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# SPECIFICATIONS

## SDT028T

Swissdis 108666

TFT 2.8" with Touch  
Resolution 240 x 320

Version September 2012

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## 1. General Description

SDT028T is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit and a backlight unit.

The panel size is 2.8 inch and the resolution is 240x320, the panel can display up to 262K colors. The LCM can be easily accessed by micro-controller via parallel interface.

## 2. Physical Features

Display Mode	TFT-LCD Module
	Active matrix TFT, Transmissive type
Display Format	Graphic 240 x RGB x 320 Dot-matrix
Input Data	Parallel and SPI interface
Viewing Direction	12 O' clock
Drive	ILI9341

## 3. Mechanical Specification

Item	Contents	Unit
Module size (WxHxT)	49.8x69x3.5	mm
Number of dots	240(RGB) x 320	-
Active area (WxH)	43.2 x 57.6	mm

### 4. Outline Dimension

Customer:	Customer NO.:	Customer Approve By:	REV.:	DESCRIPTION OF MODIFY	DATE
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BL CIRCUIT

**NOTES:**

1. 2.8" Normally white TFT-LCD Module
2. Resolution: 240(RGB) x 320
3. Driver IC: ILI9341
4. Backlight: 4 LED in parallel

LCM NO.:	LCM+
DWG NO.:	LCM+
DRAWN BY:	
CHECKED BY:	
APPROVE BY:	

NO.	FILE DEFINITION	FILE DEFINITION
1	PROJ/REV	41
2	INDICATOR/REV	42
3	VECTOR/REV	43
4	GND	44
5	GND	45
6	C.S.K	46
7	D/CLOCK	47
8	WEAD/CLK	48
9	RD	49
10	RESET	50
11	SDA/SDI	
12	GND	
13	GND	
14	DB0	
15	DB1	
16	DB2	
17	DB3	
18	DB4	
19	DB5	
20	DB6	
21	DB7	
22	GND	
23	DB8	
24	DB9	
25	DB10	
26	DB11	
27	DB12	
28	DB13	
29	DB14	
30	DB15	
31	DB16	
32	DB17	
33	GND	
34	DB18	
35	Y-/Y0	
36	X-/X0	
37	Y-/Y1	
38	X-/X1	
39	LEDA	
40	LEDK1	

LCM NO.:	LCM+
DWG NO.:	LCM+
DRAWN BY:	
CHECKED BY:	
APPROVE BY:	

REV.:

DESCRIPTION OF MODIFY

DATE

Customer Approve By:

Customer NO.:

Customer:

REV.:

DESCRIPTION OF MODIFY

DATE

Customer Approve By:

Customer NO.:

Customer:

## 5. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Remark
Power Voltage	V <sub>CC</sub>	-0.3	4.6	V	Note1、Note2
Input Voltage	V <sub>IN</sub>	-0.3	V <sub>CC</sub> +0.3	V	
Operating temperature	T <sub>OPR</sub>	-20	70	°C	
Storage temperature	T <sub>STR</sub>	-30	80	°C	
Humidity	---	---	90	%RH	

Remark:

*Note 1) The ILI9341 may be permanently damaged if it is used under the condition exceeding the above absolute maximum values. It is also recommended to use the ILI9341 within the limit of its electric characteristics during normal operation. Exceeding the conditions may lead to malfunction of ILI9341 and affect its credibility.*

*Note 2) The voltage from GND.*

## 6. Electrical Characteristics

Item		Symbol	Rating			Unit	Remark
			Min	Typ	Max		
Power Voltage	Logic	V <sub>CC</sub>	2.5	---	3.3	V	Note1
Input Voltage	L level	V <sub>IL</sub>	-0.3	----	0.2*IOVCC	V	V <sub>CC</sub> =1.8 ~ 3.3V
	H level	V <sub>IH</sub>	0.8* IOVCC	---	IOVCC	V	
LCD Drive Power current		I <sub>LCD</sub>	---	3.0	---	mA	Note2

Remark:

*Note1: Vcom must be adjusted to optimize display quality: Cross-talk, Contrast Ratio and etc.*

*Note2: VCC=2.8V, VREG1OUT =4.8V DDVDH=5.0V, fOSC = 376KHz (320 line), Ta=25 °C, GRAM data = 0000h, REV="0", SAP="001", ON4-0="0", OP4- 0="0", MP52-00="0", MN52-00="0", CP12-00="0" CN12-00="0"*

## 7. Module Function Description

### 7-1. Pin Description

NO.	Symbol	Function
1	NC	NC
2	IOVCC	Power supply for LCM
3	VCI	Power supply for LCM
4~5	GND	Power ground
6	/CS	Chip select
7	RS	Command/data select pin
8	/WR	Write execution control pin
9	/RD	Read execution control pin
10	/RESET	Reset pin
11	SDA	The data is applied on the rising edge of the SCL signal
12~13	GND	Power ground
14~21	DB0~DB7	Data bus
22	GND	Power ground
23~32	DB8~DB17	Data bus
33	GND	Power ground
34	SD0	The data is outputted on the falling edge of the SCL signa
35	YD	Touch
36	XR	Touch
37	YU	Touch
38	XL	Touch
39	LEDA	Back light power line
40~43	LEDK1-4	Back light power line
44~46	GND	Power ground
47	IM0	Choice pin
48	IM1	Choice pin
49	IM2	Choice pin
50	IM3	Choice pin

