)	mm	
		CTP:72.88(W) x 55.36(H)	mm	
	LCM (W x H x D)	79.9x68.9x4.38	mm	
	Control IC	CTP: HX8526	--	
		TFT LCD: NV3035C	--	
	CTP Touch Method	Bare finger	--	
	Number of simultaneous touches	5 points	--	
	Minimum Touch Area	Φ6	mm	

	Finger Touch Pitch	11	mm	
	CTP Structure	Glass Lens－Glass Sensor	--	
	LED Numbers	6 LEDs	pcs	

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%

3 Input/Output Terminals

3.1 TFT LCD Pin Assignment

Recommend connector type: Kyocera elco:6240serials

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

32	D20	I	Data 20	
33	D21	I	Data 21	
34	D22	I	Data 22	
35	D23	I	Data 23	
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	

Note: I=Input O=Output, P=Power

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

3.2 CTP Pin Assignment

Pin No.	Symbol	Description	Remark
1	VDD	CTP power supply	--
2	GND	Ground	--
3	IIC RESET (INT)	Interrupt line,active low	--
4	SCL	I2C clock input	Note 1
5	SDA	I2C data input and output	Note 1
6	Global RESET (RESET)	Reset pin,active low	--

Note 1: On SDA and SCL there be pull-up resistors.

4 Absolute Maximum Ratings

Ta = 25℃

Item	Symbol	MIN	MAX	Unit	Remark
Power Supply Voltage	VDD(LCD)	-0.3	5.0	V	
Power Supply Voltage	VDD(CTP)	-0.3	7.0		
Back Light Forward Current	ILED		25	mA	One LED
Operating Temperature	T_{OPR}	-20	70	℃	
Storage Temperature	T_{STG}	-30	80	℃	

5 Electrical Characteristics

5.1 Driving TFT LCD

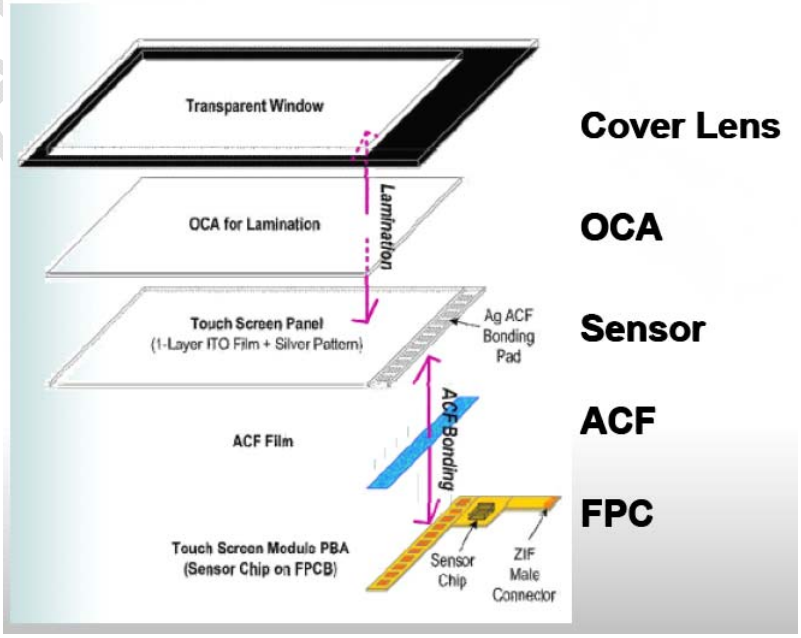
GND=0V, Ta=25℃

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)		45	65	mW	
		Standby Mode		0.2	0.3	mW	

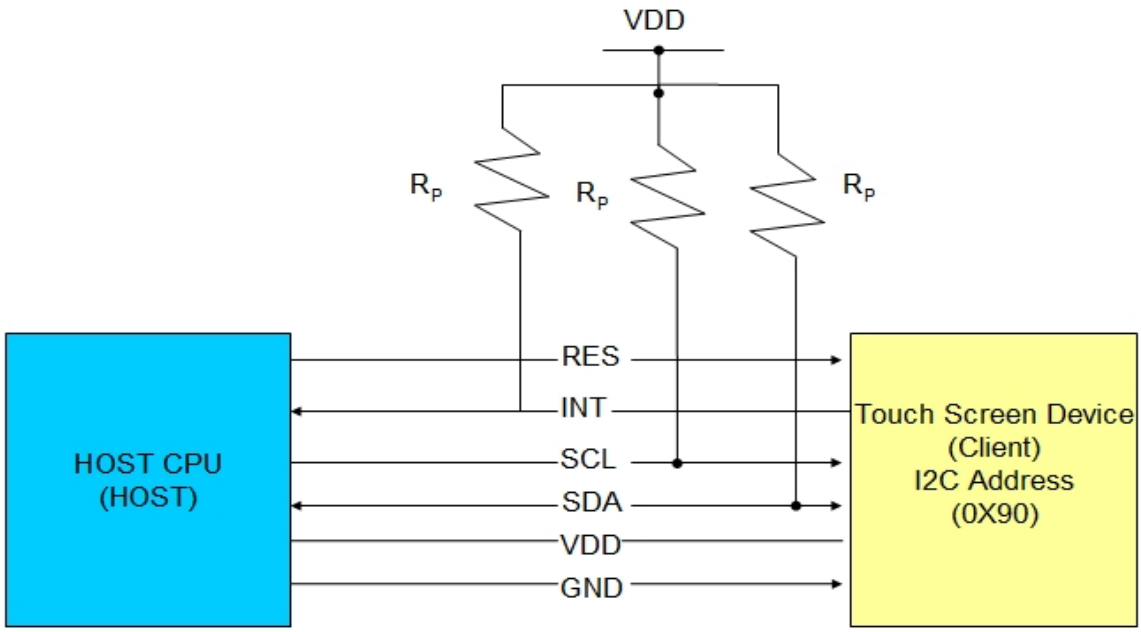
5.2 Driving CTP

Ta = 25℃

Item		Min	Typ	Max	Unit	Note
power supply voltage		2.7	3.3	3.5	V	DC(noise should be under 100mV)
Power supply current		--	6	10	mA	
Input Signal Voltage	Low Level	0	-	0.3xVCC	V	RESET,SCL,SDA
	High Level	0.7xVCC	-	VCC	V	



