



Date : 2008.05.15

# 승 인 원

## Specification for Approval

고객명 :  
customer :

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모델명 : UF80I010A  
model name :

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품 명 : Liquid Crystal Display module  
description :

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검 토 (Proposed by)		승 인(Approved by)
기 안 Designed	승 인 Approved	
전산결재	전산결재	
M.J.BAEK 2008.05.15	H.S.KIM 2008.05.15	

**SAMSUNG SDI CO., LTD**



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## 1. Introduction

This specification defines the general provisions of the product as well as the inspection standard for Samsung SDI's a-Si TFT LCD module. If the event of unforeseen problems or unspecified items occur, we naturally shall negotiate and agree to solution with customer.

## 2. Warranty and Disclaimer

Samsung warranty term is 12 months from the production date. Within the period, Samsung shall compensate for the defectives as specified in this document. User must take care of the precautions and the product should be stored and used in right manner specified in this document. Any type of mishandling or any type of change on the Samsung product in electrical and mechanical shall void Samsung warranty. After the expiration of the warranty period, the replacement of any parts or of the entire product shall be charged. For further information or the customer service, contact Samsung Quality Assurance Group.

This Specification stipulates the final and comprehensive requirements for the respective products hereof. Beyond this Specification, it is the responsibility of the customer to explicitly disclose any additional requirements, information or reservations regarding these requirements to Samsung SDI prior to implementation, where any and all disclosures of the customer shall be with an authorized representative of Samsung SDI in writing.

Samsung SDI shall not be responsible for safety, performance, functionality or compatibility of the system with which the Samsung SDI-supplied components are integrated unless such features have been expressly communicated and described in the Specification.

**SAMSUNG SDI MAKES NO GUARANTY OR WARRANTY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, TO ANY PARTY.** Moreover, any party should do their own due diligence regarding these requirements prior to implementation.

## 3. Features

### 3-1 MAIN LCD

ITEM	Specifications	Unit	Note
Number of dots	800(W) * (RGB) * 480(H)	dots	-
Display Mode	TN Color (16.7M colors under normal driving mode)	-	-
Viewing Angle	6	o'clock	
Driving LSI & Manufacturer	HX8234(Source), HX8662(Gate) by HIMAX		
Pixel Array	RGB vertical stripes		
BACK LIGHT	LED, WHITE		
CPU INTERFACE	24 bit Parallel RGB Interface		
DISPLAY SIZE	4.0"		

## 4. Mechanical characteristics

ITEM	Specifications	-	Unit
Dimensional outline	Refer to attached drawing	-	mm
Number of pixels	800(W) X 480(H)	Main	pixels
Panel Active area	86.4(W) X 51.84(H)	Main	mm
Pixel pitch	0.108(W) X 0.108(H)	Main	mm
Dots size	0.036(W) X RGB X 0.108(H)	Main	mm
Glass Thickness	0.4(T)	Main	mm
Surface Hardness for pol	2	Main	H

## 5. Maximum rating

ITEM		Symbol	Min.	Max.	Unit	Note
Supply voltage	Digital Power	DVDD	-0.3	5.0	V	1,2
	Analog Power	VDC	-0.3	7.0	V	1,2
Input voltage	Vin	-0.3	DVDD + 0.3	V	2	
Operating temperature	Top	-20	60	°C		
Humidity	Hop	10	90	%RH		
Storage temperature	Tstg	-30	70	°C		
Humidity	Hstg	10	90	%RH	3	

Note 1) All supply voltages should be supplied over Vss(GND) level.

Note 2) This product must be used under the absolute maximum ratings at any time.

The values exceeding the ratings may result in a permanent failure of the product.

Note 3) Wet bulb temperature should be kept under 29°C of no condensation.