## - Select the MCU interface mode

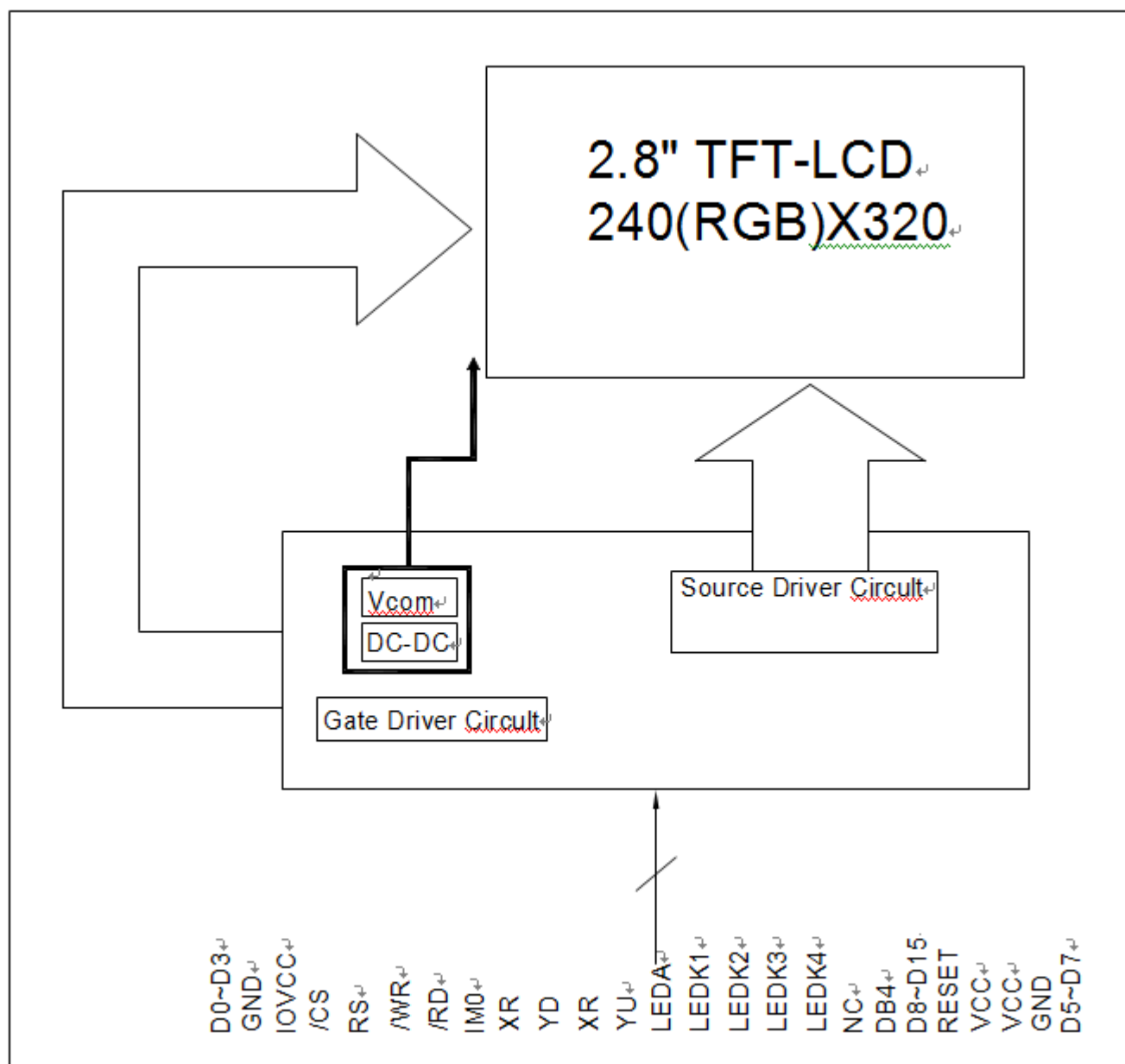
IM3	IM2	IM1	IM0	MCU-Interface Mode	DB Pin in use	
					Register/Content	GRAM
0	0	0	0	80 MCU 8-bit bus interface I	D[7:0]	D[7:0]
0	0	0	1	80 MCU 16-bit bus interface I	D[7:0]	D[15:0]
0	0	1	0	80 MCU 9-bit bus interface I	D[7:0]	D[8:0]
0	0	1	1	80 MCU 18-bit bus interface I	D[7:0]	D[17:0]
0	1	0	1	3-wire 9-bit data serial interface I	SDA: In/OUT	
0	1	1	0	4-wire 8-bit data serial interface I	SDA: In/OUT	
1	0	0	0	80 MCU 16-bit bus interface II	D[8:1]	D[17:10], D[8:1]
1	0	0	1	80 MCU 8-bit bus interface II	D[17:10]	D[17:10]
1	0	1	0	80 MCU 18-bit bus interface II	D[8:1]	D[17:0]
1	0	1	1	80 MCU 9-bit bus interface II	D[17:10]	D[17:9]
1	1	0	1	3-wire 9-bit data serial interface II	SDI: In SDO: Out	
1	1	1	0	4-wire 8-bit data serial interface II	SDI: In SDO: Out	

MPU Parallel interface bus and serial interface select

If use RGB Interface must select serial interface.

\* : Fix this pin at VDDI or VSS.