Structure of touch lens



Interface application

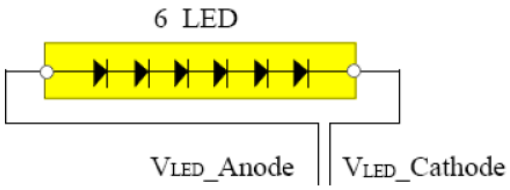
Rp=4.7K

5.3 Driving Backlight

Ta=25□

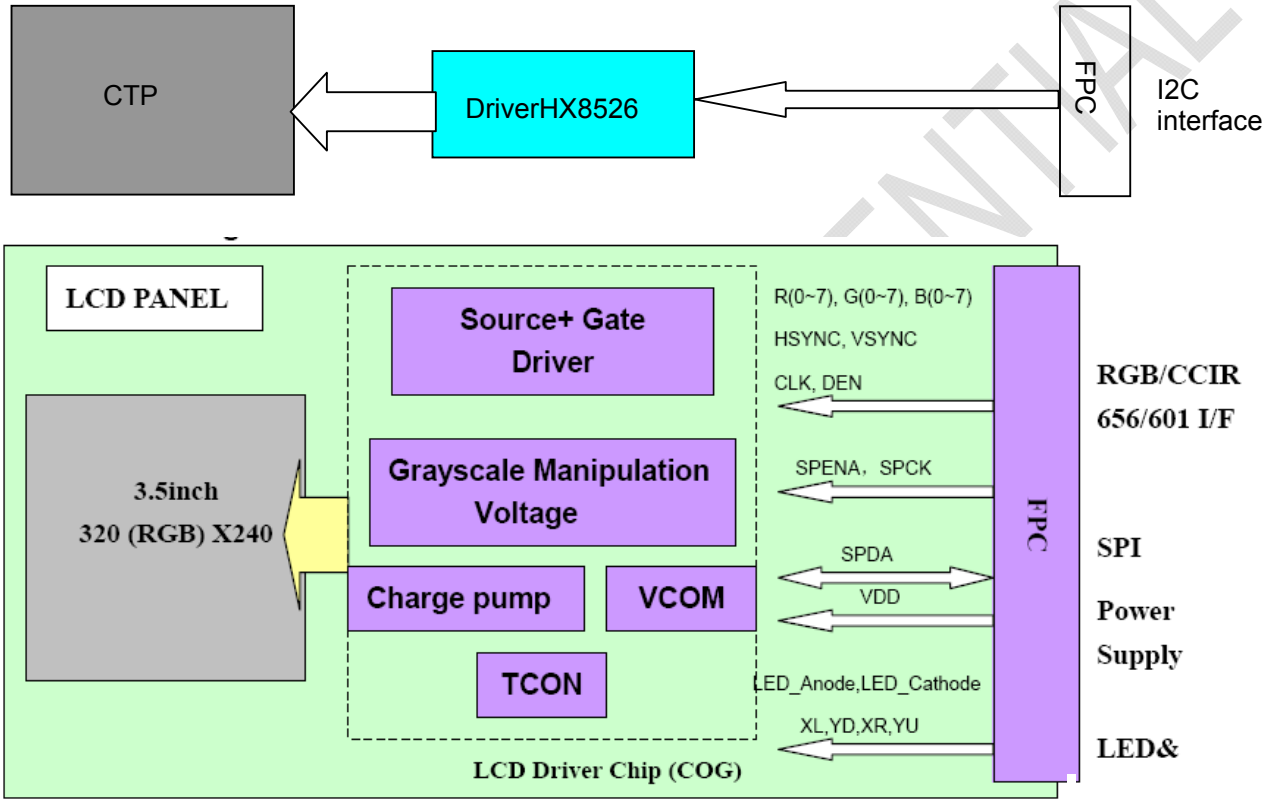
Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	--	20	25	mA	
Forward Current Voltage	V_F	16.8	19.2	21.6	V	
Backlight Power Consumption	W_{BL}	--	384	--	mW	

Note 1: I_F is defined for one channel LED. There are total three LED channels in back light unit.Under LCM operating, the stable forward current should be inputted.
Note 2: Optical performance should be evaluated at Ta=25℃ only.
Note 3: 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.



LED connection of backlight

5.4 Block Diagram



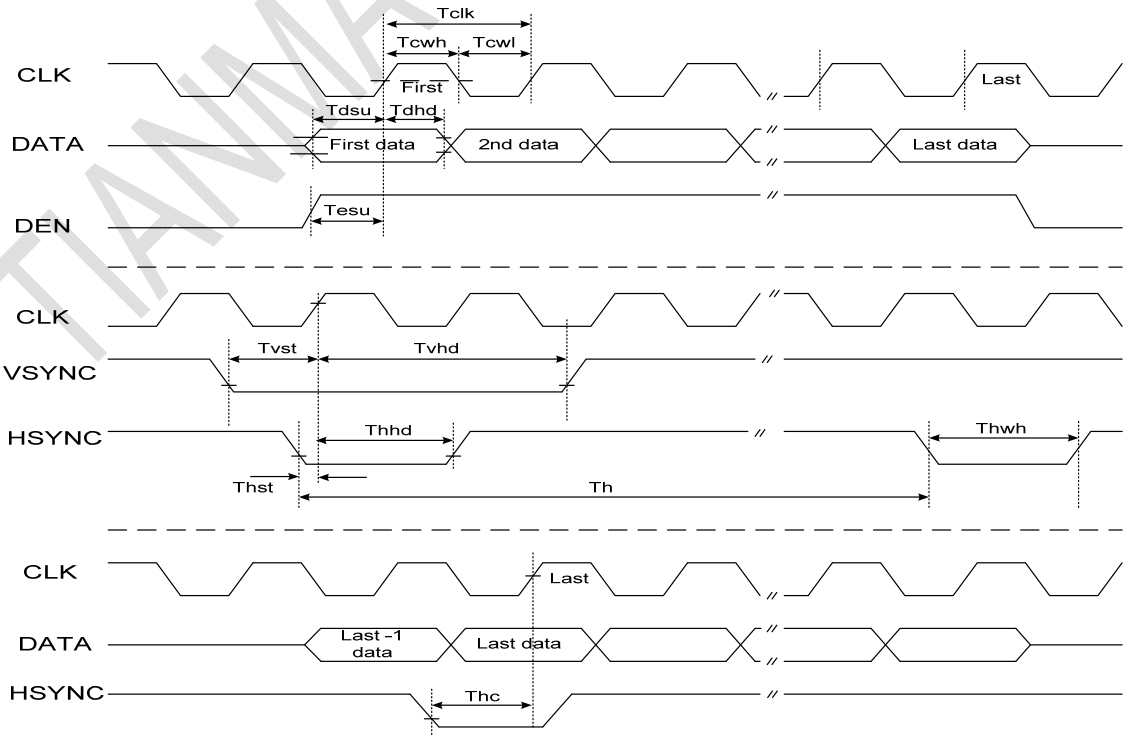
6 Timing Chart

6.1 Timing Parameter

(VCC=3.3V GND =0V,Ta=25℃)

