MODEL NO. : ___SP035GT-07___

ISSUED DATE: ___2010-11-10___

VERSION : ___Ver1. 0___

■ **Preliminary Specification**
□ **Final Product Specification**

Customer :_____

Approved by	Notes

SHANGHAI TIANMA Confirmed :

Prepared by	Checked by	Approved by
	李红明	吴小峰

Table of Contents

Record of Revision

Rev	Issued Date	Description
1.0	Nov,10,2010	Preliminary release

1 GENERAL SPECIFICATIONS

Feature		Spec
Display Spec.	Size	3.5"
	Resolution	320(RGB) X 240
	Interface	RGB/CCIR656/601
	Color Depth	24bit
	Technology type	a-si
	Pixel pitch (mm)	0.219 x 0.219
	Display colors	16.7M dithering
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment	Anti-Glare , 3H
	Viewing direction	12 o'clock
	Gray Scale Inversion Direction	6 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	76.9 x 64.0 x 3.05
	Active Area(mm)	70.08 x 52.56
	With /Without TSP	Without TSP
	Weight (gram)	TBD.
	LED Numbers	6 LEDs Serial
	Driver IC	Novatek 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

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	NC	–	No Connect	
7	NC	–	No Connect	
8	RESET	I	Reset	
9	SPENA	I	Serial port data enable signal	
10	SPCK	I	SPI Serial Clock	
11	SPDA	I/O	SPI Serial Data Input/output	
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（3.3V）	
42	VDD	P	power supply（3.3V）	
43	NC	-	No Connect	
44	NC	-	No Connect	
45	NC	-	No Connect	
46	NC	-	No Connect	
47	NC	-	No Connect	
48	NC	-	No Connect	
49	NC	-	No Connect	
50	NC	-	No Connect	
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

6 LED

V_{LED}_Anode V_{LED}_Cathode
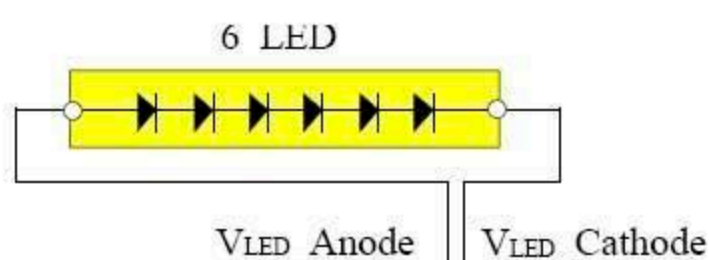
Note 2-2:

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		0.3VCC	V	
	High Level	V_{IH}	0.7VCC		VCC	V	
(Panel+LSI) Power Consumption	Black Mode(60HZ)			35		mW	
	Sleeping Mode			TBD		mW	

4.2 Driving Backlight

Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	—	15	25	mA	
Forward Current Voltage	V_F	16.8	19.2	21.6	V	
Backlight Power Consumption	W_{BL}	—	288	--	mW	

4.3. Block Diagram

LCD module diagram

- LCD PANEL
- 3.5inch 320 (RGB) X240
- Source+ Gate Driver
- Grayscale Manipulation Voltage
- Charge pump
- VCOM
- TCON
- LCD Driver Chip (COG)
- R(0~7), G(0~7), B(0~7)
- HSYNC, VSYNC
- CLK, DEN
- SPENA，SPCK
- SPDA
- VDD
- LED_Anode,LED_Cathode
- FPC
- RGB/CCIR 656/601 I/F
- SPI
- Power Supply
- LED
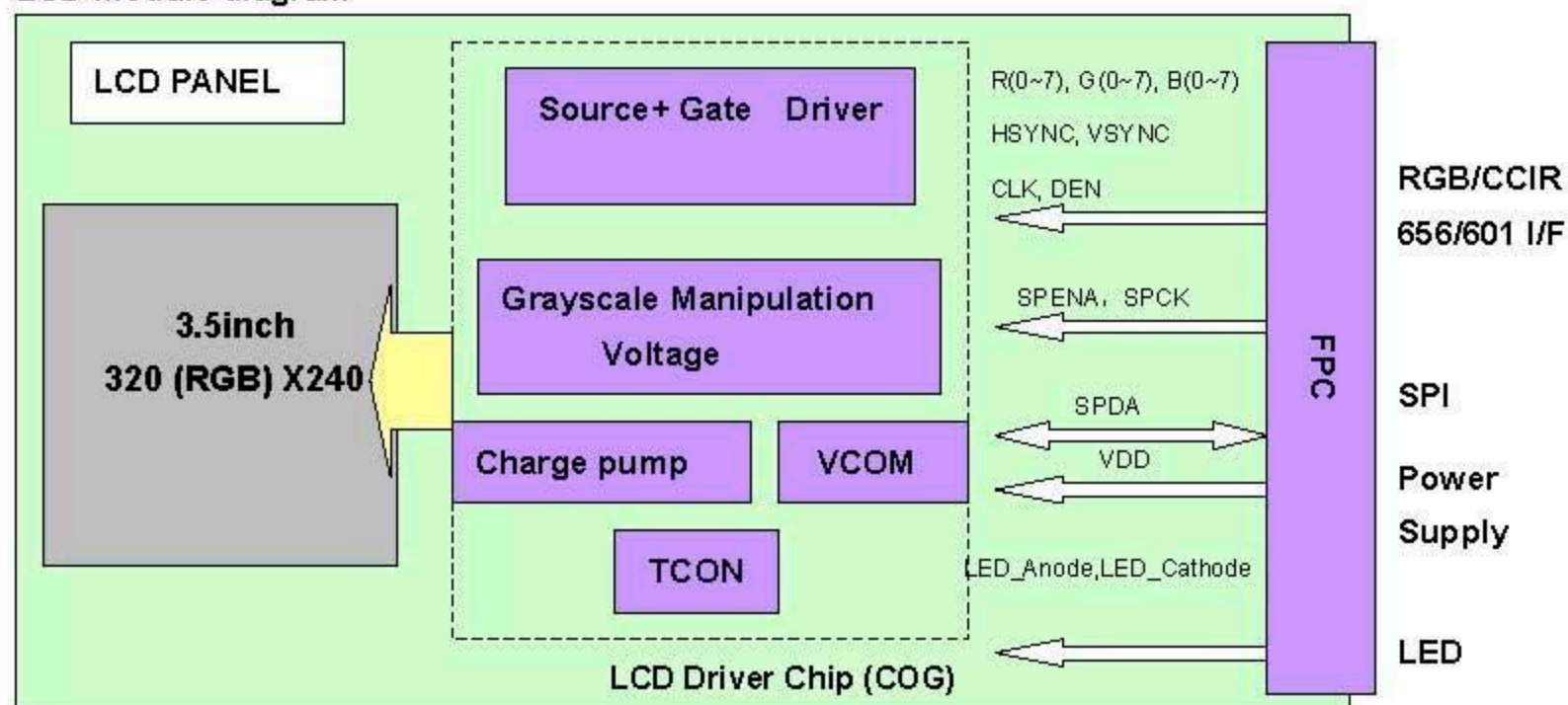
5 TIMING CHART