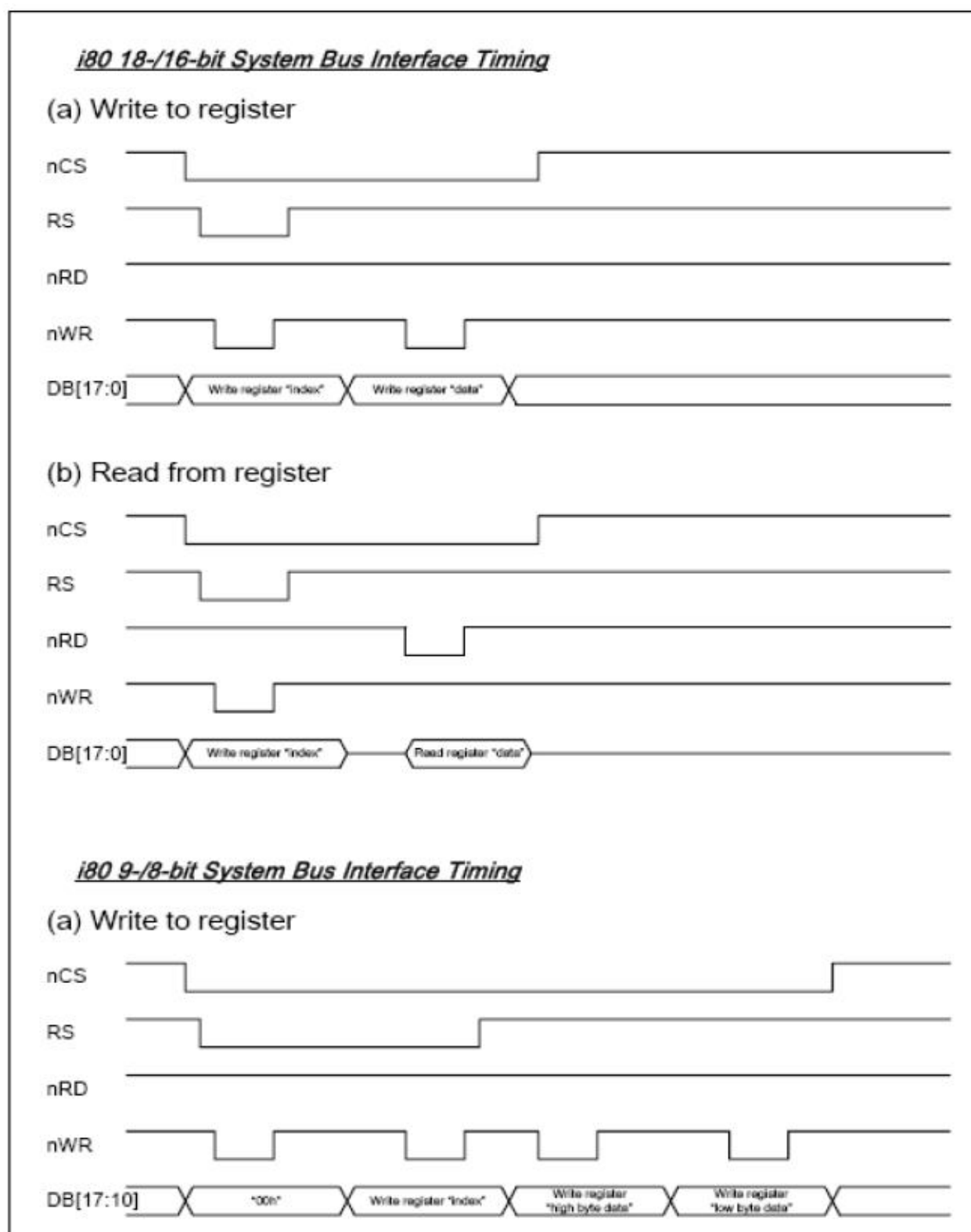
7-2. Block Diagram Of LCM





### 7-3. Timing Characteristics

#### 7.3.1 8/9/16/18-bit Parallel 8080-series Interface Timing Characteristics



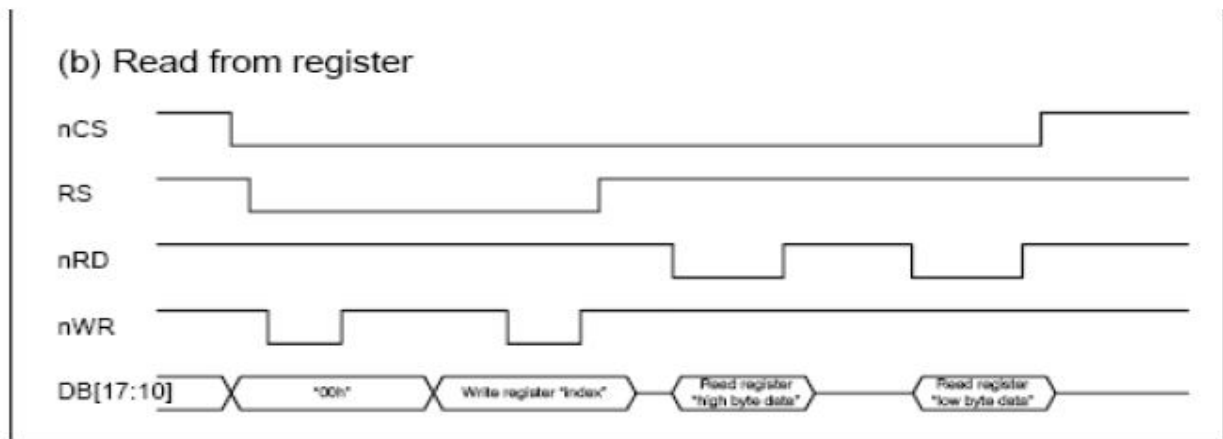
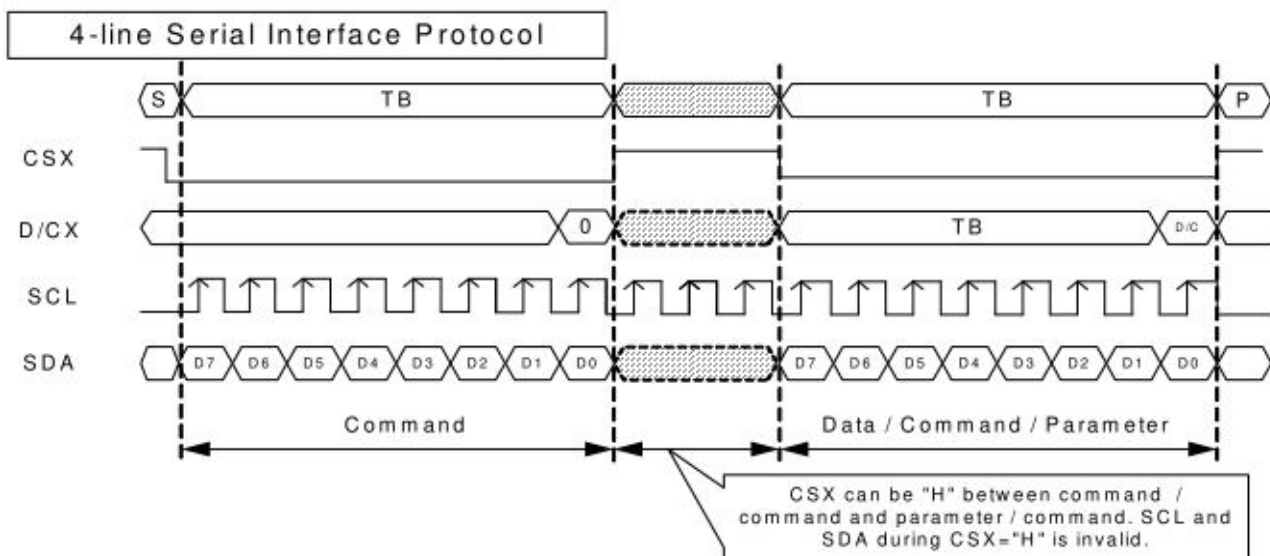
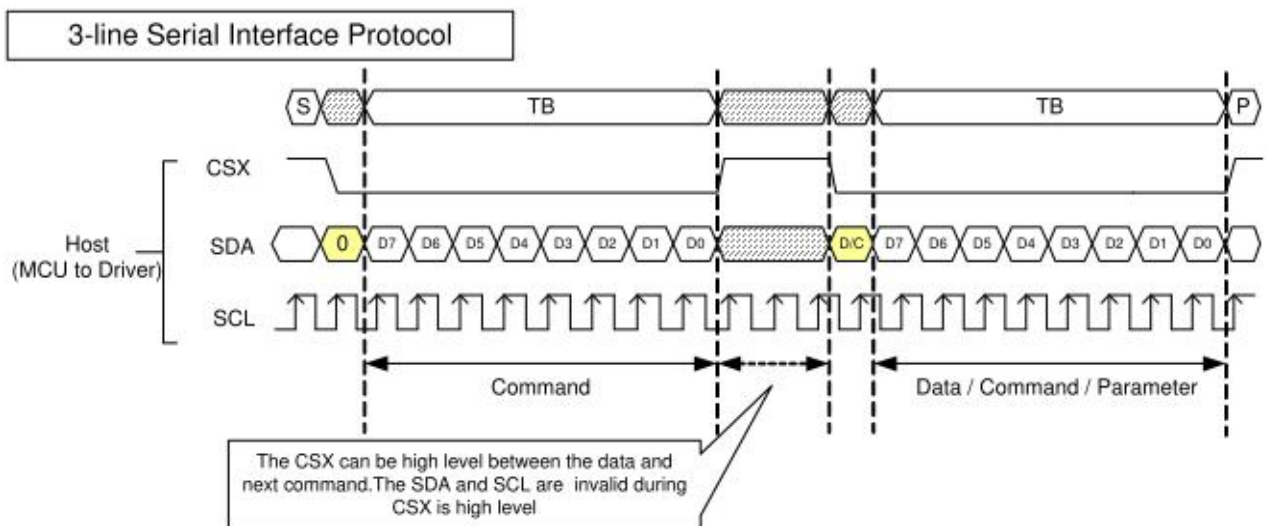