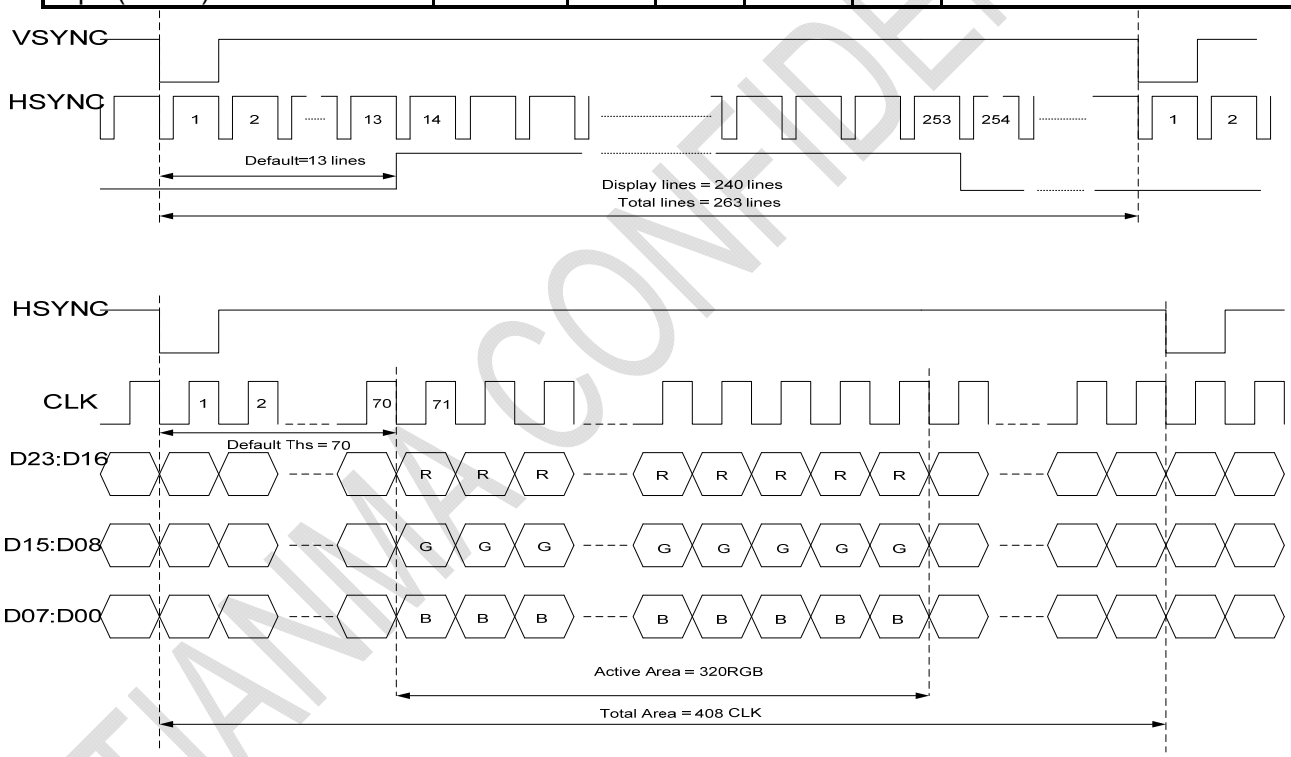
Parameter	Symbol	Min	Typ	Max	Unit	Condition
CLK Clock Time	T_{clk}	1/Max(F_{clk})	--	1/Min(F_{clk})	ns	
CLK Pulse Duty	T_{chw}	40	50	60	%	T_{clk}
HSYNC to CLK	T_{hc}	--	--	1	CLK	--
HSYNC Width	T_{hwh}	1	--	--	CLK	--
VSYNC Width	T_{vwh}	1	--	--	ns	--
HSYNC Period Time	T_h	60	63.56	67	ns	--
VSYNC Set-up Time	T_{vst}	8	--	--	ns	--
VSYNC Hold Time	T_{vhd}	10	--	--	ns	--
HSYNC Setup Time	T_{hst}	8	--	--	ns	--
HSYNC Hold Time	T_{hhd}	10	--	--	ns	--
Data Set-up Time	T_{dsu}	8	--	--	ns	D00~D23 to CLK
Data Hold Time	T_{dhd}	10	--	--	ns	D00~D23 to CLK
DEN Set up Time	T_{esu}	12	--	--	ns	DEN to CLK

Note: Each CLK Frequency of 24 Bit RGB Mode,8 Bit RGB Mode,CCIR601and CCIR656 are different.



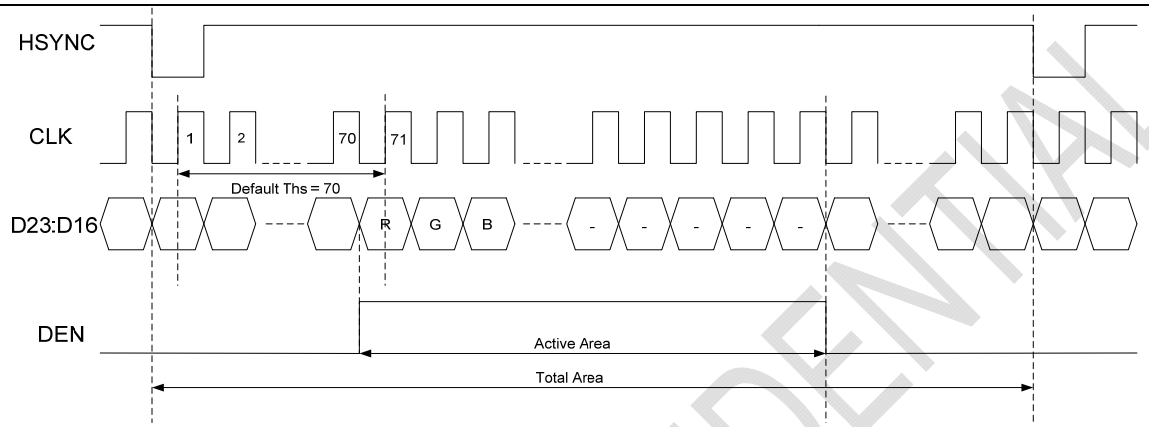
6.2 24 Bit RGB Mode for 320RGB x 240

Parameter	Symbol	Min	Typ	Max	Unit	Condition
CLK Frequency	F_{clk}	6.1	6.4	8.0	MHz	VCC=3.0V~3.6V
CLK Cycle Time	T_{clk}	125	156	164	ns	
CLK Pulse Duty	T_{cwh}	40	50	60	%	
Time that HSYNC to 1 st data input(NTSC)	T_{hs}	40	70	255	CLK	DDLY =70, Offset = 0 (fixed)



6.3 8 Bit RGB Mode for 320RGB x 240

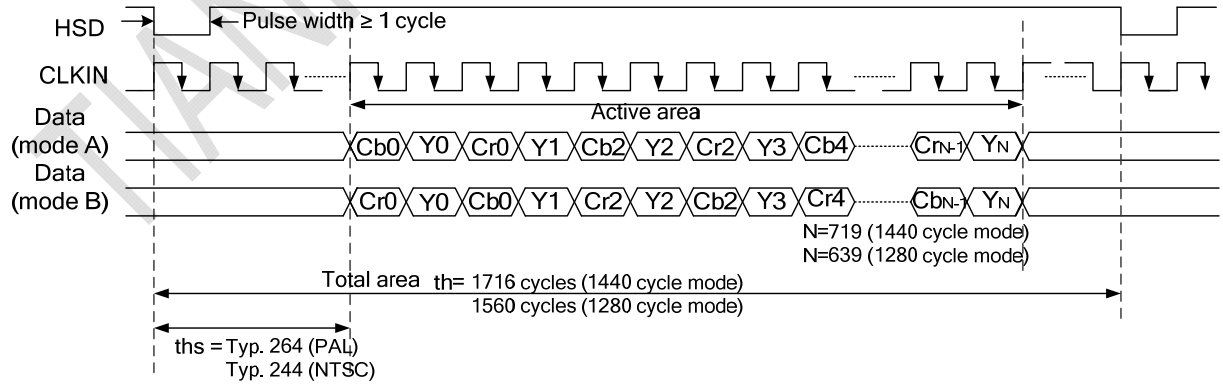
Parameter	Symbol	Min	Typ	Max	Unit	Condition
CLK Frequency	Fclk	--	27	30	MHz	VCC=3.0~3.6V
CLK Cycle Time	Tclk	--	37	--	ns	
Time that HSYNC to 1'st data input(NTSC)	Ths	35	70	255	CLK	DDLY = 70, Offset = 0 (fixed)



6.4 CCIR601

Parameter	Symbol	Min	Typ	Max	Unit	Condition
CLK Frequency	F_{clk}	--	24.54/ 27	30	MHz	VCC=3.0V~3.6V
CLK Cycle Time	T_{clk}	--	40/37	--	ns	
Time From HSYNC to1 st data input(PAL)	T_{hs}	128	264	--	CLK	DDLY = 136, Offset = 128 (fixed)
Time From HSYNC to1 st data input(NTSC)	T_{hs}	128	244	--	CLK	DDLY = 116, Offset = 128 (fixed)