5.1 AC Electrical Characteristics (VDD=3.3V, GND= 0V,Ta=25℃)
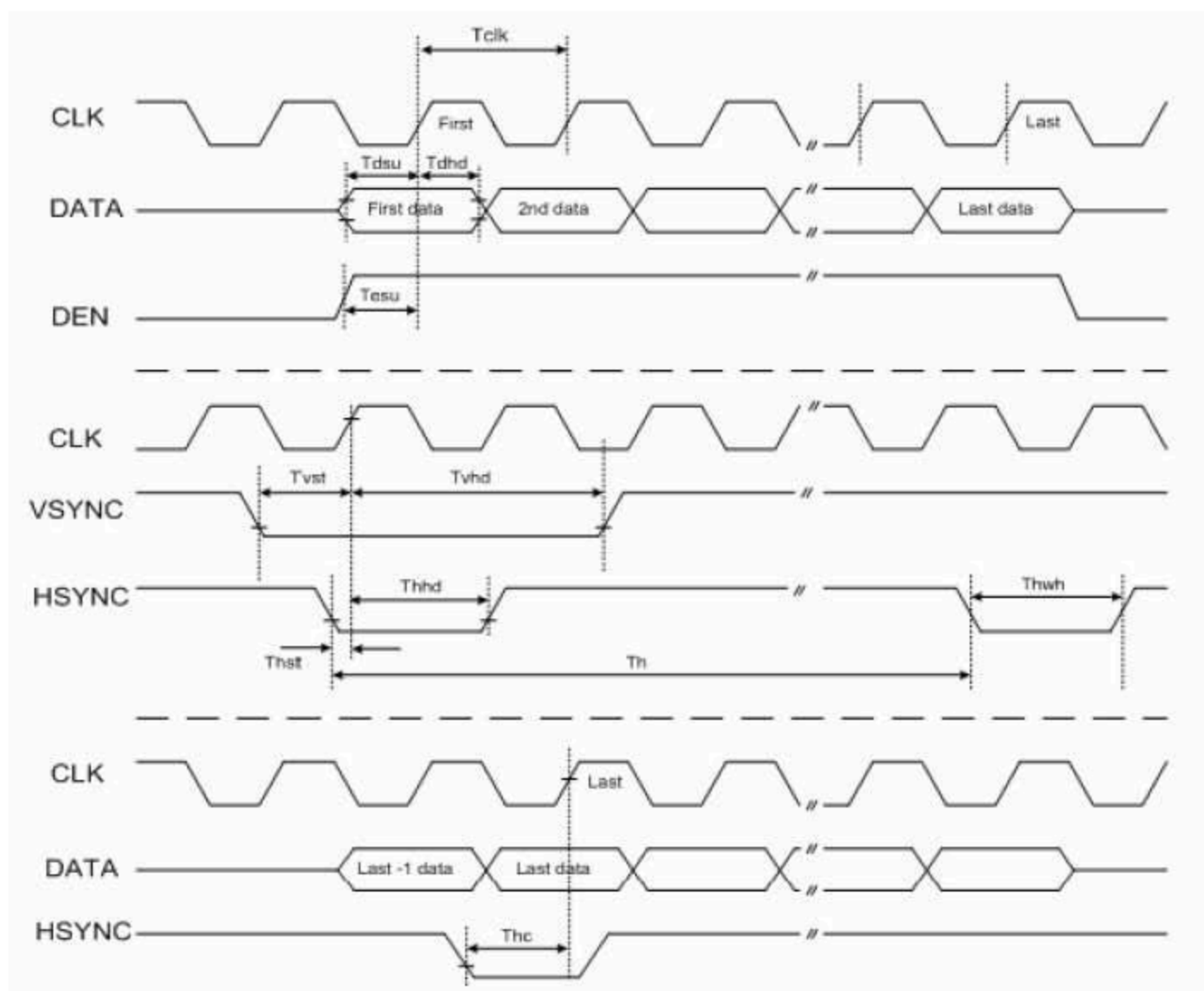
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK clock time	Tclk	-	-	35.7	ns	CLK=28MHz
CLK pulse duty	Tchw	40	50	60	%	Tclk
HSYNC to CLK	Thc	-	-	1	CLK	
HSYNC width	Thwh	1	-	-	CLK	
VSYNC width	Tvwh	1	-	-	Th	
HSYNC period time	Th	60	63.56	67	us	
VSYNC setup time	Tvst	12	-	-	ns	
VSYNC hold time	Tvhd	12	-	-	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
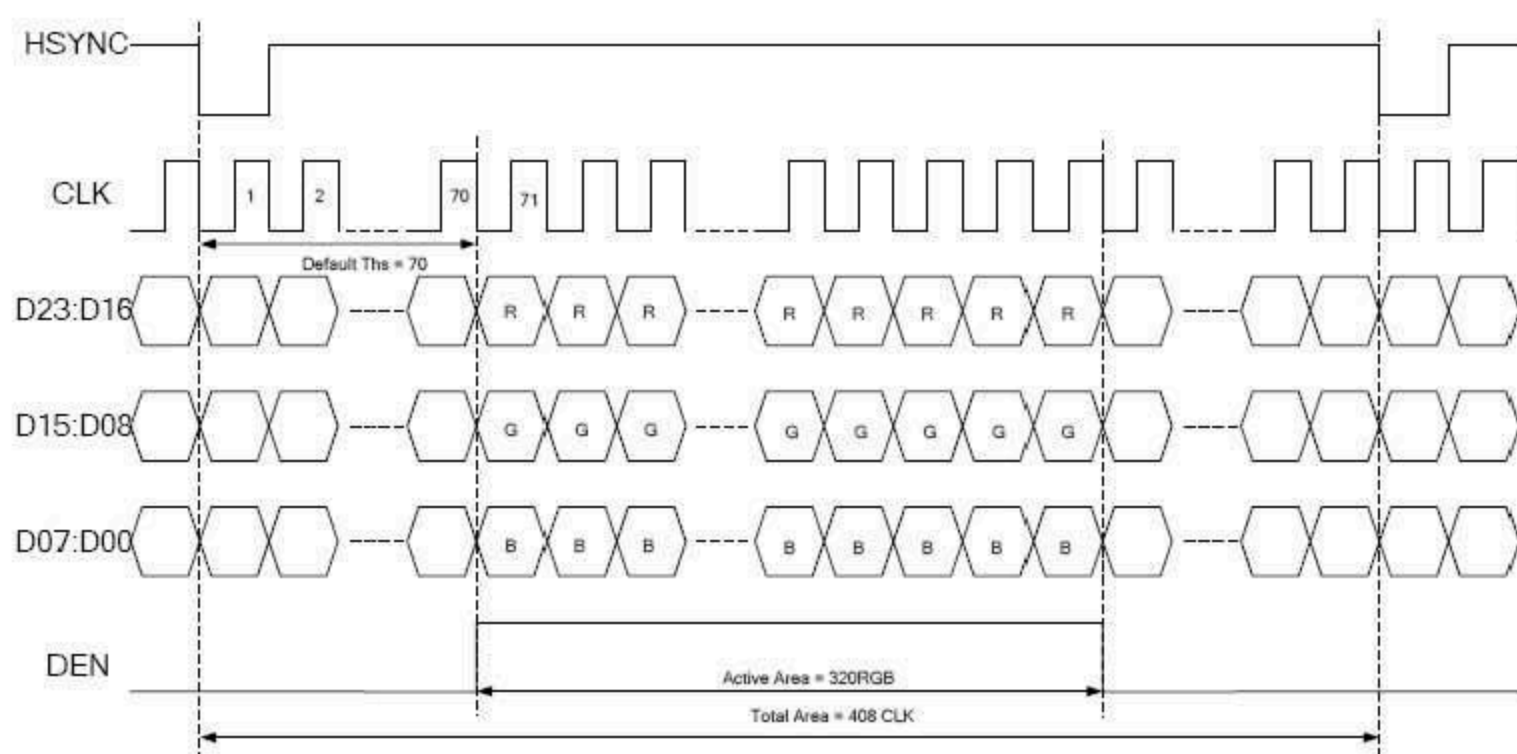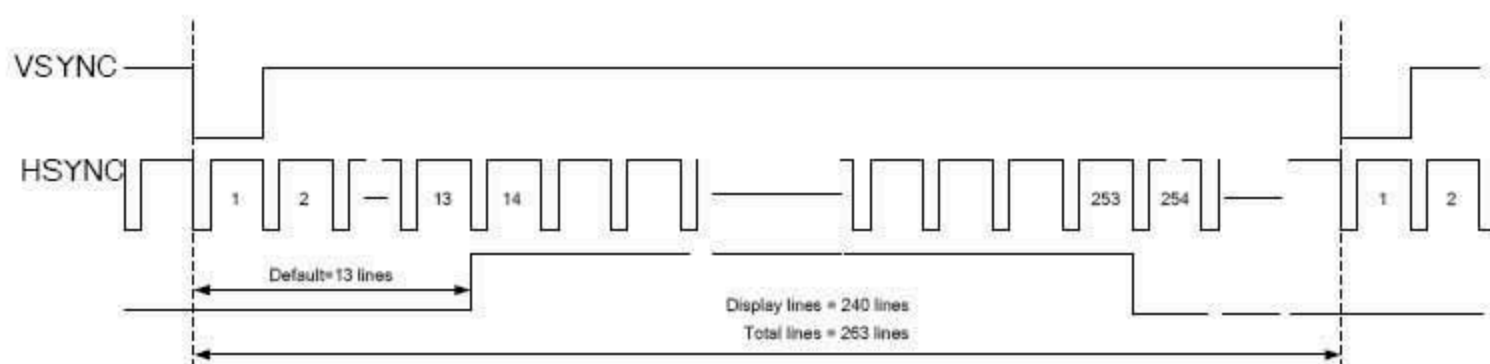
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK frequency	Fclk	-	6.4	-	MHz	VDD=3.0~3.6V
CLK cycle time	Tclk	-	156	-	ns	
Time that HSYNC to 1'st data input(NTSC)	Ths	40	70	255	CLK	