## 6. Electrical characteristics

### 6-1. Electrical Characteristics.

( V<sub>SS</sub>=0V )

ITEM		Symbol	Condition	Min	Typ.	Max.	Unit	Note
Supply voltage (Logic)		DVDD	-	2.25	2.5	3.3	V	-
Supply voltage (Power Circuit)		VDC	-	4.75	5.0	5.5	V	-
Input voltage	"H" level	V <sub>IH</sub>	-	0.7DVDD	-	DVDD	V	1
	"L" level	V <sub>IL</sub>		V <sub>SS</sub>	-	0.3DVDD		
Output voltage	"H" level	V <sub>OH</sub>	I <sub>OH</sub> = -1mA I <sub>OL</sub> = 1mA	DVDD -0.4	-	DVDD	V	1
	"L" level	V <sub>OL</sub>		V <sub>SS</sub>	-	V <sub>SS</sub> +0.4		
I/O leakage current		I <sub>IL</sub>	V <sub>IN</sub> =0 or V <sub>SS</sub>	-1.0	-	+1.0	uA	2
Current consumption		I <sub>DD</sub>	Full Display (DVDD=2.5V)	-	6	-	mA	3
		I <sub>DC</sub>	Full Display (VDC=5V)	-	40	-	mA	3

#### Note

- 1) The following figures illustrate the configurations of 1 pin - I pin and O pin.
- 2) This excludes the current through the output drive MOS.
- 3) Min : Full white, Max : Full black (Backlight power consumption is Excluded.)

## 6-2. LED back light specification (per a Chip)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit.
Forward voltage	$V_F$	$I_F=20\text{mA}$	2.9	-	3.4	V
Reverse voltage	$V_R$	$I_R=10\text{mA}$	0.6	-	2.0	V
Forward current	$I_F$	-	-	-	22	mA
Reverse Current	$I_R$	$V_R=5V$	-	-	85	mA
Uniformity(with L/G)	-	$I_F=15\text{mA}$	70%	-	-	-
Luminous color	White					
Chip , maker	SLSNNWH422USI3EJ, SAMSUNG					
RANK SORTING	Rank of the chromaticity coordinate : E Rank of the luminous intensity : J					
Chip connection	2Channel, Each Channel 5chip serial connection.					

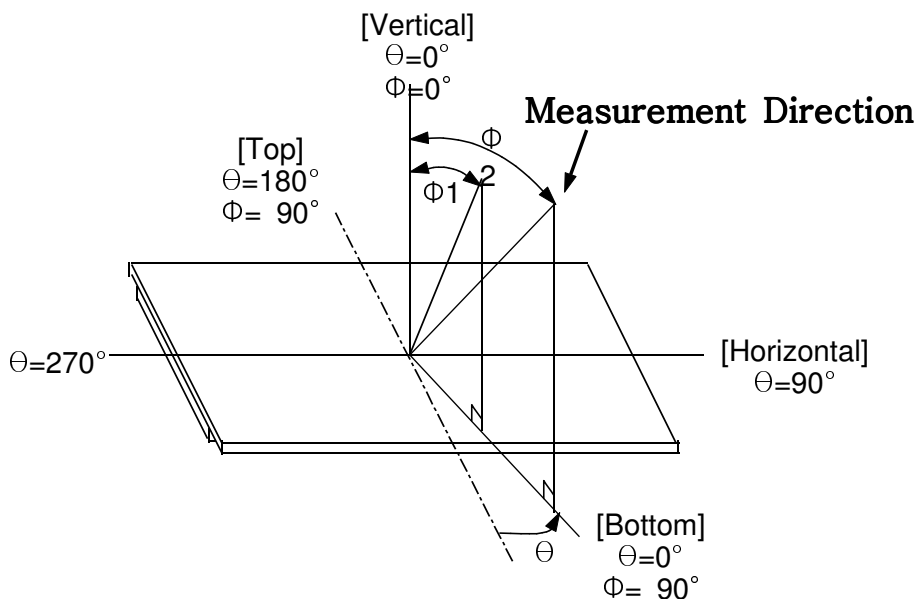
## 7. Electro-Optical characteristic

### 7-1. Targeted optical characteristics for design

(Ta : 25°C)