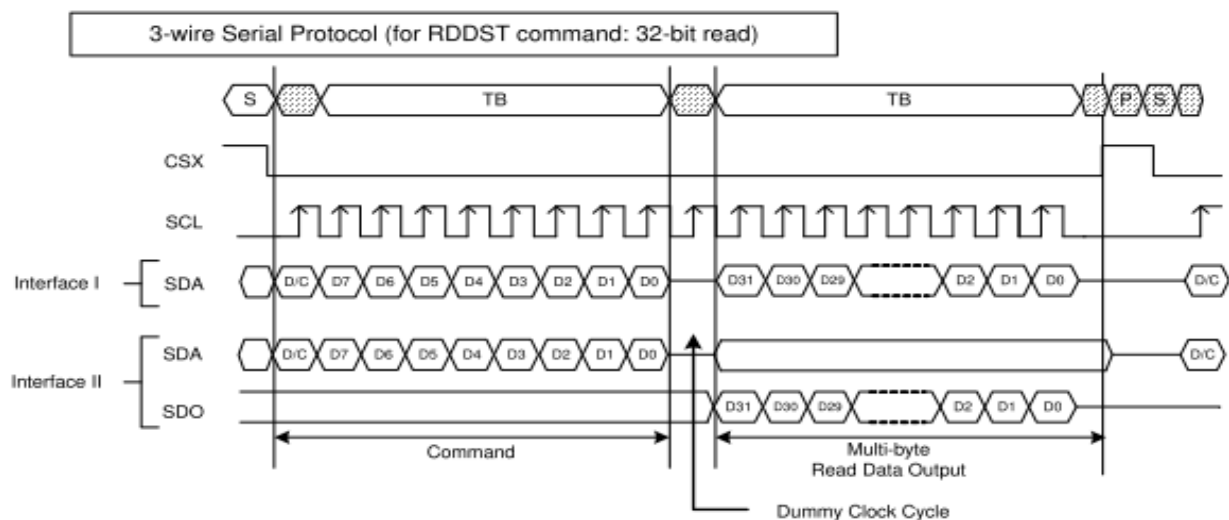
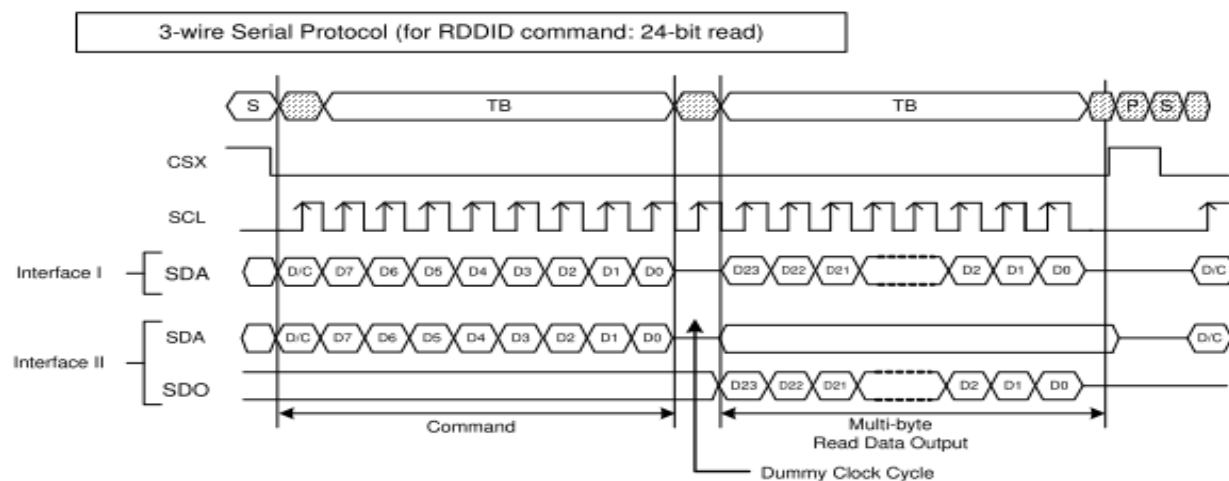
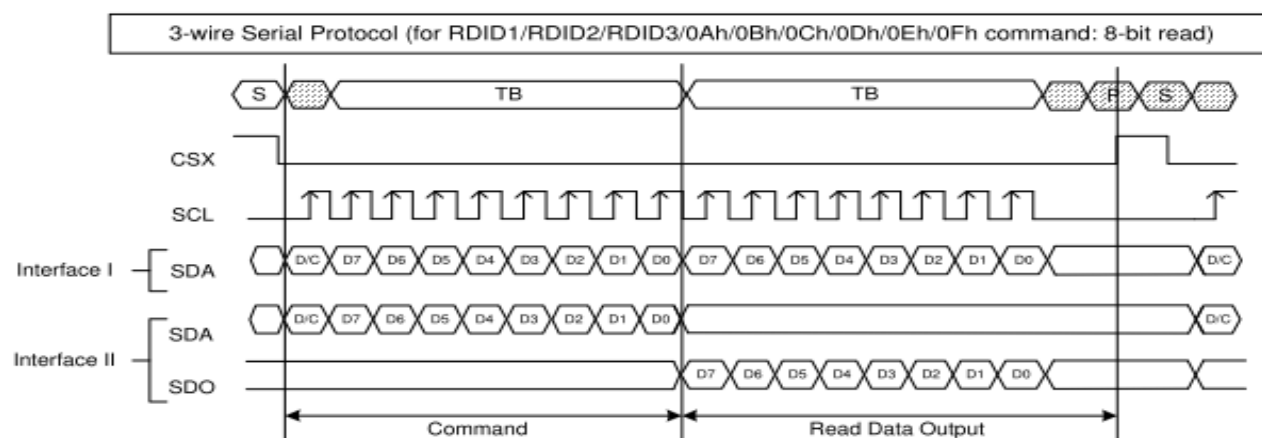
Figure 24 Register Read/Write Timing of i80 System Interface