5.3 8 bit RGB mode for 320RGB x 240
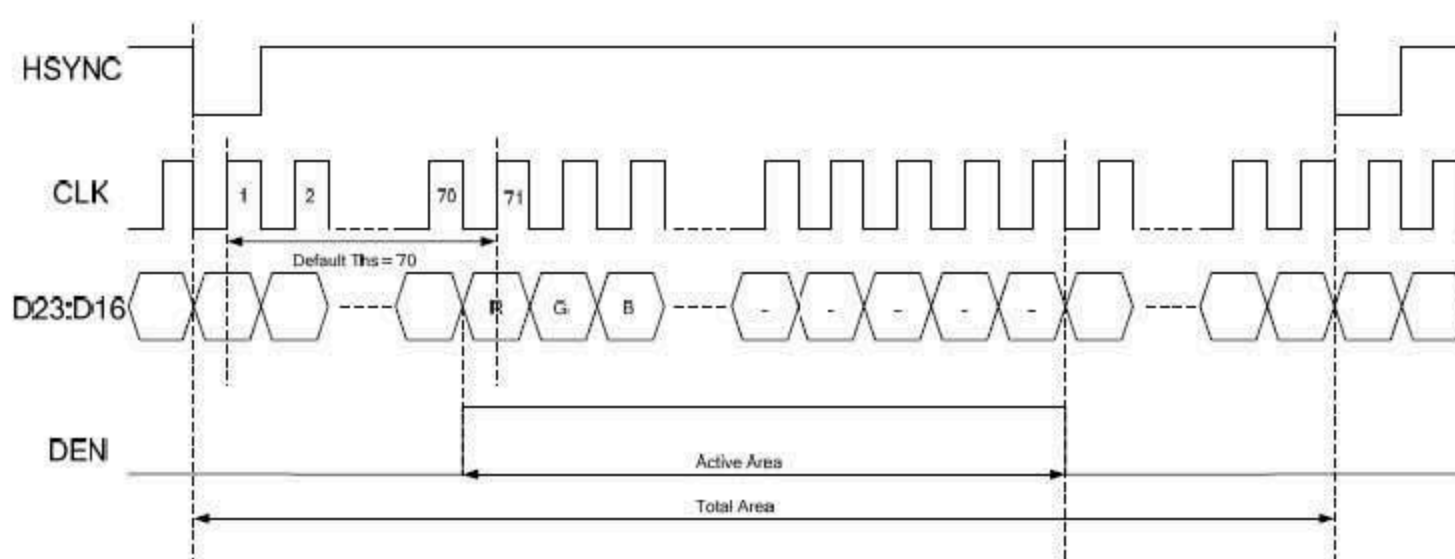
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK frequency	Fclk	-	27	-	MHz	VDD=3.0~3.6V
CLK cycle time	Tclk	-	37	-	ns	
Time that HSYNC to 1'st data input(NTSC)	Ths	35	70	255	CLK	

5.4 ITU-R BT 601
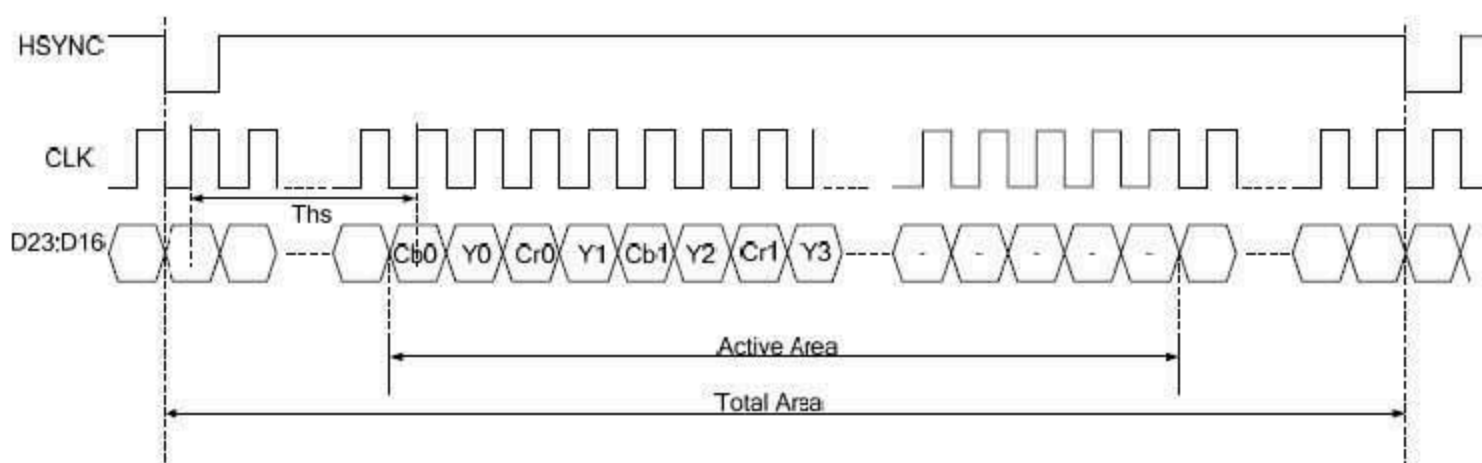
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK frequency	Fclk	-	24.54/27	-	MHz	VDD=3.0~3.6V
CLK cycle time	Tclk	-	40/37	-	ns	
Time from HSYNC to 1'st data input(PAL)	Ths	128	264	-	CLK	
Time from HSYNC to 1'st data input(NTSC)	Ths	128	244	-	CLK	

5.5　ITU-R BT 656
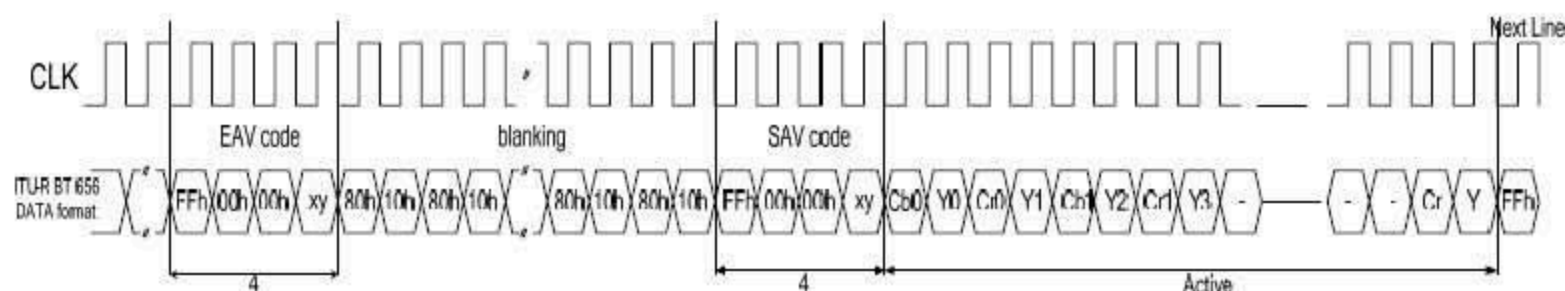
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK frequency	Fclk	-	27	-	MHz	VDD=3.0~3.6V
CLK cycle time	Tclk	-	37	-	ns	
Time from EAV to 1'st data input(PAL)	Ths	128	288	-	CLK	
Time from EAV to 1'st data input (NTSC)	Ths	128	276	-	CLK	