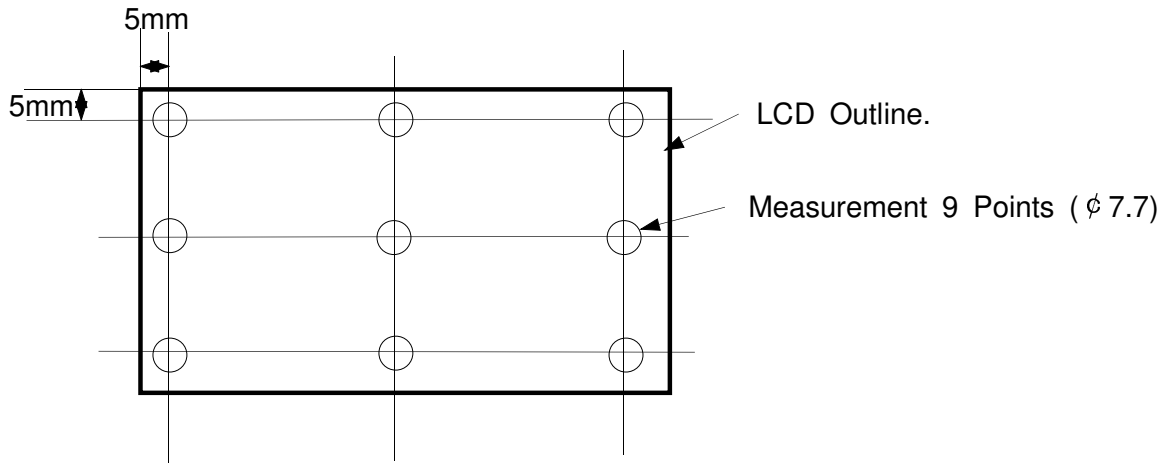
ITEM		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note		
Response time	Rising	Ton	$\Phi=0^\circ, \theta=0^\circ$ Display : White→Black	-	25ms	35ms	msec	1,2,3		
	Falling	Toff	$\Phi=0^\circ, \theta=0^\circ$ Display : Black→White	-	15ms	25ms				
Viewing angle		$\Phi$	$K \geq 10$	Display B/W	$\theta=0^\circ$	60	70	-	deg.	1,4,6
					$\theta=180^\circ$	55	65	-		
					$\theta=90^\circ$	60	70	-		
					$\theta=270^\circ$	60	70	-		
Contrast ratio		K	$\Phi=0^\circ, \theta=0^\circ$	-	300:1	-	-	1,2,5		
Brightness	Normal	Bn	$\Phi=0^\circ, \theta=0^\circ$ ILED=20mA	200	-	-	cd/m <sup>2</sup>	1,2		
Color of CIE coordinate	White	X	$\Phi=0^\circ \quad \theta=0^\circ$	0.28	0.33	0.38	-	1,2		
		Y		0.30	0.35	0.40	-			
	Red	X		0.56	0.61	0.66	-			
		Y		0.32	0.37	0.42	-			
	Green	X		0.29	0.34	0.39	-			
		Y		0.55	0.59	0.64	-			
	Blue	X		0.10	0.15	0.20	-			
		Y		0.07	0.12	0.17	-			

Note 1)  $\Phi$  and  $\theta$  Definition



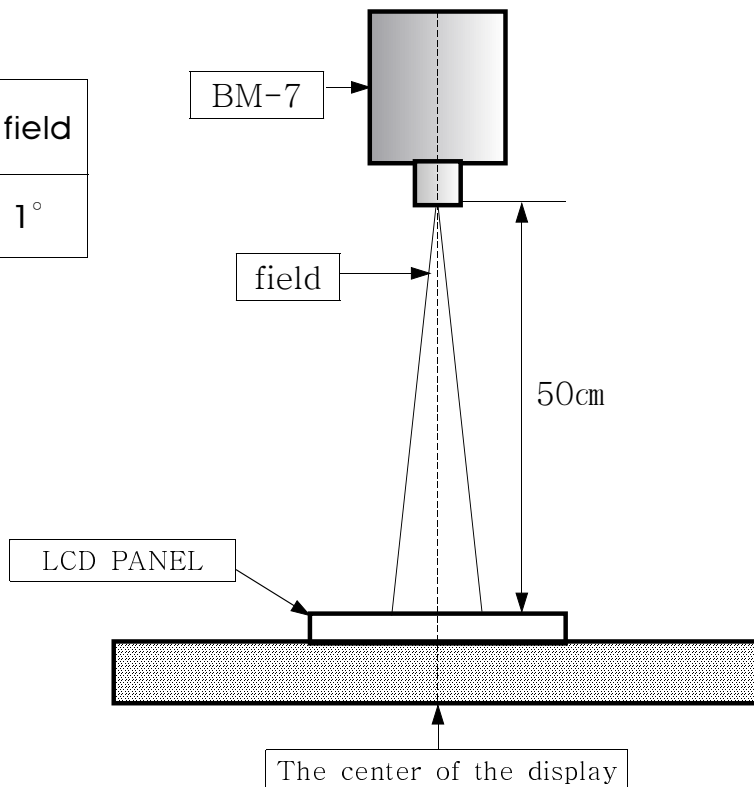
Note 2) Backlight Measurement.