### 7.3.2 Serial Interface \_Write Cycle Sequence



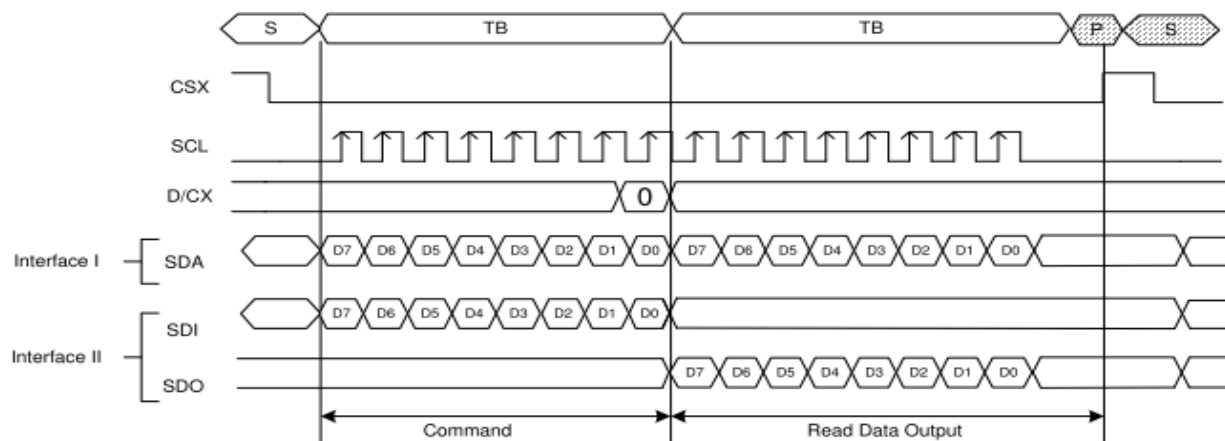
### 7.3.3 Serial Interface\_Read Cycle Sequence

#### 3-wire Serial Interface Protocol

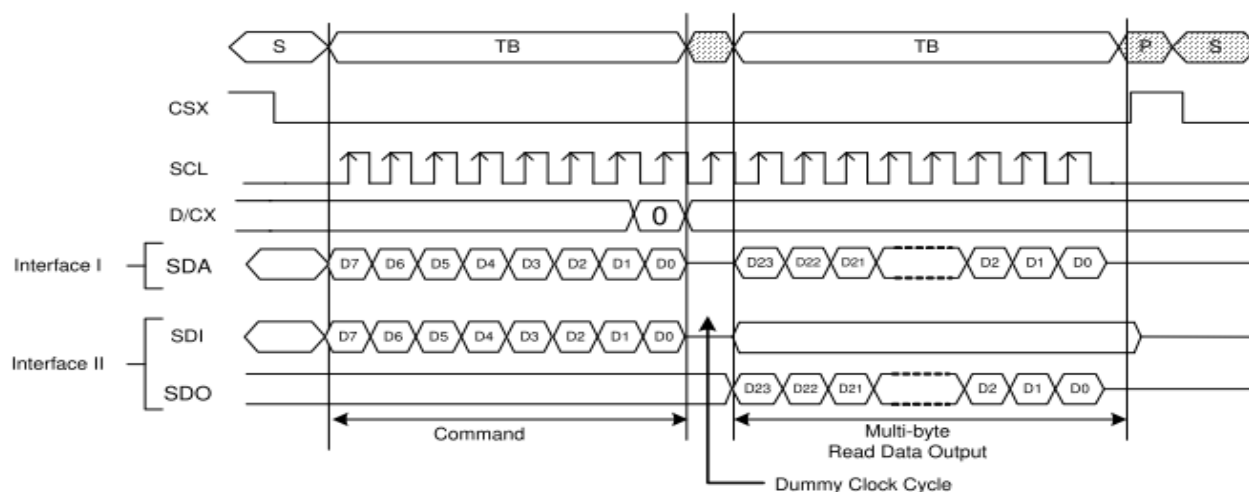


4-wire Serial Interface Protocol

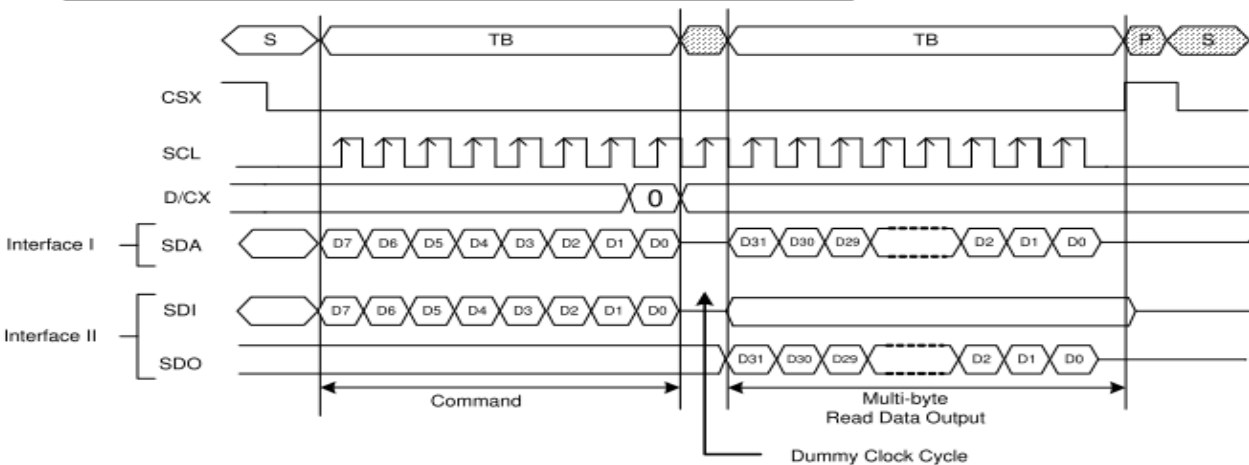
4-wire Serial Protocol (for RDID1/RDID2/RDID3/0Ah/0Bh/0Ch/0Dh/0Eh/0Fh command: 8-bit read)