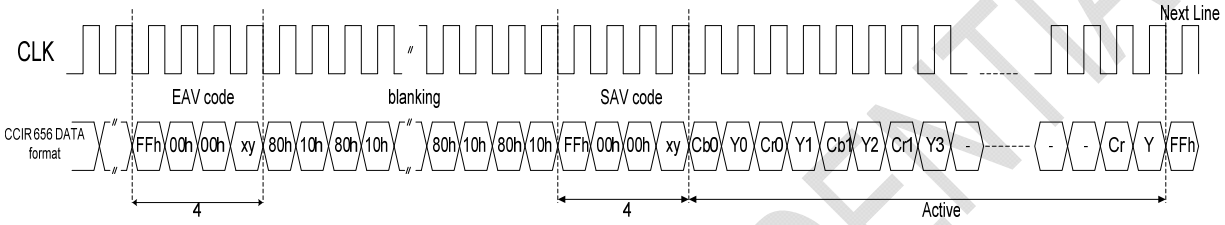
CLKIN frequency:
24.54MHz for 1280-cycle mode
27MHz for 1440-cycle mode



6.5 CCIR656

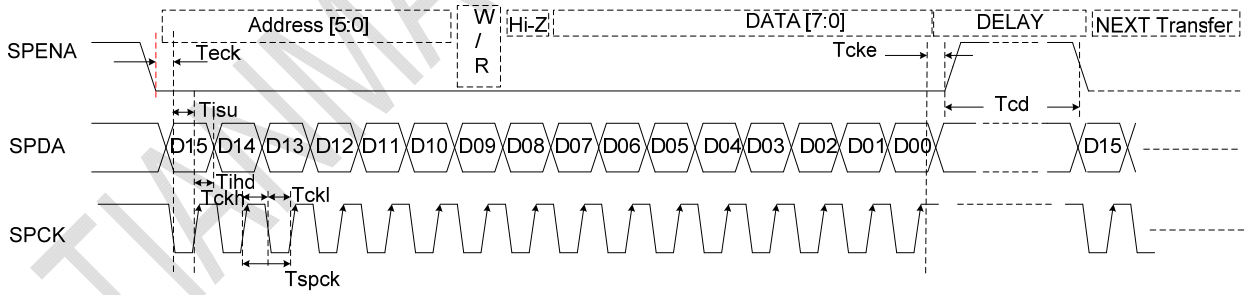
Parameter	Symbol	Min	Typ	Max	Unit	Condition
CLK Frequency	Fclk	--	27	30	MHz	VCC=3.0V~3.6V
CLK Cycle Time	Tclk	--	37	--	ns	
Time that EVA	Ths	128	288	--	CLK	DDLY = 152, Offset =

to 1'st data input(PAL)						128 (fixed)
Time that EVA to1'stdatainput(NTSC)	Ths	128	276	--	CLK	DDLY = 140, Offset = 128 (fixed)



6.6 3-Wire Serial Communication AC Timing

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Serial Clock	T_{SPCK}	320	--	--	ns	
SPCK Pulse Duty	T_{scdut}	40	50	60	%	
Serial Data Setup Time	T_{isu}	120	--	--	ns	
Serial Data Hold Time	T_{ihd}	120	--	--	ns	
Serial Clock High/Low	T_{ssw}	120	--	--	ns	
Chip Select Distinguish	T_{cd}	1	--	--	us	



Note：DDLY Description (Ths= DDLY+ Offset)

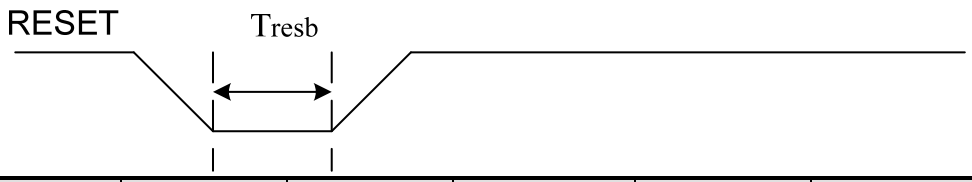
6.7 3-Wire Control Registers List

3-Wire Registers		Register Description		
D[15:10]	Name	Init	R/W	Function Description
000000b	R00	03h	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

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
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	2Bh	R/W	VCOMDC level control register
001111b	R0F	A6h	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
011101b	R1D	00h	R/W	OTP operation control register
011110b	R1E	00h	R/W	OTP operation control register
011111b	R1F	00h	R/W	OTP operation control register

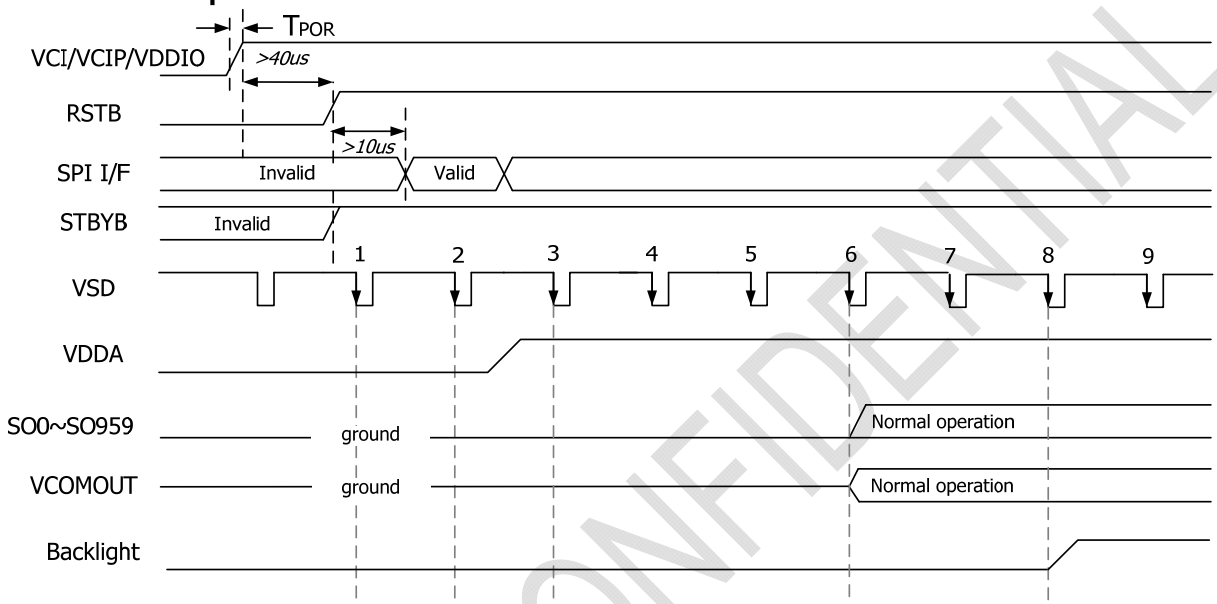
Note : R03: c4h:CCIR656 Mode
c2h:CCIR601 Mode
c8h:8 bit RGB Mode(HV Mode)
c9h:8 bit RGB Mode(DEN Mode)
cch(default):24 bit RGB Mode (HV mode)
cdh:24 bit RGB Mode (DEN mode)

6.8 Reset Timing

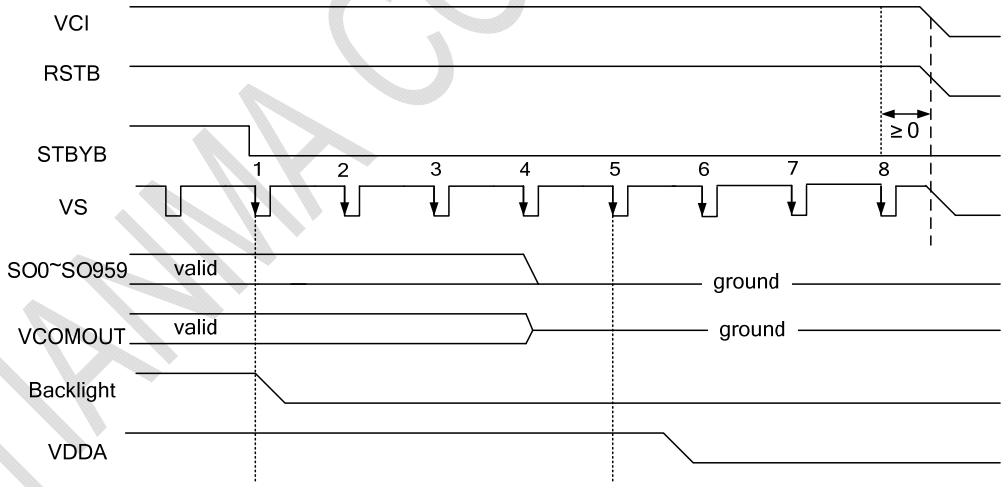


Parameter	Min	Typ	Max	Unit	Conditions
Tresb	40	-----	----	us	VCC = 3.3V

6.9 Power On Sequence



6.10 Power off Sequence



6.11 CTP Timing

Note: Please refer to HX8526-D32 data sheet for more details.
HX8526-D32 supports the I2C interfaces, which can be used by a host processor or other devices. The I2C is always configured in the Slave mode. The data transfer format is shown in Fig 5