Measuring equipment : BM-7 (TOPCON), Vertical front Measurement.

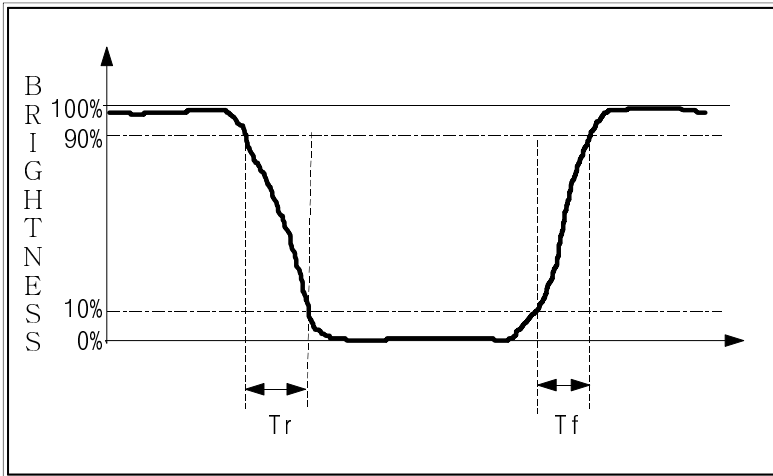


$$\text{Uniformity} = L_{\min}/L_{\max} * 100 [\%]$$

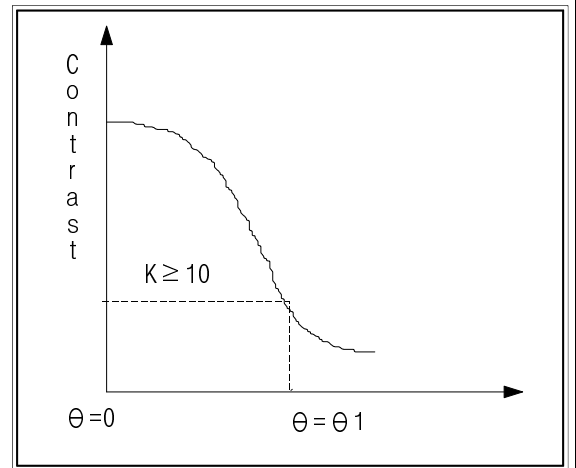
Instruments	field
BM-7	1°



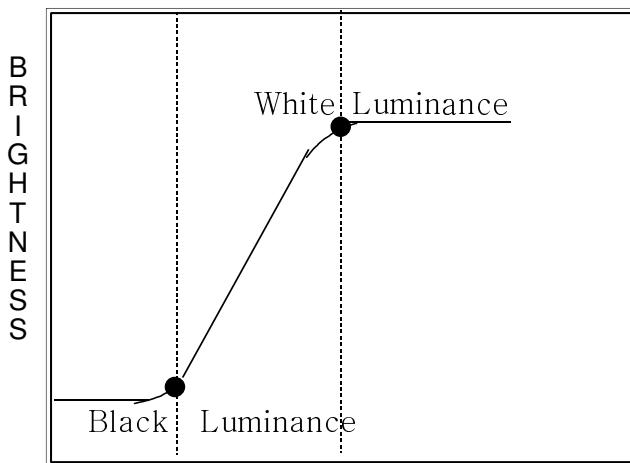
Note 3) Definition of Response time



Note 4) Definition of Viewing angle

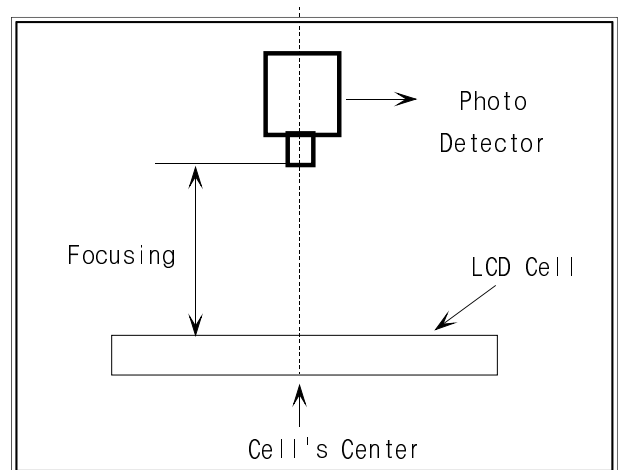


Note 5) Definition of contrast ratio (K)



Drive voltage

Note 6) Optical measuring system  
temperature regulated chamber



$$\text{Contrast ratio (K)} = \frac{\text{Brightness of non-Selected dot (Boff)}}{\text{Brightness of selected dot (Bon)}}$$