4-wire Serial Protocol (for RDDID command: 24-bit read)



4-wire Serial Protocol (for RDDST command: 32-bit read)



## 8. Backlight Characteristics

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward voltage	VBL	2.9	3.2	3.4	V	-
Current	IBL	-	60	-	mA/chip	-
ICE	X	0.26	-	0.32	-	-
	Y	0.26	-	0.32	-	-
Brightness	-	3500	-	-	cd/m <sup>2</sup>	★1
Uniformity	-	80	-	-	%	★2

★1 Test condition is :

(a) Center point on active area

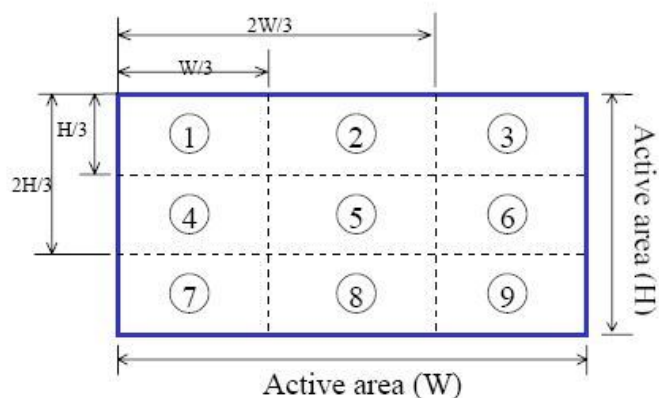
(b) Best Contrast

★2 Uniform measure condition :

(1) Measure 9 point. Measure location is show below :

(2) Uniform = (Min. brightness / Max. brightness) × 100%

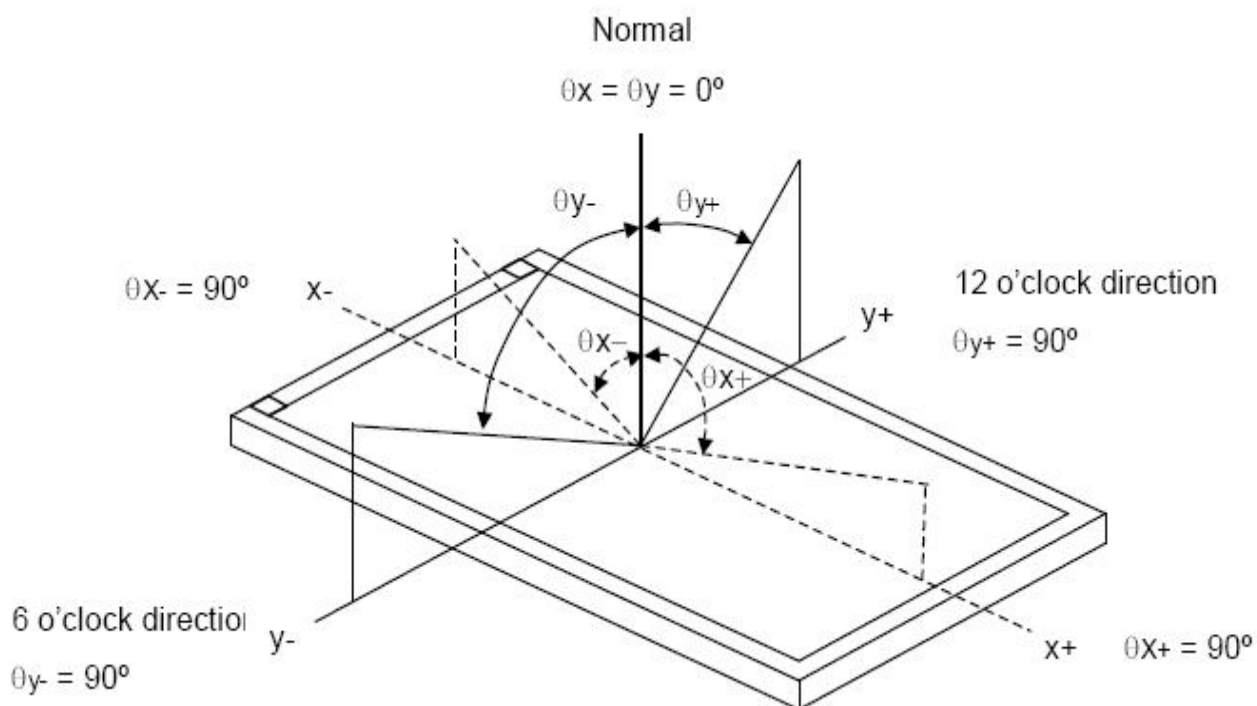
(3) Best Contrast.



## 9. Electro-Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Response time	Tr +Tf	$\theta_x = \theta_y = 0$	---	30	40	ms	<b>Reference Only</b>	
Contrast Ratio	CR		---	240	---	---		
Transmittance	T%		---	6.2	---	%		
Color chromaticity	white		Wx	0.290	0.310	0.330		-
			Wy	0.322	0.342	0.362		
	Red		Rx	0.635	0.655	0.675		
			Ry	0.312	0.332	0.352		
	Green	Gx	0.293	0.313	0.333			
		Gy	0.555	0.575	0.595			
Blue	Bx	0.117	0.137	0.157				
	By	0.126	0.146	0.166				
Viewing angle	Hor.	$\theta_{x+}$	45	---	---	-		
		$\theta_{x-}$	45	---	---			
	Ver.	$\theta_{y+}$	40	---	---			
		$\theta_{y-}$	20	---	---			