5.6　3-Wire Serial Communication AC Timing
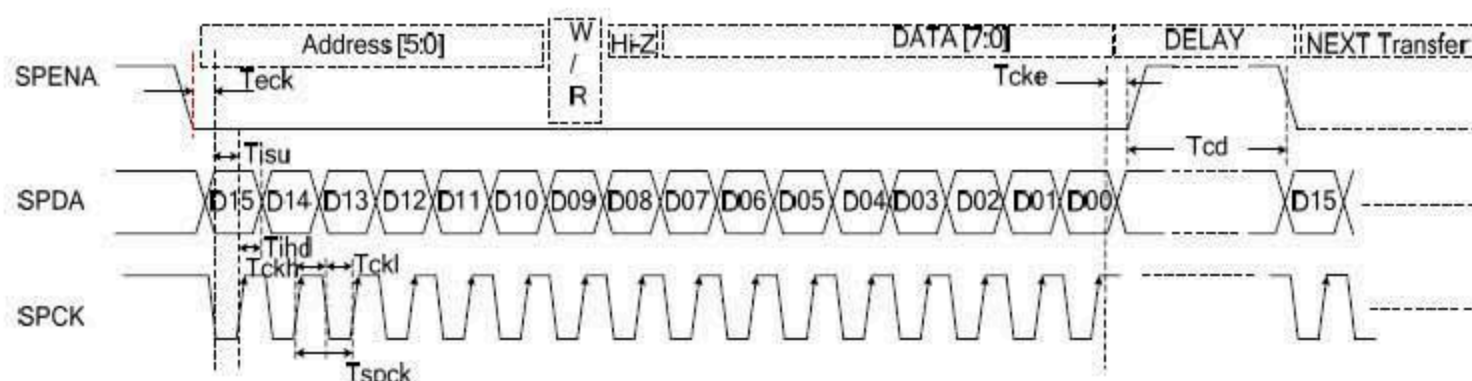
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
SPCK cycle time	Tspck	320	-	-	ns	
SPCK pulse duty	Tscdut	40	50	60	%	
Serial data setup time	Tisu	120	-	-	ns	
Serial data hold time	Tihd	120	-	-	ns	
Serial clock high/low	Tssw	120	-	-	ns	
Chip select distinguish	Tcd	1	-	-	us	

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

Power on sequence
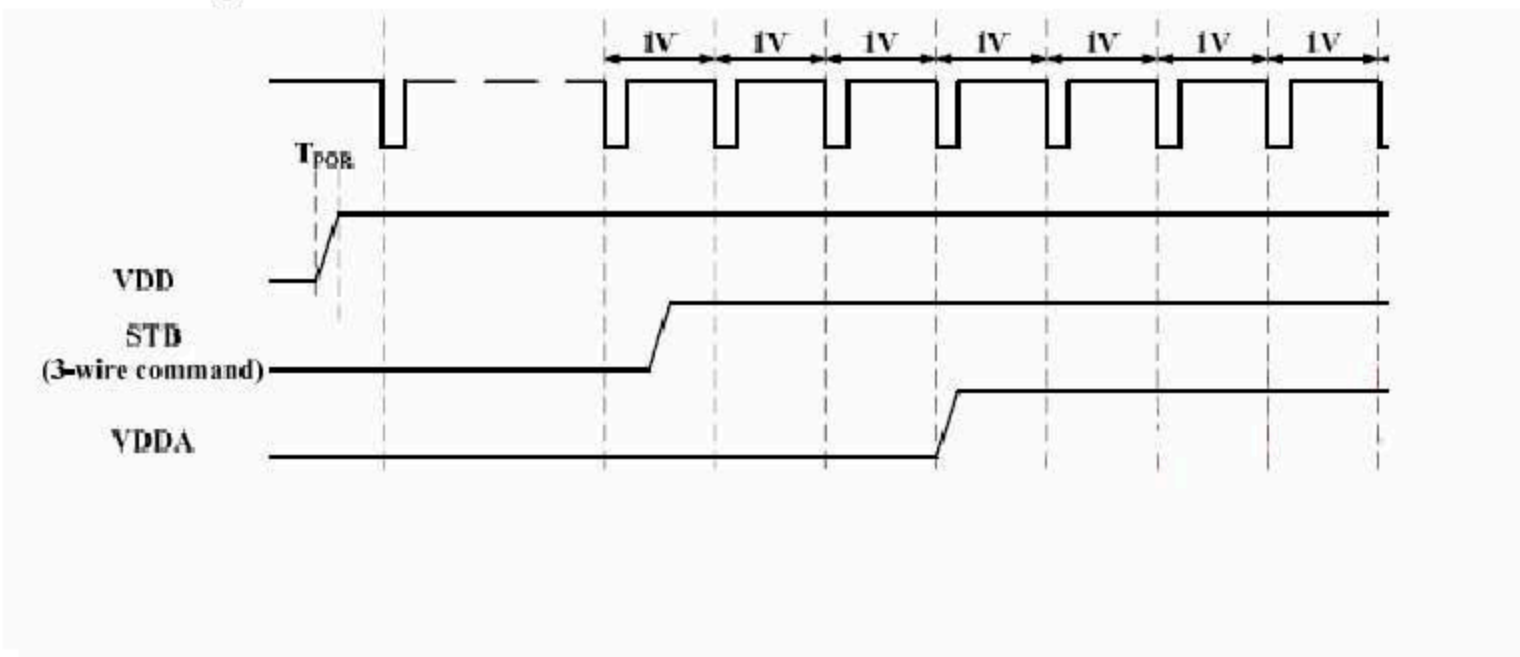
Power off sequence
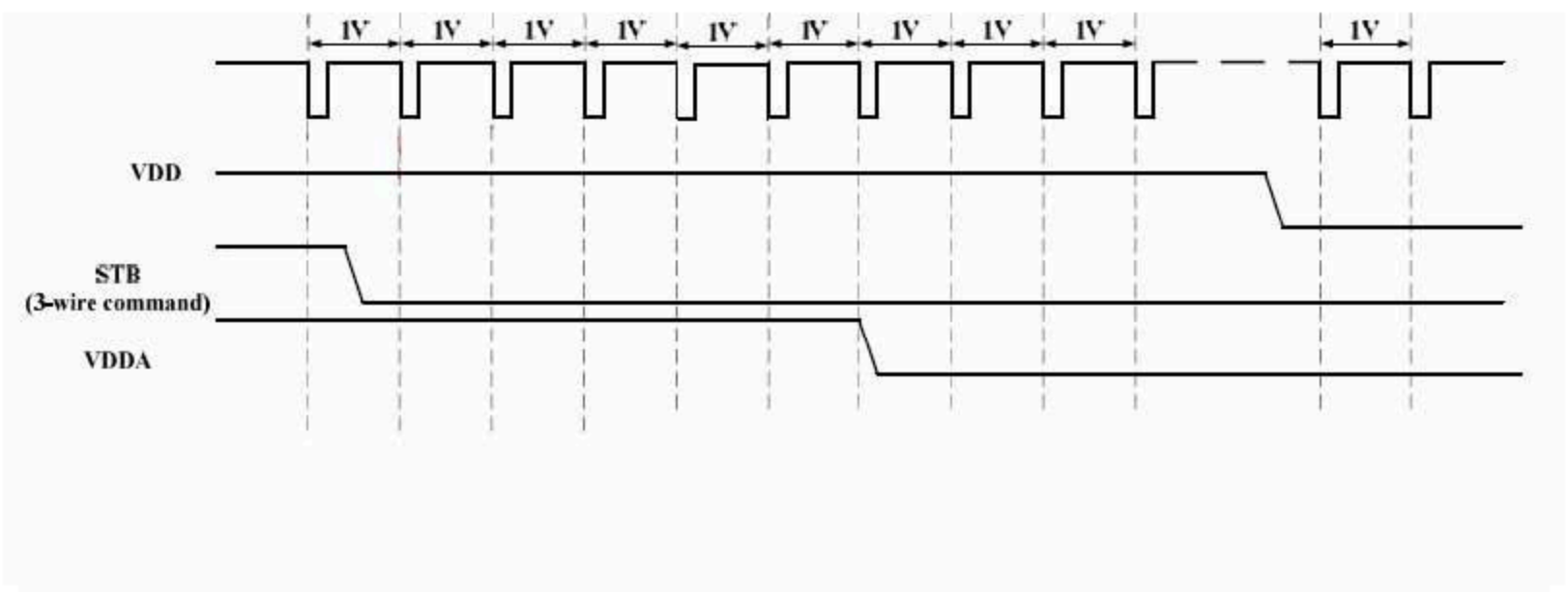
# 6 OPTICAL CHARACTERISTICS