## 8. Interface

### 8-1. I/O connection

Pin No.	Symbol	Pin No.	Symbol
1	DVDD	26	GND
2	DVDD	27	GND
3	DVDD	28	GND
4	D0	29	D14
5	D1	30	D15
6	D2	31	D16
7	D3	32	D17
8	D4	33	D20
9	D5	34	D21
10	D6	35	D22
11	D7	36	D23
12	D10	37	D24
13	D11	38	D25
14	D12	39	D26
15	D13	40	D27
16	RESETB	41	DE
17	HS	42	GND
18	CLK	43	DISP(Keep it OPEN)
19	VDC	44	VS
20	VDC	45	TP1(X1)
21	LED1+	46	TP2(Y2)
22	LED2+	47	TP3(X2)
23	LED1-	48	TP4(Y1)
24	LED2-	49	GND
25	GND	50	GND

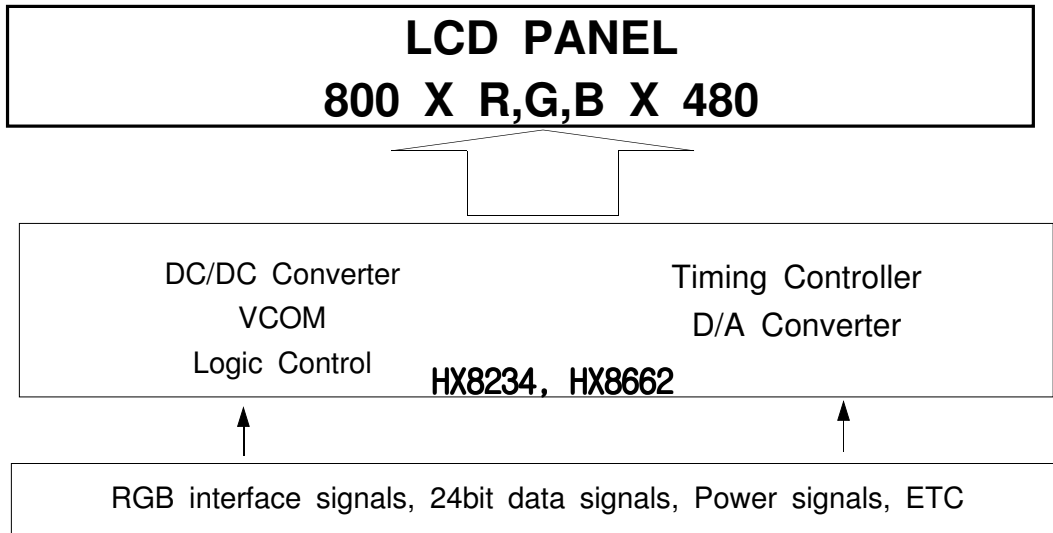
\*) DVDD is the digital supply voltage for HX8234, HX8662.