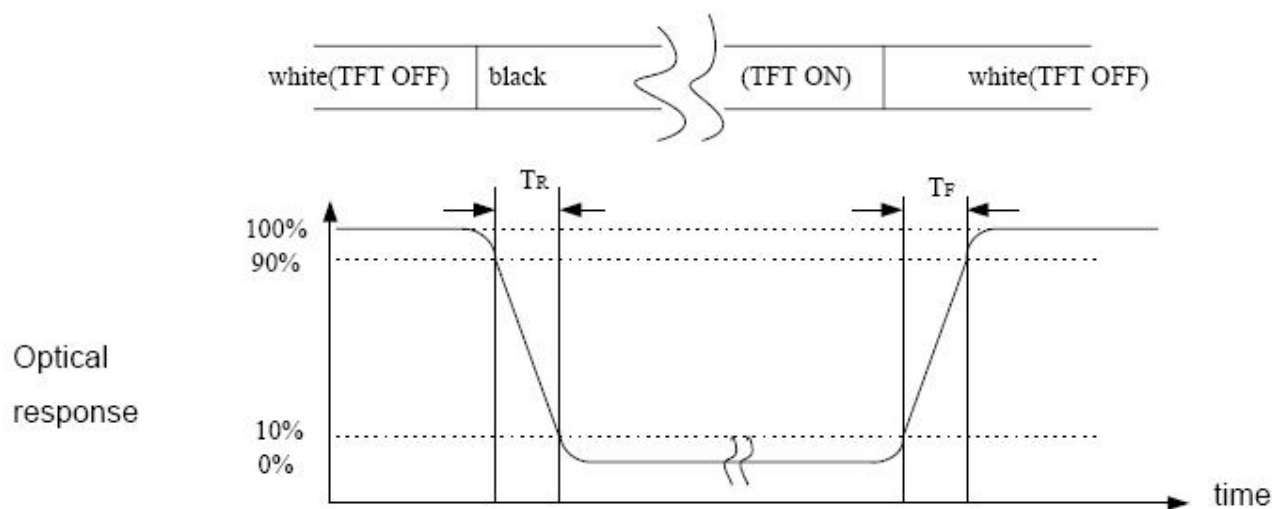
Note (1) Definition of Viewing Angle  $\theta_x$  and  $\theta_y$ :



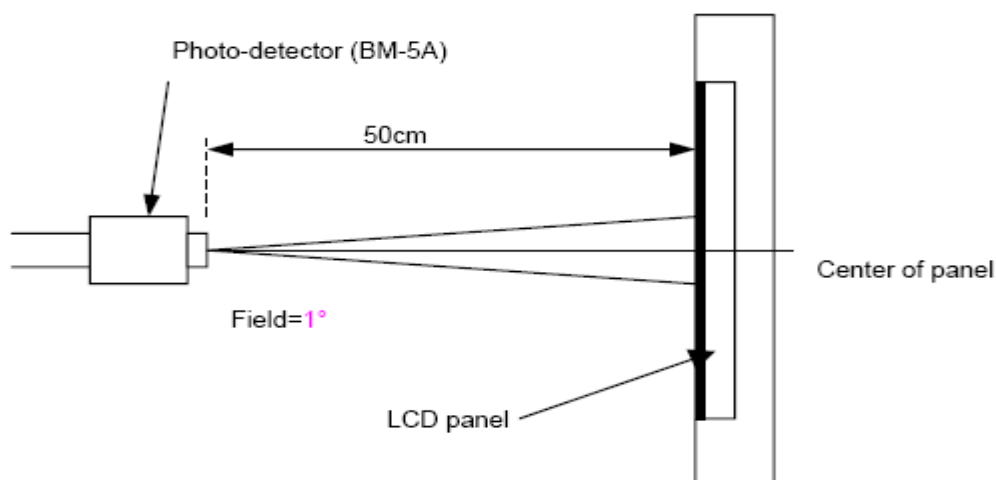
**Note (2) Definition of Contrast Ratio(CR) :**  
 measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

**Note (3) Definition of Response Time :** Sum of  $T_R$  and  $T_F$



**Note (4) Definition of optical measurement setup**



## 10. Reliability

### 10. 1. MTBF

The LCD module shall be designed to meet a minimum MTBF value of 50000 hours with normal. (25°C in the room without sunlight)

### 10. 2. Test condition

NO.	ITEM	CONDITION	CRITERION
1	High Temperature Non-Operating Test	80°C * 240Hrs	<ul style="list-style-type: none"> <li>◦ No Defect Of Operational Function In Room Temperature Are Allowable.</li> <li>◦ IDD of LCM in Pre-and Post-Test Should Follow Specification</li> </ul>
2	Low Temperature Non-Operating Test	-30°C * 240Hrs	
3	High Temperature/Humidity Non-Operating Test	50°C * 90%RH * 240 Hrs	
4	High Temperature Operating Test	70°C * 240Hrs	
5	Low Temperature Operating Test	-20°C * 240Hrs	
6	Thermal Shock Test	-30°C (30Min )↔ 80(30Min)* 10 Cycles	

#### Notes:

1. Judgments should be made after exposure in room temperature for two hours.
2. The distill water is used for the high temperature / humidity test.
3. The sample above is individually for every reliability tests condition.



## 11. Inspection Standards

### 1. AQL(Acceptable Quality Level)

AQL of major and minor defect

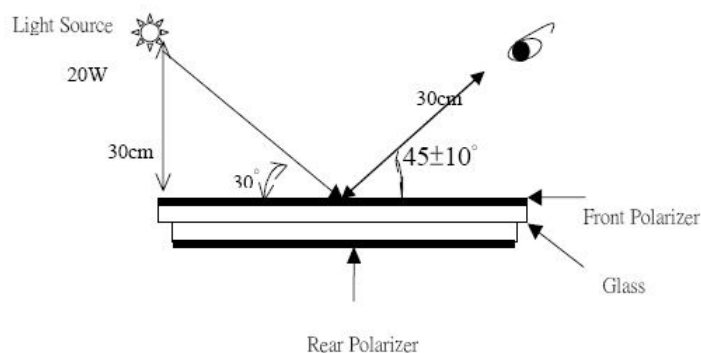
	MAJOR DEFECT	MINOR DEFECT	MAJOR+MINOR
APPEARANCE	0.40%	1.0%	1.0%
ELECTRIC-OPTICAL	0.15%	0.15%	0.15%

### 2. Basic conditions for inspection

The LCM face to us, in normal environment, the lux is  $1000 \pm 200$ . (Darkroom's lux:  $100 \pm 50$ ),

About an angle of incidence 30, a distance of 30cm with normal eye, with an angle of 45 degree to check the products without uncovering the film!