6.1 Optical Specification

Ta=25℃

Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
View Angles		ΘT	CR≧10	30	40		Degree	Note 2
		ΘB		50	60			
		ΘL		50	60			
		θR		50	60			
Contrast Ratio		CR	θ=0°		350			Note1,3
Response Time		Ton	25℃		25	40	ms	Note1,4
		Toff						
Chromaticity	White	x		0.260	0.310	0.360		Note1,5
		y		0.283	0.333	0.383		
	RED	x		0.574	0.624	0.674		
		y		0.318	0.368	0.418		
	GREEN	x		0.300	0.350	0.400		
		y		0.500	0.550	0.600		
	BLUE	x		0.093	0.143	0.193		
		y		0.069	0.119	0.169		
Uniformity		U		75	80		%	Note1,6
NTSC					50		%	Note 5
Luminance		L		150	200		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.
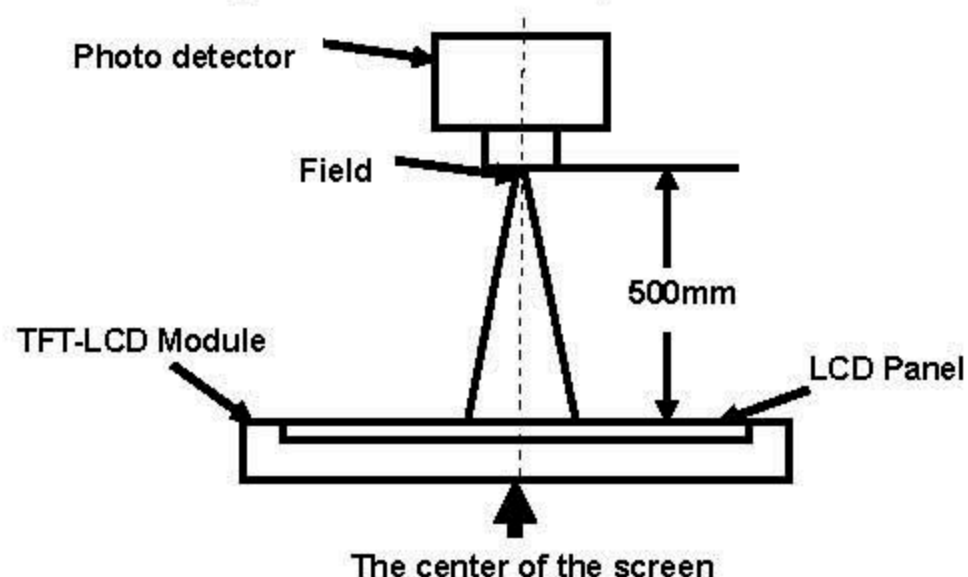
Item	Photo detector	Field
Contrast Ratio		
Luminance	SR-3A	1°
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

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)。
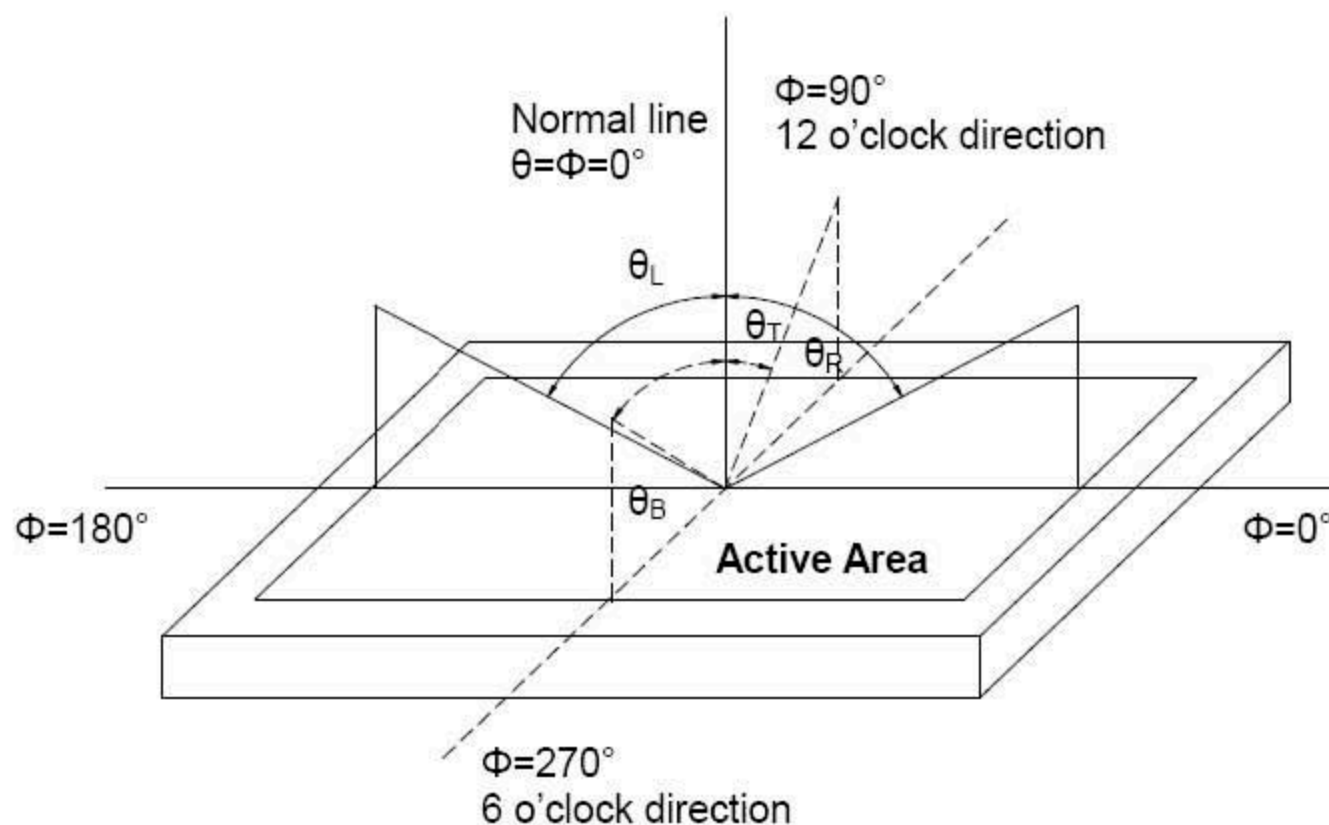
Fig. 1 Definition of viewing angle

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 V_{white}.

"Black state": The state is that the LCD is driven by V_{black}.