VDC is the analog supply voltage for HX8662 and External DC/DC converter.

D27~D20 : BLUE(MSB to LSB), D17~D10 : GREEN(MSB to LSB)

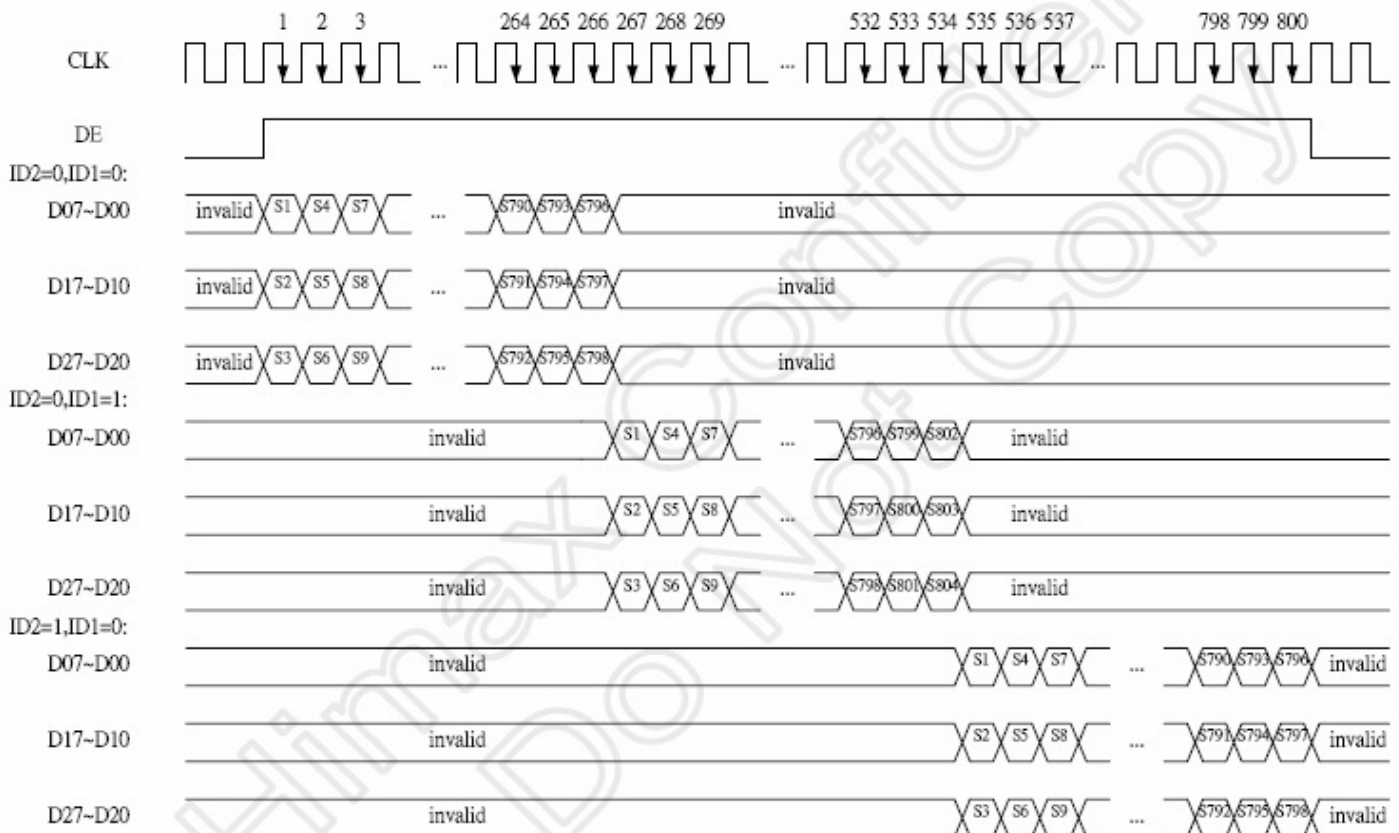
D7~D0 : RED(MSB to LSB)