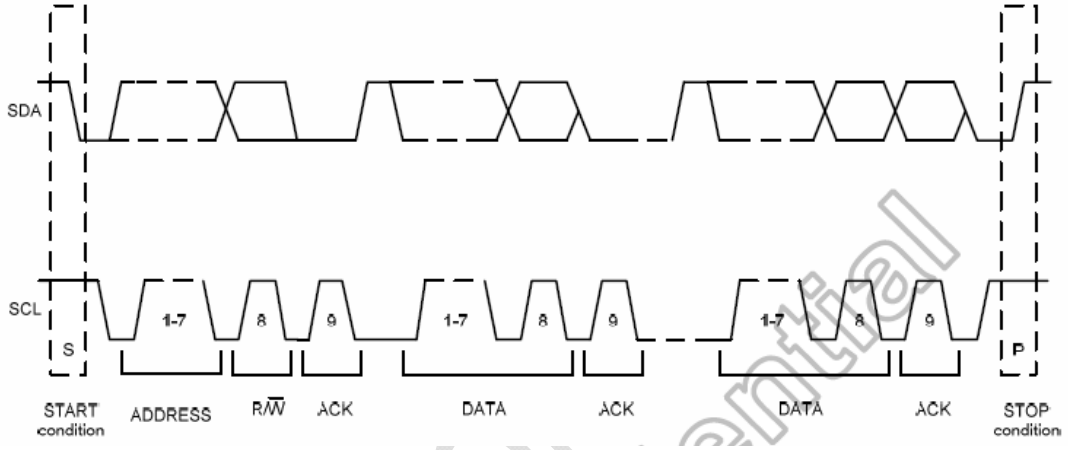


Fig 1 . I2C serial data transfer format

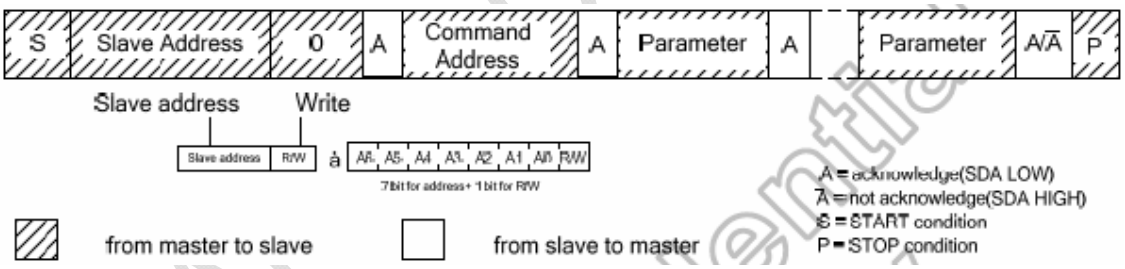


Fig 2 . Data format of writing mode

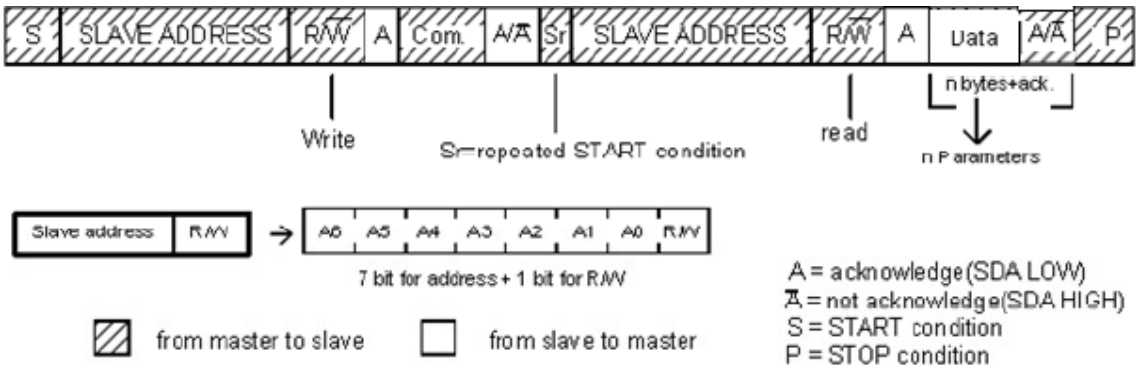


Fig 3. Data format of reading mode

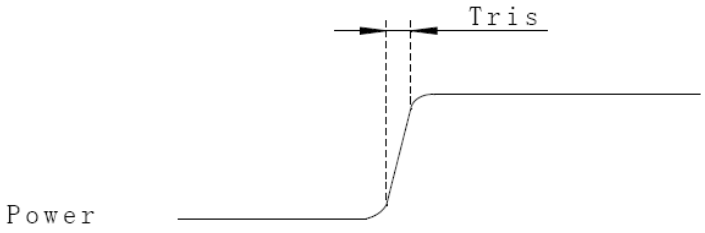
6.11.2 COMMAND LIST(HX8526-D32)

Standard command

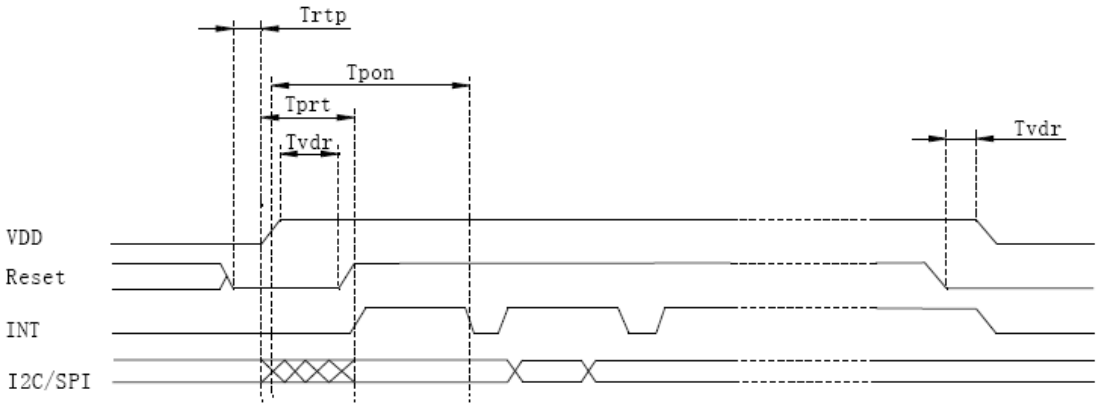
(Hex)	Operation Code	D7	D6	D5	D4	D3	D2	D1	D0	Function
0	No operation	0	0	0	0	0	0	0	0	-
80	Sleep IN	1	0	0	0	0	0	0	0	-
81	Sleep Out	1	0	0	0	0	0	0	1	-
82	Sense Off	1	0	0	0	0	0	1	0	-
83	Sense On	1	0	0	0	0	0	1	1	-
85	Read Event	1	0	0	0	0	1	0	1	-
	1st parameter	B31	B30	B29	B28	B27	B26	B25	B24	-
	2nd parameter	B23	B22	B21	B20	B19	B18	B17	B16	-
	3rd parameter	B15	B14	B13	B12	B11	B10	B9	B8	-
	4th parameter	B7	B6	B5	B4	B3	B2	B1	B0	-
86	Read All Events	1	0	0	0	0	1	1	0	-
	1st parameter	B31	B30	B29	B28	B27	B26	B25	B24	-
	2nd parameter	B23	B22	B21	B20	B19	B18	B17	B16	-
	3rd parameter	B15	B14	B13	B12	B11	B10	B9	B8	-
	4th parameter	B7	B6	B5	B4	B3	B2	B1	B0	-
	5th parameter	E3	E2	E1	E0	FI	P2	P1	P0	-
	6th parameter	B23	B22	B21	B20	B19	B18	B17	B16	-
	:	:	:	:	:	:	:	:	:	-
	(n+1)th parameter	B7	B6	B5	B4	B3	B2	B1	B0	-
87	Read Latest Event	1	0	0	0	0	1	1	1	-
	1st parameter	B31	B30	B29	B28	B27	B26	B25	B24	-
	2nd parameter	B23	B22	B21	B20	B19	B18	B17	B16	-
	3rd parameter	B15	B14	B13	B12	B11	B10	B9	B8	-
	4th parameter	B7	B6	B5	B4	B3	B2	B1	B0	-
88	Clear Stack	1	0	0	0	1	0	0	0	-