V_{white}: **To be determined** 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%.
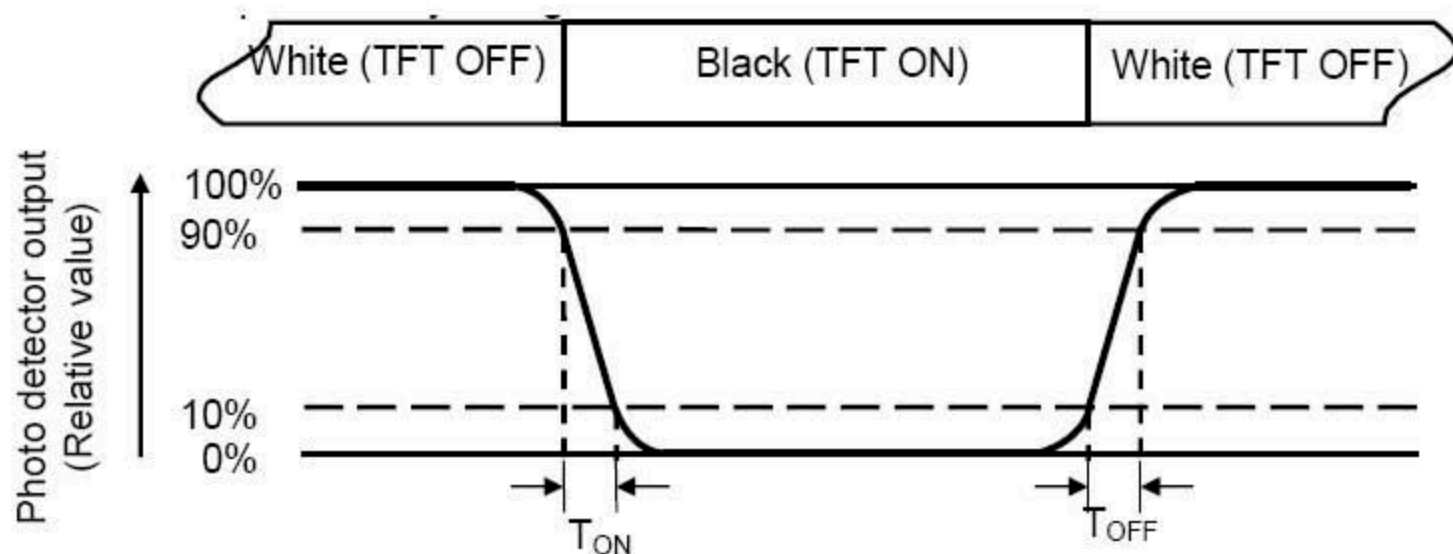
Note 5: Definition of color chromaticity (CIE1931)
Color coordinates measured at center point of LCD.

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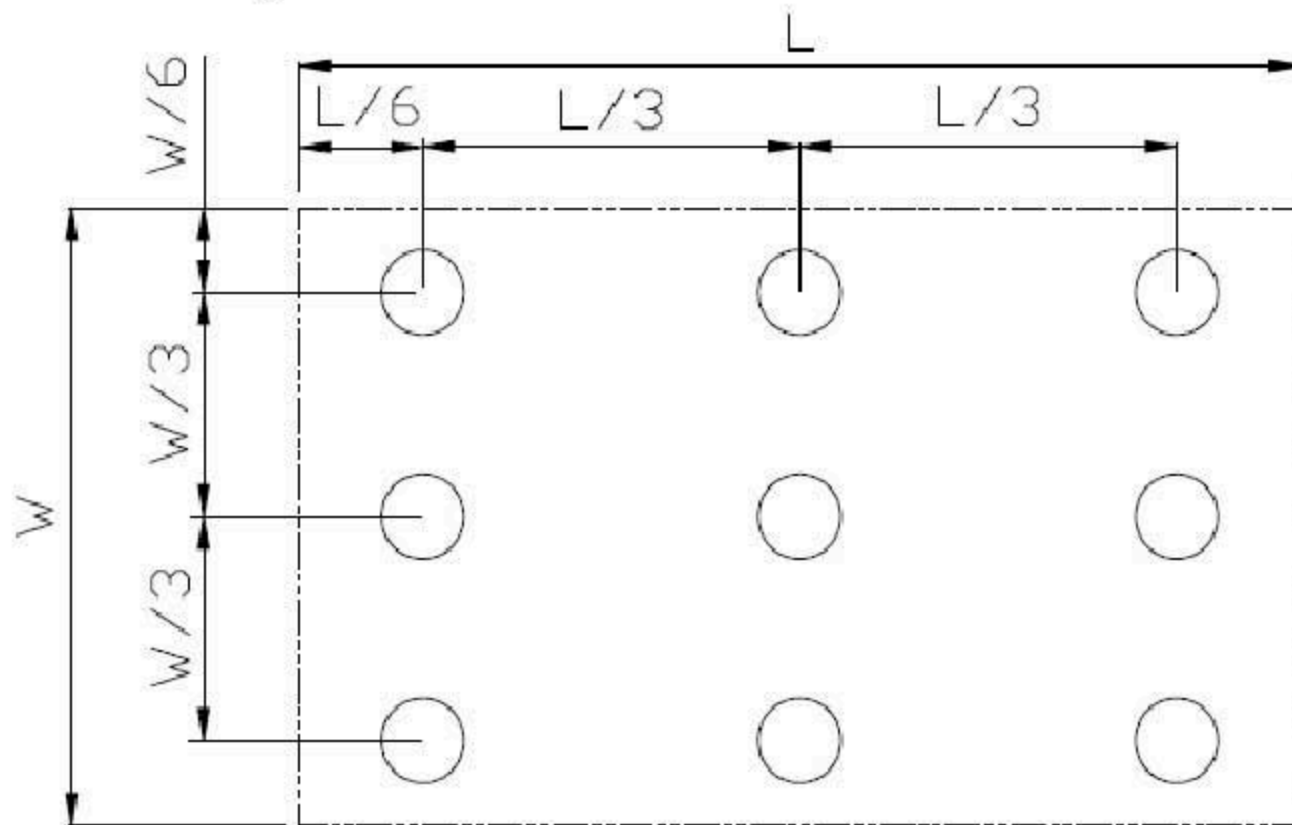
L------Active area length W---- Active area width

Fig. 2 Definition of uniformity

L_{max}: The measured maximum luminance of all measurement position.

L_{min}: The measured minimum luminance of all measurement position.
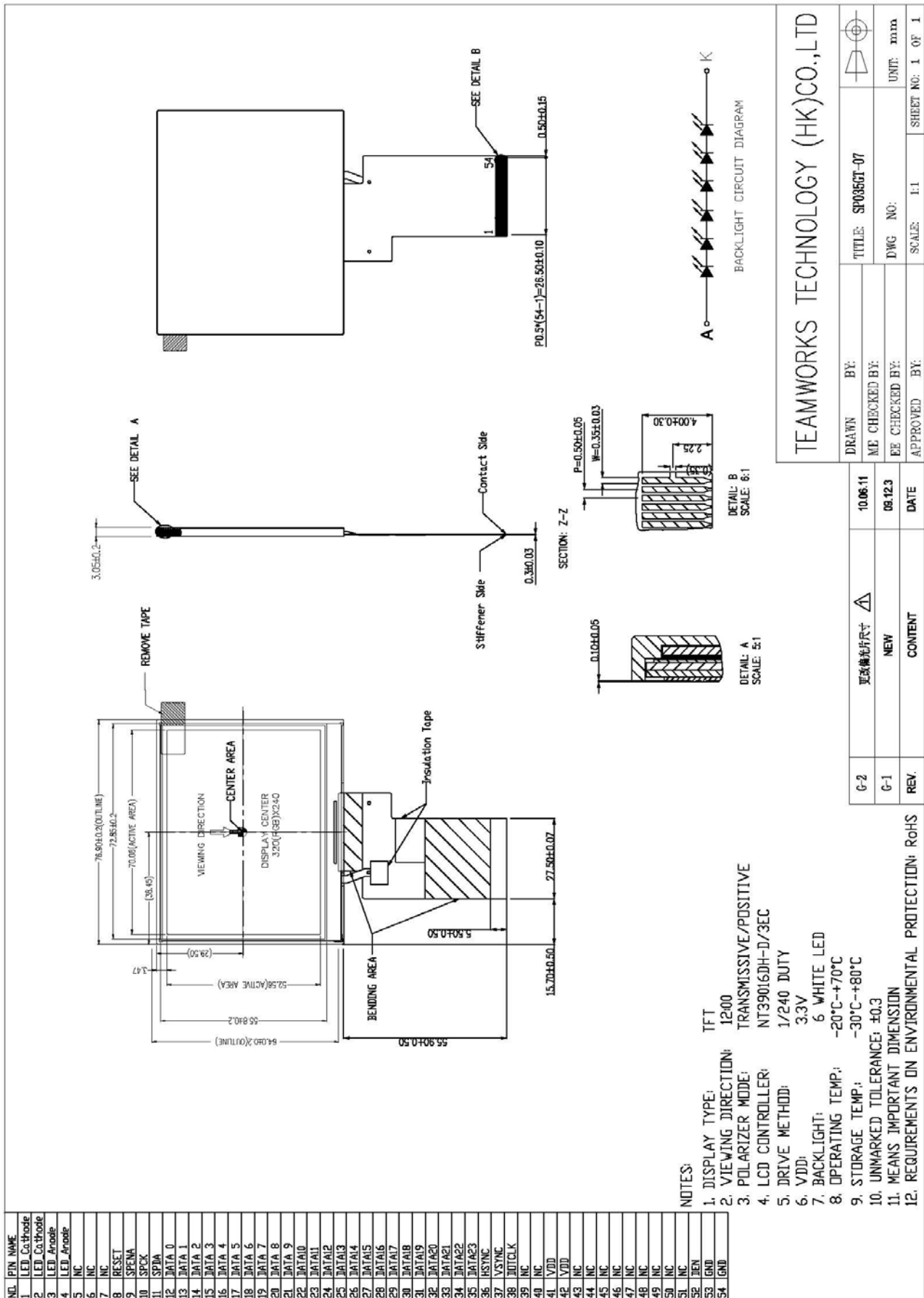
Note 7: Definition of Luminance :