(As shown below)

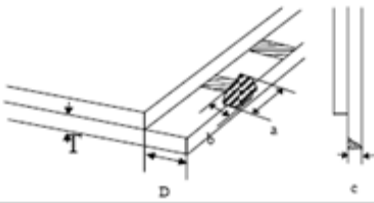
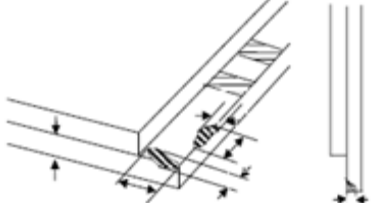


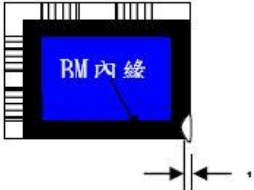
### 3. Inspection item and criteria

#### 3.1 Visual inspection criterion in immobility


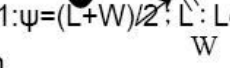
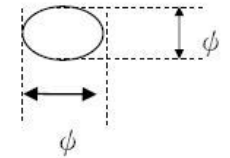
##### 3.1.1 Glass defect

No	Defect item	Criteria	Remark
1	Dimension Unconformity  (Major defect)	By Engineering Drawing	

No	Defect item	Criteria	Remark
2	Cracks (Major defect)	1.Linear cracks on panel 【Reject】 2. Nonlinear crack contrast by limited sample	
3	Glass extrude the conductive area (minor defect)	a: disregards and no influence assemblage 1) $b \leq 1/3$ Pin width(non bonding area) 【Accept】 2) bonding area $\leq 0.5$ mm 【Accept】	a:Length, b:Width
4	Pin-side · conductive area damaged (minor defect)	(a c : disregards) $b \leq 1/3$ 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 (Including contraposition mark,except scribing mark ) 【Accept】 2) $c < T$ $b \leq BM 1/3$ of width 【Accept】 3) $c = T$ b not touch the seal glue 【Accept】 4) a disregards	a : Length · b : Width · c : Thickness 

No	Defect item	Criteria	Remark
6	Non-pin-side damage  (minor defect)	$c < T$  1) $b$ exceeds $1/3$ BM  $c = T$ $b$ not touch the seal glue	$c$ : Thickness $b$ : width of damage    【 Reject】  【 Reject】

## 3.1.2 LCD appearance defect (View area)

No	Defect item	Criteria	Remark	
1	Fiber · glass crack · polarizer scratch/folded  (minor defect)	Specification	Allowable	note1: $L$ : Length · $W$ : Width note2: disregard if out of AA  
		$0.05\text{mm} < W \leq 0.1\text{mm};$ $L \leq 3.0\text{mm}$	1	
		$W > 0.1\text{mm}; L > 3.0\text{mm}$	0	
2	Polarizer bubble · concave and convex  (minor defect)	$\psi \leq 0.2\text{mm}$	disregard	note 1: $\psi = (L+W)/2$ ; $L$ : Length · $W$ : Width note2: disregard if out of AA  
		$0.2\text{mm} < \psi \leq 0.3\text{mm}$	2	
		$0.3\text{mm} < \psi \leq 0.5\text{mm}$	1	
		$0.5\text{mm} < \psi$	0	
3	Black dots · dirty dots · impurities · eyewinker  (Major defect)	$\psi \leq 0.15\text{mm}$	disregard	note2: disregard if out of AA  
		$0.15\text{mm} < \psi \leq 0.25\text{mm}$	2	
		$0.25\text{mm} < \psi \leq 0.3\text{mm}$	1	
		$0.3\text{mm} < \psi$	0	
4	Polarizer prick  (Major defect)	$\psi \leq 0.1\text{mm}$	disregard	note1: $\psi = (L+W)/2$ ; $L$ = Length · $W$ = Width note2: the distance between two dots $> 5\text{mm}$
		$0.1\text{mm} < \psi \leq 0.25\text{mm}$	3	
		$\psi > 0.25\text{mm}$	0	

## 3.1.3 .FPC

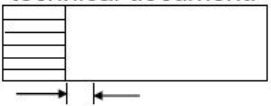
No	Defect item	Criteria		Remark
1	Copper screen peel (Major defect)	Copper screen peel 【 Reject 】		
2	No release tape or peel (Major defect)	No release tape or peel 【 Reject 】		
3	Dirty dot and impurity of FPC for customer using side (minor defect)	Specification	Allowable	note1: Cannot have stride ITO impurities
		$\psi \leq 0.25\text{mm}$	2	
		$\psi > 0.25$	0	

## 3.1.4 Black tape &amp; Mara tape

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 】	

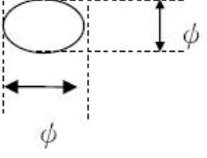
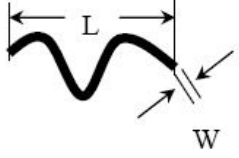
## 3.1.5 Silicon and Tuffy glue

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

No	Defect item	Criteria	Remark
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	Depth of glue covering (minor defect)	Depth of glue covering overtop front Polarizer 【 Reject】	Except of the special requirement .

## 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】	ND filter 2% test
4	No display in immobility (Major defect)	No display in immobility 【 Reject】	
5	Flicker of Pattern (Major defect)	Flicker of Pattern 【 Reject】	
6	Mura (Major defect)	ND filter 2% test	
7	Over current (Major defect)	Over current 【 Reject】	
8	Voltage out of specification (Major defect)	Voltage out of specification 【 Reject】	
9	Pattern blur ,error code (Major defect)	Pattern blur ,error code 【 Reject】	
10	Dark light, Flicker (Major defect)	Dark light, Flicker 【 Reject】	

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

## 12. Precautions For Using LCD Modules

Please pay attentions to the followings as using the LCD module.

### 12.1 Handling

- (a) Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.
- (b) Because the ITO film very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.
- (c) Do not put heavy or hard material on the display surface, and do not stack LCD modules.
- (d) If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.
- (e) Wipe off water droplets or oil immediately.
- (f) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.
- (g) Do not touch the output pins directly with bare hands.
- (h) Do not disassemble the LCD module.

### 12.2 Storage

- (a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.
- (b) Do not expose the LCD modules to sunlight directly.
- (c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.
- (d) Avoid condensation of water. It may cause improper operation.
- (e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

### 12.3 Operation

- (a) When mounting or dismounting the LCD modules, turn the power off.
- (b) Protect the LCD modules from electric shock.
- (c) The Driver IC control algorithms stated above should always obeyed to avoid damaging the LSI and electronic circuit.
- (d) Be careful to avoid mixing up the polarity of power supply for backlight.