6.11.3 Power ON/RESET Sequence

Reset should be pulled down to be low before powering on and powering down. I2C shouldn't be used by other devices during Reset time after IOVCC powering on (Tprt). INT signal will be sent to the host after initializing all parameters and then start to report points to the host.

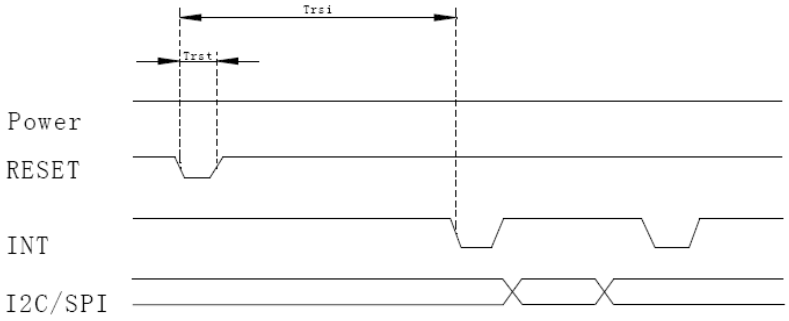


Power on Time



Power on sequence

Reset time must be enough to guarantee reliable reset, the time of starting to report point after resetting approach to the time of starting to report point after powering on.



Reset sequence

Parameter	Description	Min	Max	Units
Tris	Rise time from 0.1VDD to 0.9VDD	--	5	ms
Trtp	Time of resetting to be low before powering on	100	--	μs
Tpon	Time of starting to report point after powering on	300	--	ms
Tvdr	Reset time after VDD powering on	1	--	ms
Tprt	Reset time after IOVCC powering on	2Tris +Tvdr	--	ms
Trsi	Time of starting to report point after resetting	300	--	ms
Trst	Reset time	5	--	ms

7 Optical Characteristics

Ta=25□

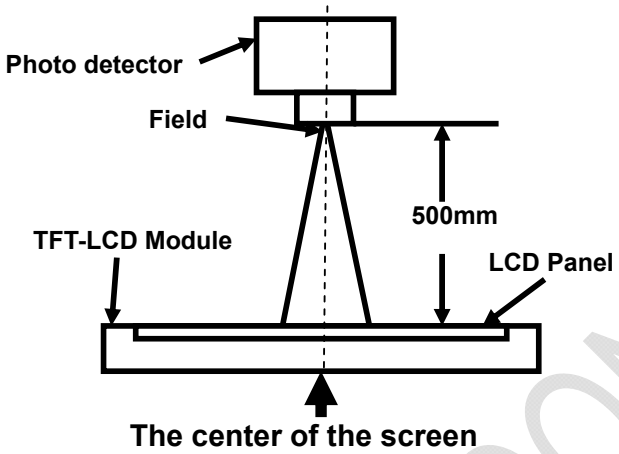
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR□10	50	60		Degree	Note2,3
		θB		60	70			
		θL		60	70			
		θR		60	70			
Contrast Ratio		CR	θ=0°	400	500			Note 3
Response Time		T_{ON}	25℃		20	30	ms	Note 4
		T_{OFF}						
Chromaticity	**White**	x	Backlight is on	0.230	0.280	0.330		Note 1,5
		y		0.260	0.310	0.360		
	Red	x		0.530	0.580	0.630		Note 1,5
		y		0.270	0.320	0.370		
	Green	x		0.280	0.330	0.380		Note 1,5
		y		0.535	0.585	0.635		
	Blue	x		0.100	0.150	0.200		Note 1,5
		y		0.050	0.100	0.150		
Uniformity		U		75	80		%	Note 6
NTSC					50		%	Note 5
Luminance		L		320	400		cd/m^2	Note 7
Reflectivity						4	%	Note 8
HAZE						2	%	Note 8

Test Conditions:

1. I_F= 22 mA, and the ambient temperature is 25□.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

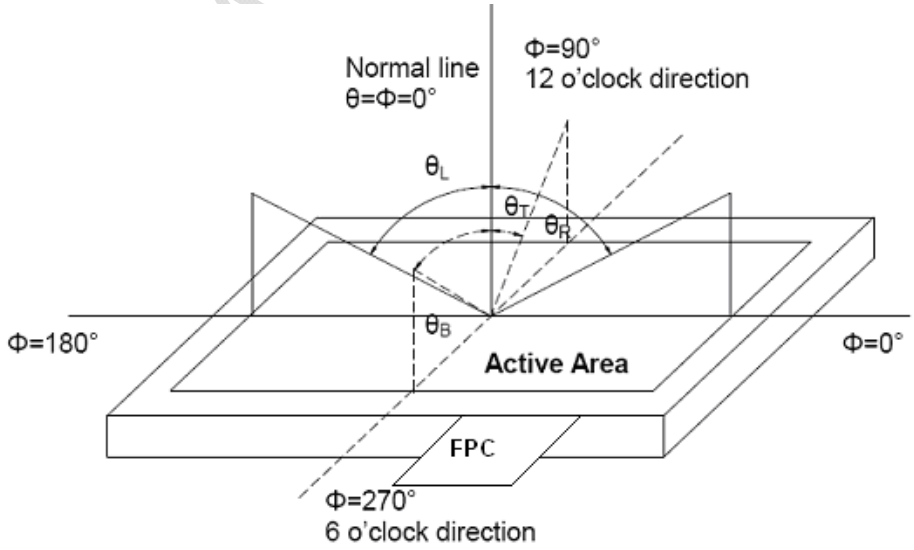
The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



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)。



Note 3: Definition of contrast ratio

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

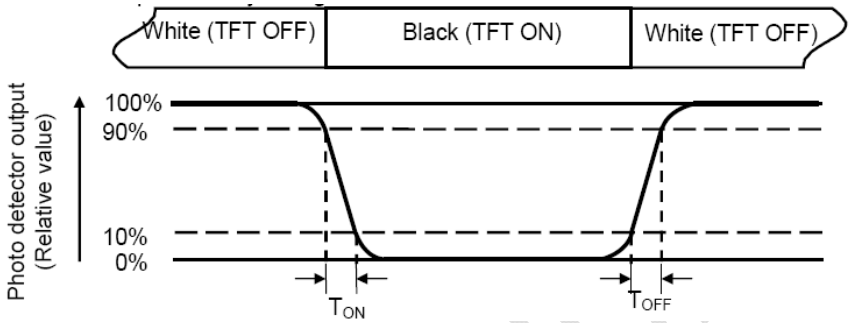
“White state “: The state is that the LCD should drive by Vwhite.