## 8-2. Circuit block diagram



## 8-3. Signal timing diagram for TFT LCD driver HX8234

### 8-3-1. Interface Function



## 8-3-2. Parallel RGB Interface Timing Operation

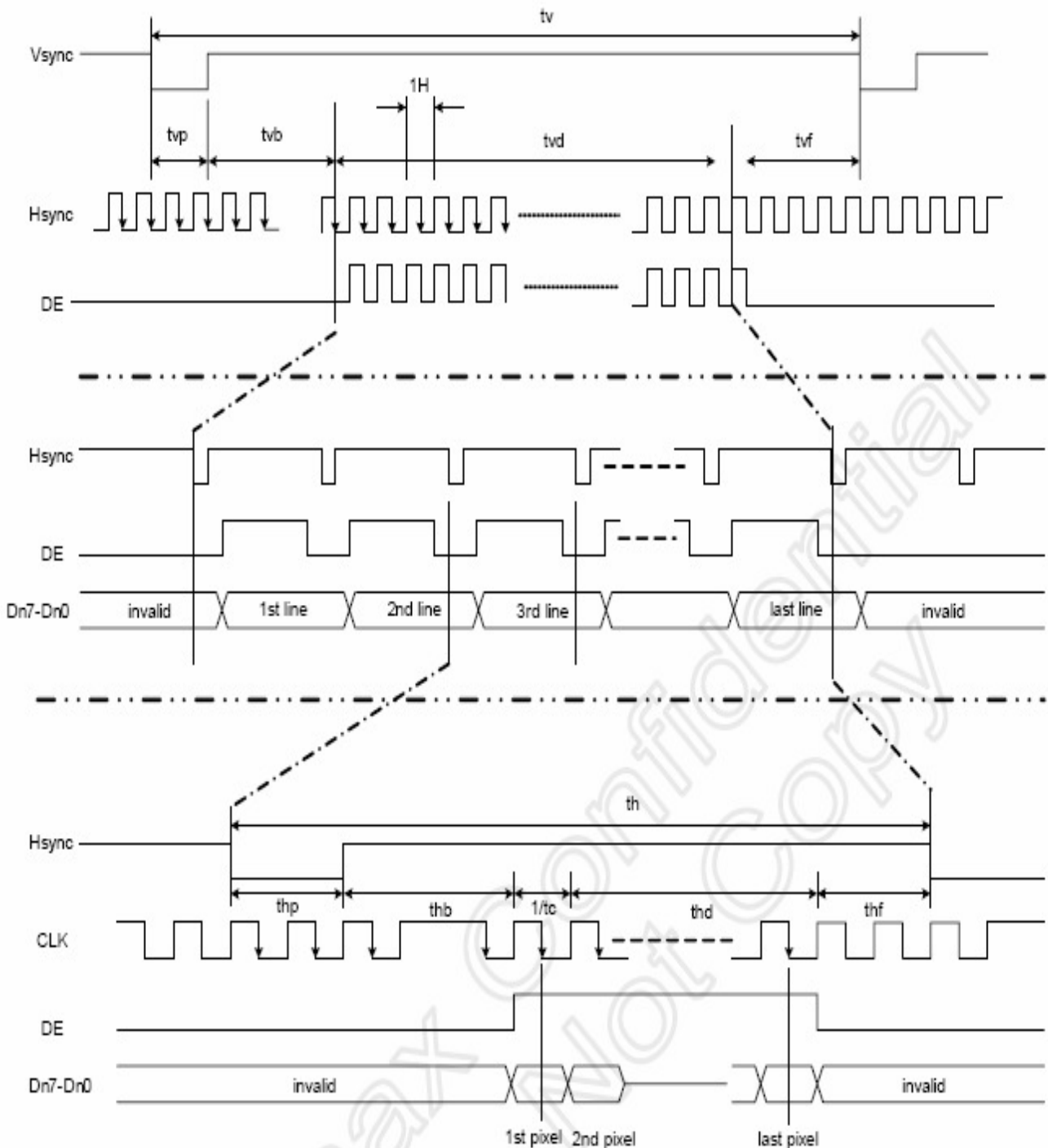


Figure 7. 4 Timing Requirement 1

## 8-3-2. Parallel RGB Interface Timing Operation (continued)

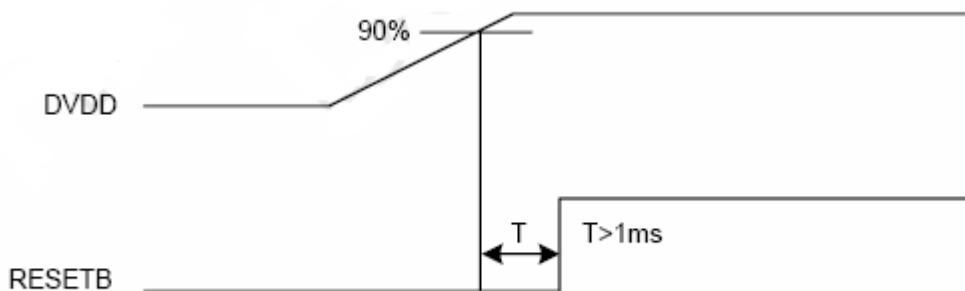
### 1. 800RGBx480( $T_A=25^\circ\text{C}$ , DVDD=2.25V to 3.6V, DVSS= 0V)

PARAMETER	Symbol	Min.	Typ.	Max.	Unit
Clock cycle	$1/t_C$	20	33.3	45	MHz
Hsync cycle	$1/f_H$	-	31.5	-	KHz
Vsync cycle	$1/f_V$	-	60	-	Hz
Horizontal Signal					
Horizontal cycle	Th	-	1056	2047	CLK