Measure the luminance of white state at center point

5 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

8 MECHANICAL DRAWING

Pin table

NO.	PIN NAME
1	LED_Cathode
2	LED_Cathode
3	LED_Anode
4	LED_Anode
5	NC
6	NC
7	NC
8	RESET
9	SPENA
10	SPCK
11	SPDA
12	DATA0
13	DATA1
14	DATA2
15	DATA3
16	DATA4
17	DATA5
18	DATA6
19	DATA7
20	DATA8
21	DATA9
22	DATA10
23	DATA11
24	DATA12
25	DATA13
26	DATA14
27	DATA15
28	DATA16
29	DATA17
30	DATA18
31	DATA19
32	DATA20
33	DATA21
34	DATA22
35	DATA23
36	HSYNC
37	VSYNC
38	DOTCLK
39	NC
40	VDD
41	VDD
42	VDD
43	VDD
44	NC
45	NC
46	NC
47	NC
48	NC
49	NC
50	NC
51	NC
52	DEN
53	GND
54	GND

NOTES:
1. DISPLAY TYPE: TFT
2. VIEWING DIRECTION: 12:00
3. POLARIZER MODE: TRANSMISSIVE/POSITIVE
4. LCD CONTROLLER: NT39016DH-D/3EC
5. DRIVE METHOD: 1/240 DUTY
6. VDD: 3.3V
7. BACKLIGHT: 6 WHITE LED
8. OPERATING TEMP.: -20°C~+70°C
9. STORAGE TEMP.: -30°C~+80°C
10. UNMARKED TOLERANCE: ±0.3
11. MEANS IMPORTANT DIMENSION
12. REQUIREMENTS ON ENVIRONMENTAL PROTECTION: RoHS

DISPLAY CENTER 320(RGB)X240

SECTION: Z-Z

DETAIL: B SCALE: 6:1

DETAIL: A SCALE: 5:1

BACKLIGHT CIRCUIT DIAGRAM

Title block

TEAMWORKS TECHNOLOGY (HK)CO.,LTD

	BY:	DATE
DRAWN		
ME CHECKED BY:		
EE CHECKED BY:		
APPROVED BY:		

TITLE: SP035GT-07
DWG NO:
SCALE: 1:1
SHEET NO: 1 OF 1
UNIT: mm

REV.	CONTENT	DATE
G-2	更改编起外形尺寸	10.06.11
G-1	NEW	09.12.3

9. INSPECTION CRITERIA

9.1 AQL(Acceptable Quality Level)
AQL of major and minor defect

	MAJOR DEFECT	MINOR DEFECT	MAJOR+MINOR
APPEARANCE	0.40%	1.0%	1.0%
ELECTRIC-OPTICAL	0.15%	0.15%	0.15%

9.2 Basic conditions for inspection
The LCM face to us, According to the criteria of luminance measurement instruction, About an angle of incidence 30,a distence of 30 cm with normal eye.with an angle of 45 degree to check the products without uncovering the film!
    (As shown below).

Light Source

30cm

30cm

30°

45±10°

Front Polarizer

Glass

Rear Polarizer
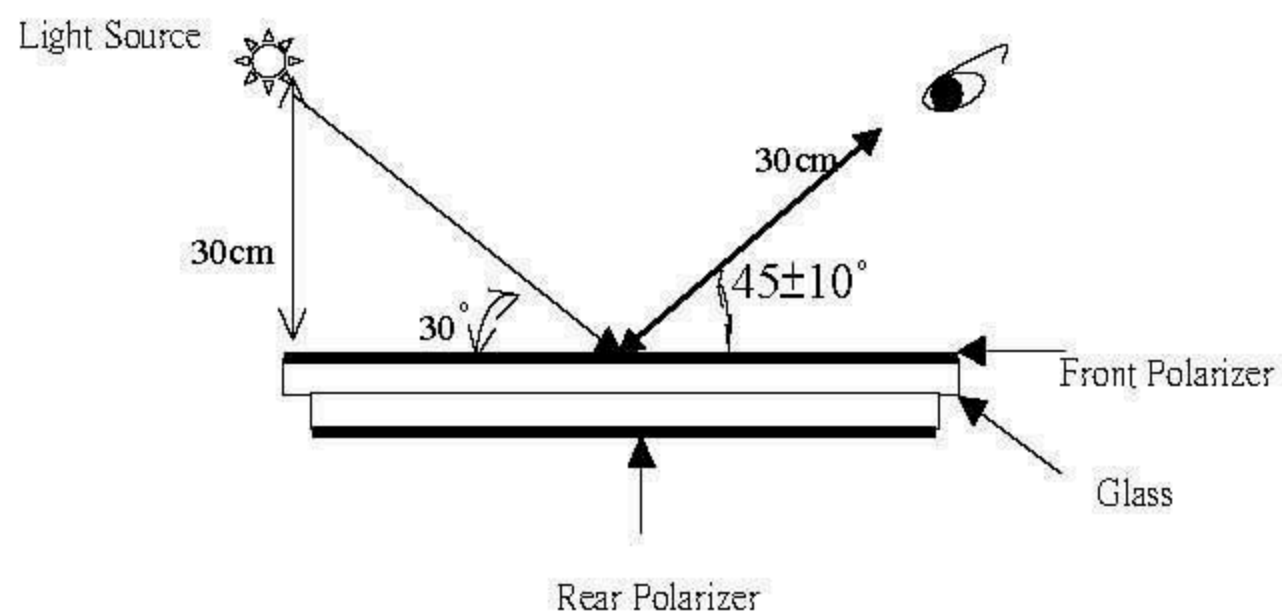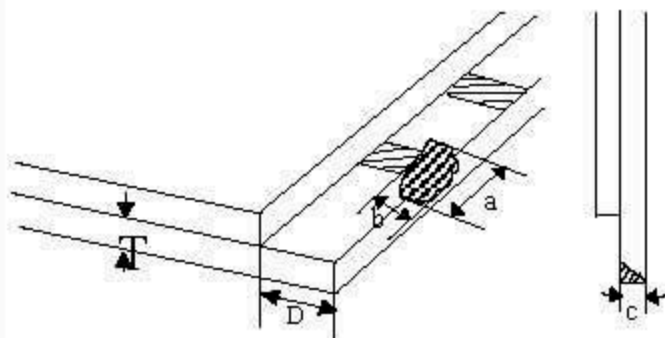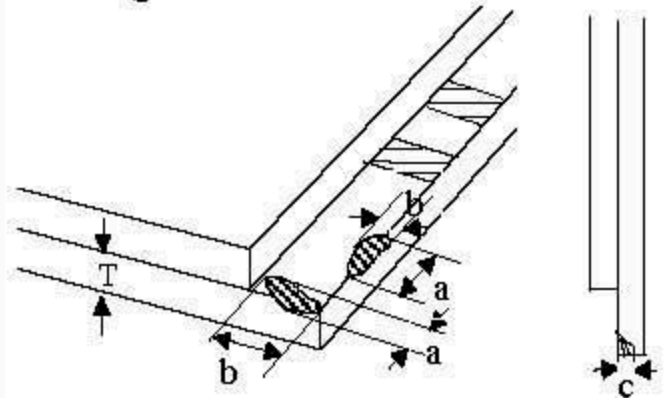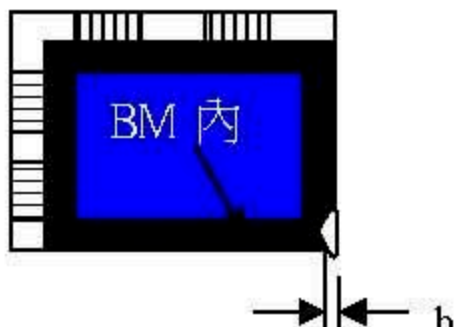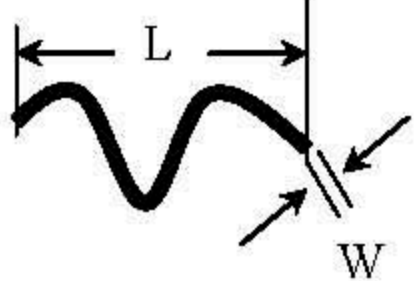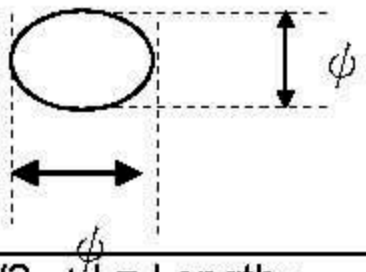
9.3 Inspection item and criteria
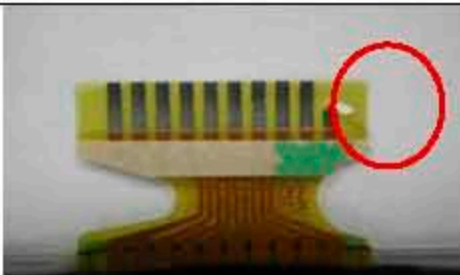
9.3.1 Visual inspection criterion in immobility