“Black state”: The state is that the LCD should drive by Vblack.

Vwhite: To be determined Vblack: 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_{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)

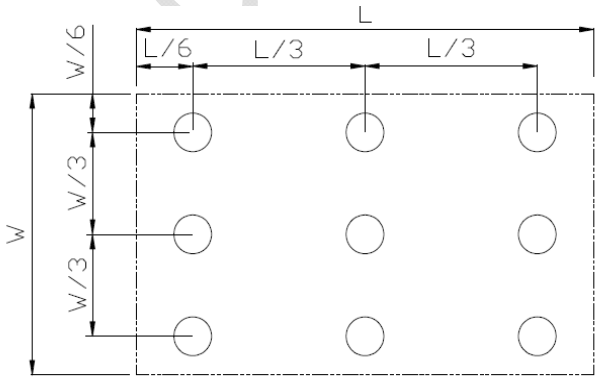
Color coordinates measured at center point of LCD.

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) = Lmin/ Lmax

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



Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

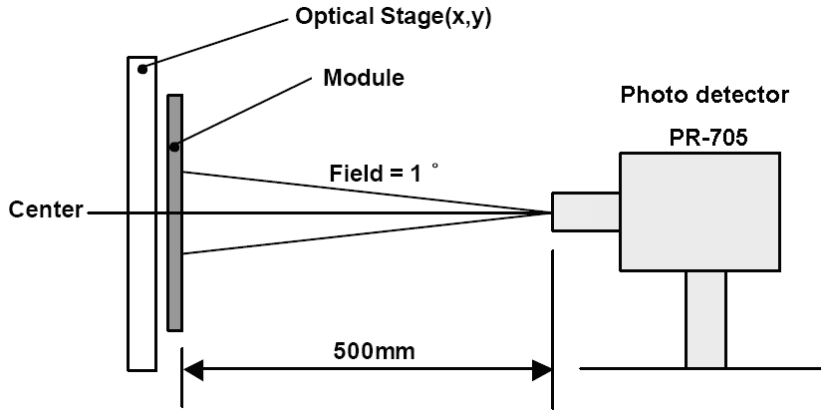
Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

Note 8: Measuring equipments: DMS-501, PR-705. @550nm

Measuring condition:

1. After stabilizing and leaving the panel alone at a given temperature for 30min, the measurement should be executed,
2. Measuring surroundings: a stable, windless and dark room,
3. Measuring temperature: Ta=25°C,
4. 30 min after lighting the back-light.



Note2: conform to National standard GB2410—80 /ASTM D1003—61(1997)

8 Environmental / Reliability Test specifications

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ta = +70℃, 120 hours	Note1,Note6,Note7 IEC60068-2-1,GB2423.2
2	Low Temperature Operation	Ta = -20℃, 120 hours	Note1, Note7,IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta = +80℃, 120 hours	Note1, Note7,Note8 IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta = -30℃, 96 hours	Note1, Note7,EC60068-2-1 GB2423.1
5	High Temperature & Humidity Storage	Ta=+65℃、RH=90%, 120 hours	Note1,Note3, Note4,Note7 IEC60068-2-78 GB/T2423.3
6	Thermal Shock/ Solder Joint Life Test	-30℃（30min）⇔80℃（30min）,Change Time:5min,30cycle	Note1,Note9 Start with cold temperature End with high temperature, IEC60068-2-14,GB2423.22
7	ESD	C=150pF、R=330Ω Air: ±8KV Contact:±4KV 5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa)	Note2,Note5, IEC61000-4-2 GB/T17626.2
8	Shock Test	Half Sine Wave 60G ,6ms,±X,±Y,±Z 3times for each direction	Note2
9	Drop Test(package state)	Height:60cm, 1corner,3edges,6surfaces	Note2,IEC60068-2-32 GB/T2423.8
10	Surface hardness	4H	JIS-K5600
11	Drop ball test	Use the 64g steel (¢ 25) ball is dropped on the Glass surface from 70cm height at 1time(Glass side)	No crack after test.

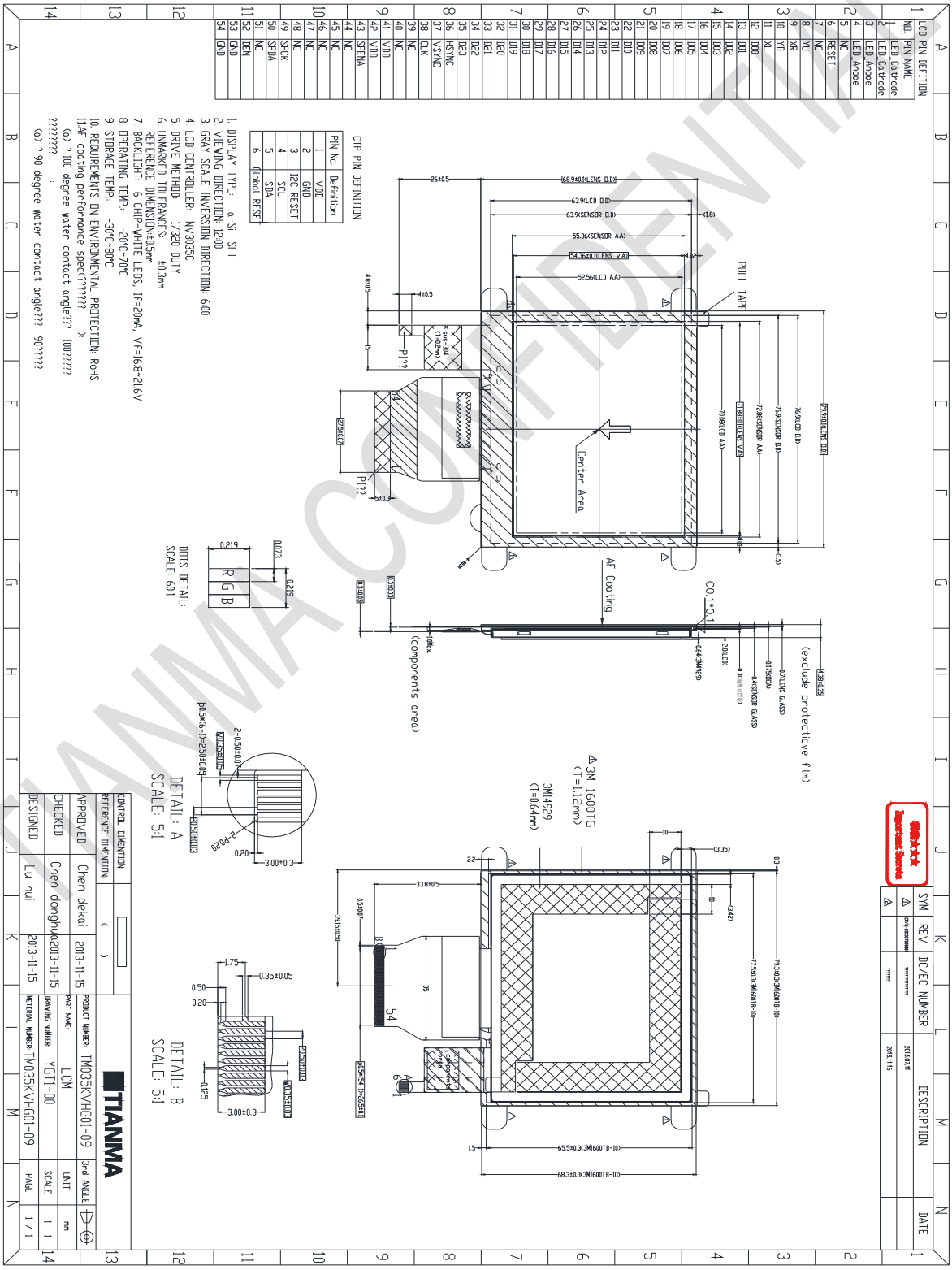
Note1: Ts is the temperature of panel's surface.

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.

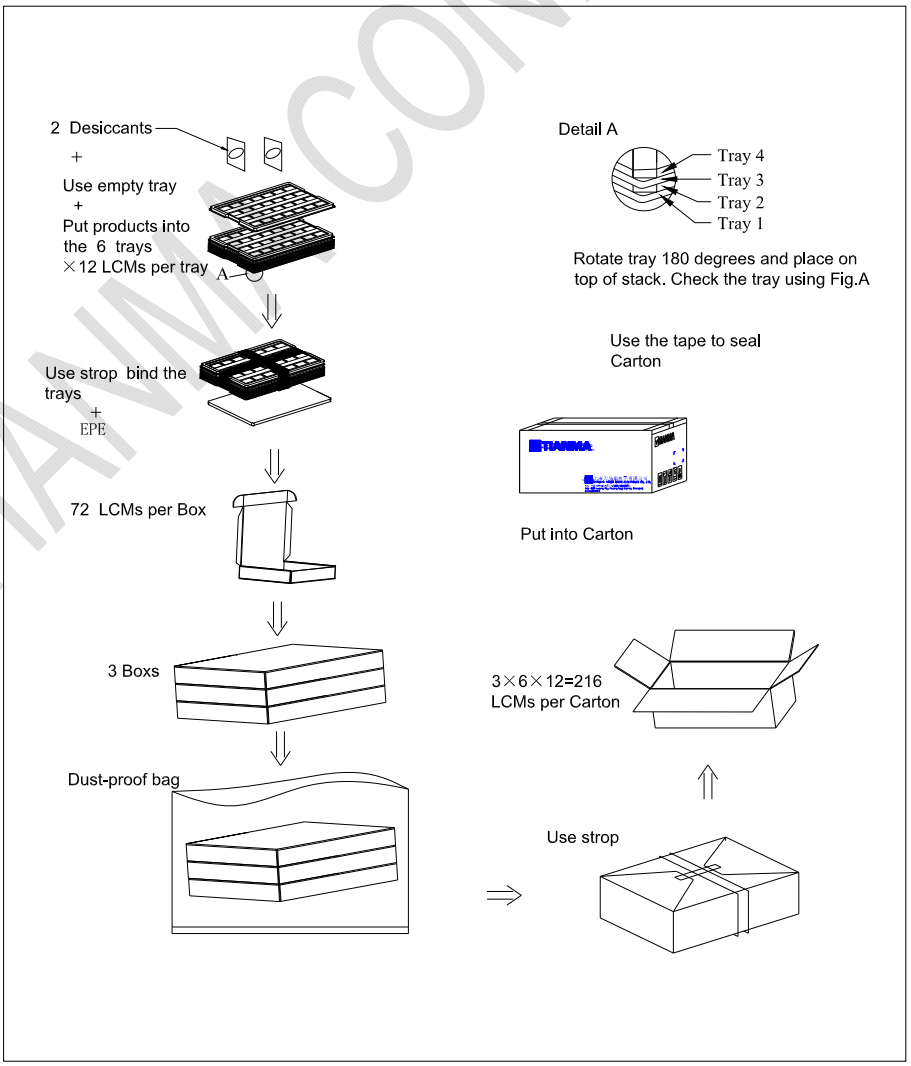
Note 4: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

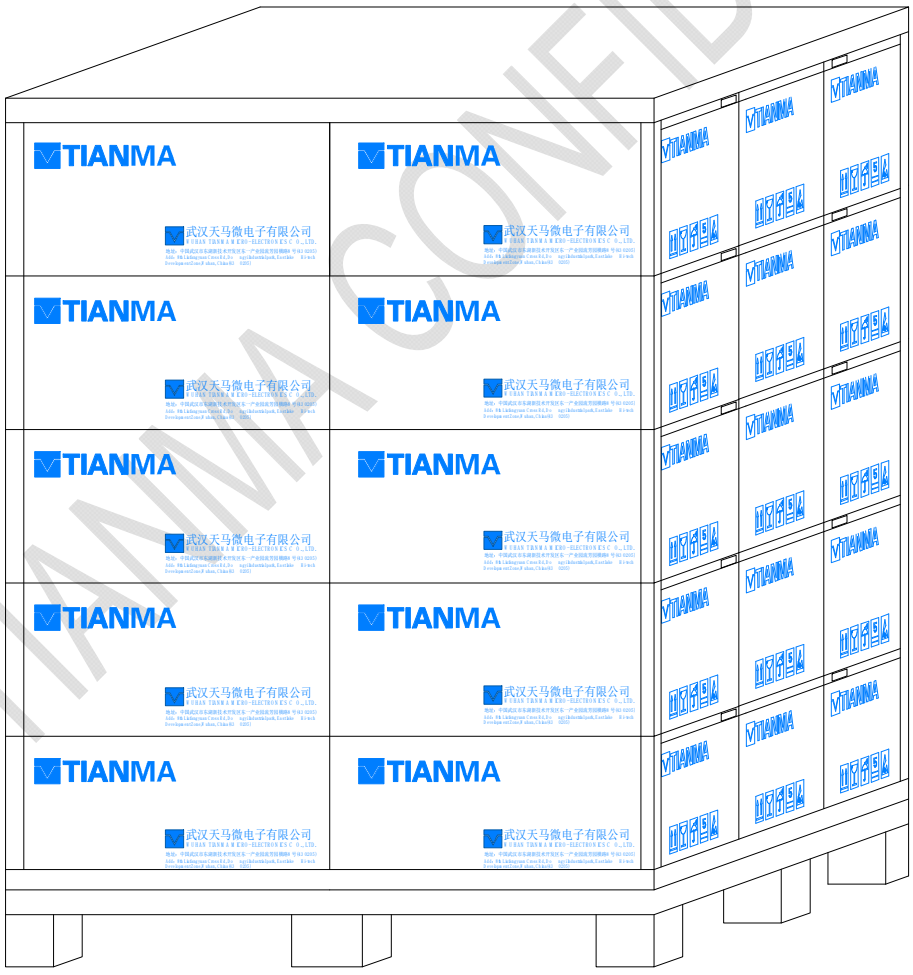
9 Mechanical Drawing



10 Packing Drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM	TM035KVHG01	79.9×68.9×5.02	TBD	216	
2	Tray	PET	485X330X13.8	TBD	21	
3	EPE	EPE	485×330×5	0.183	3	
4	Dust-Proof Bag	PE	700×545	0.046	1	
5	Box	CORRUGATED PAPER	520×345×74	0.3879	3	
6	Desiccant	Desiccant	45X35	0.002	6	
7	Carton	CORRUGATED PAPER	544x365x250	1.01	1	
8	Total weight	TBD±5% Kg				





11 Precautions for Use of LCD Modules

11.6 Handling Precautions

11.6.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

11.6.2 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.

11.6.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

11.6.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

11.6.5 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

11.6.6 Do not attempt to disassemble the LCD Module.

11.6.7 If the logic circuit power is off, do not apply the input signals.

11.6.8 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.

11.7 Storage precautions

11.7.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

11.7.2 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%

11.7.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

11.8 Transportation Precautions

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