9.3.1.1 Glass defect

No	Defect item	Criteria	Remark
1	Dimension Unconformity (Major defect)	By Engineering Drawing	
2	Cracks (Major defect)	1)Not-extended crack according to the limit sample 2) Extended crack when C≦T and the crack touch ≦1/3 sealant width is OK	
3	Glass extrude the conductive area (minor defect)	a: disregards and no influence assemblage 1) b≦1/3Pin width(non bonding area) 【Accept】 2) bonding area≦0.5mm 【Accept】	a:Length, b:Width
4	Pin-side，conductive area damaged (minor defect)	(a c：disregards) b≦ 1/3 of effective length for bonding electrode 【Accept】	a：Length，b：Width，c：Thickness
5	Pin-side，non-conductive area damaged (minor defect)	1) Damage area don't touch the ITO (Inclueling contraposition mark,except scribing mark) 【Accept】 2) c<T b≦BM 1/3 of width 【Accept】 3) c=T b not touch the seal glue 【Accept】 4) a disregards	a：Length，b：Width，c：Thickness
6	Non-pin-side damage (minor defect)	c<T 1) b exceeds 1/3 BM 【Reject】 c=T b not touch the seal glue 【Accept】	c：Thickness b: width of damage BM 內

9.3.1.2 LCD appearance defect (View area)

No	Defect item	Criteria			Remark
1	Fiber、glass cratch、polarizer scratch/folded (minor defect)	Specification		Allowable	note1: L：Length，W：Width note2: disregard if out of AA
		W≦0.03mm		disregard	
		0.03mm<W≦0.05mm ; L≦3.0mm		2	
		0.05mm<W≦0.1mm; L≦3.0mm		1	
		W>0.1mm ; L>3.0mm		0	
2	Polarizer bubble、concave and convex (minor defect)	ψ≦0.2mm		disregard	note 1:ψ=(L+W)/2 ; L：Length，W：Width note2: disregard if out of AA
		0.2mm<ψ ≦ 0.3mm		2	
		0.3mm<ψ ≦ 0.5mm		1	
		0.5mm<ψ		0	
3	Black dots、dirty dots、impurities、eyewinker (Major defect)	$\phi \leq 0.15mm$		disregard	note 1: disregard if out of AA note2: Inspection by RGB pattern
		0.15mm<ψ≦0.25mm		2	
		0.25<ϕ≦0.3mm		1	
4	Polarizer prick (Major defect)	ψ≦0.1mm		disregard	note1:ψ=(L+W)/2 ;L= Length，W=Width note2: the distance between two dots ＞5mm
		0.1mm<ψ≦0.25mm		3	
		ψ＞0.25mm		0	

9.3.1.3 .FPC

No	Defect item	Criteria		Remark
1	Copper screen peel (Major defect)	Copper screen peel 【Reject】		
2	No release tape or peel (Major defect)	No release tape or peel 【Reject】		
3	Dirty dot and impurity of FPC for customer using side (minor defect)	Specification	Allowable	note1: Cannot have stride ITO impurities
		ψ≦0.25mm	2	
		ψ>0.25	0	
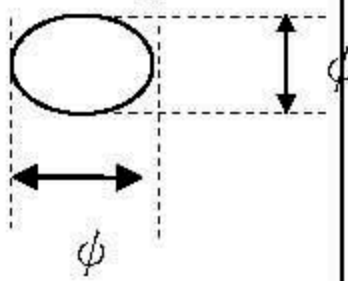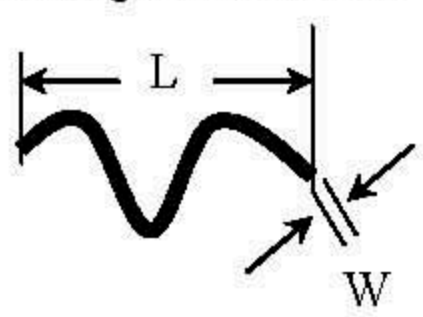
9.3.1.4 Black tape & Mara tape

No	Defect item	Criteria	Remark
1	FPC or H/S black tape shift (minor defect)	1.shift spec: 1)glue to the polarize 【Reject】 2) IC bare 【Reject】 2. left-and-right spec: 1) exceed of FPC edge or H-S edge 【Reject】 2)IC bare 【Reject】	
2	No black tape (Major defect)	No black tape 【Reject】	
3	Tape position mistake (minor defect)	Not by engineering drawing 【Reject】	
4	Mara tape defect (minor defect)	Peel before pulling the protecting film. 【Reject】	

9.3.1.5 Silicon and Tuffy glue

No	Defect item	Criteria	Remark
1	Quantity of silicon (minor defect)	Uncover the ITO and circuit area. 【Reject】	note: compared by engineering drawing.

2	Tuffy glue
	
	(minor defect)
		1. Uncover the reveal copper area
		   【Reject】
		2. Cover layer 0.3mm(Min) ~
		   3.0mm(Max) 【accept】
			note:if customer has special requirement , refer to the technical document.
			
			3.0mm(Max)

3	Depth of glue covering (minor defect)	Depth of glue covering overtop front Polarizer 【Reject】	Except of the special requirement。

9.3.2 Electrical criteria

No	Defect item	Criteria	Remark
1	No display (Major defect)	No display 【Reject】	
2	Missing line (Major defect)	Missing line 【Reject】	
3	Seg-com light and dark (Major defect)	Seg-com light and dark 【Reject】	
4	No display in immobility (Major defect)	No display in immobility 【Reject】	
5	Flicker of Pattern (Major defect)	Flicker of Pattern 【Reject】	
6	Over current (Major defect)	Over current 【Reject】	
7	Voltage out of specification (Major defect)	Voltage out of specification 【Reject】	
8	Pattern blur ,error code (Major defect)	Pattern blur ,error code 【Reject】	
9	Dark light, Flicker (Major defect)	Dark light, Flicker 【Reject】	

No	Defect item	Specification	Allowable	Remark
10	Black/White dots 、Dirty dots、eyewinker (Major defect)	$\psi \leq 0.15mm$	disregard	Note1: disregard if out of AA note2: Inspection by RGB pattern
		$0.15mm < \psi \leq 0.25mm$	2	
		$0.25 < \phi \leq 0.3mm$	1	
11	Fiber、glass cratch、polarizer scratch/folded (minor defect)	$W \leq 0.03mm$	disregard	note1: L：Length、W：Width note2: disregard if out of AA
		$0.03mm < W \leq 0.05mm$; $L \leq 3.0mm$	2	
		$0.05mm < W \leq 0.1mm$; $L \leq 3.0mm$	1	
		$W > 0.1mm$; $L > 3.0mm$	0	

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.