Horizontal display period	thd	800	800	800	CLK
Horizontal front porch	thf	2	40	-	CLK
Horizontal pulse width	thp	2	128	-	CLK
Horizontal back porch	thb	2	88	-	CLK
Vertical Signal					
Vertical cycle	Tv	-	525	1022	H
Vertical display period	Tvd	480	480	480	H
Vertical front porch	tvf	2	10	-	H
Vertical pulse width	Tvp	2	2	-	H
Vertical back porch	Tvb	2	33	-	H

Note: thd=800CLK, thf + fhp > 56

## 8-3-3. Reset sequence

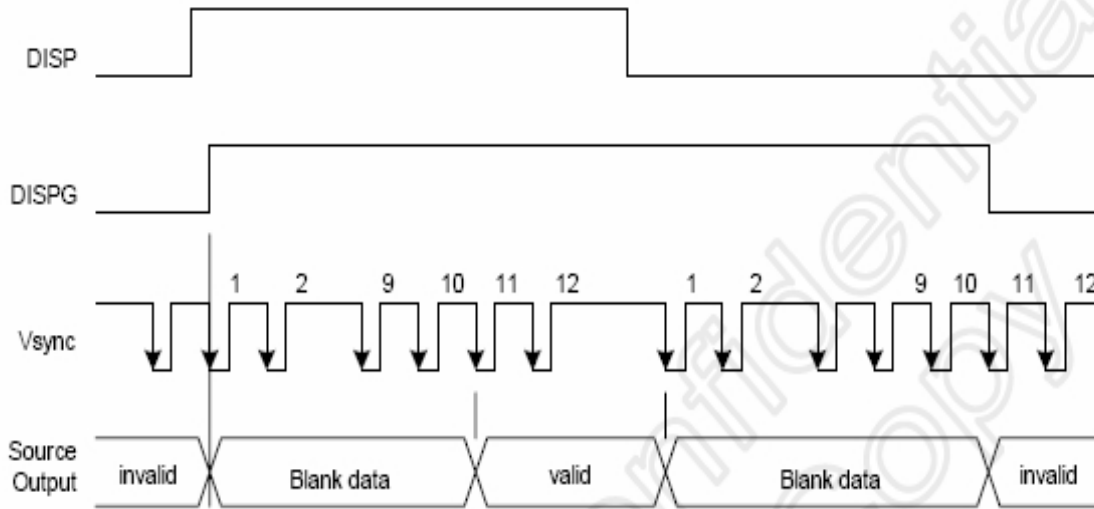
HX8234-a is internally initialized by the global reset signal, RESETB. The reset input must be held for at least 1ms after power is stable



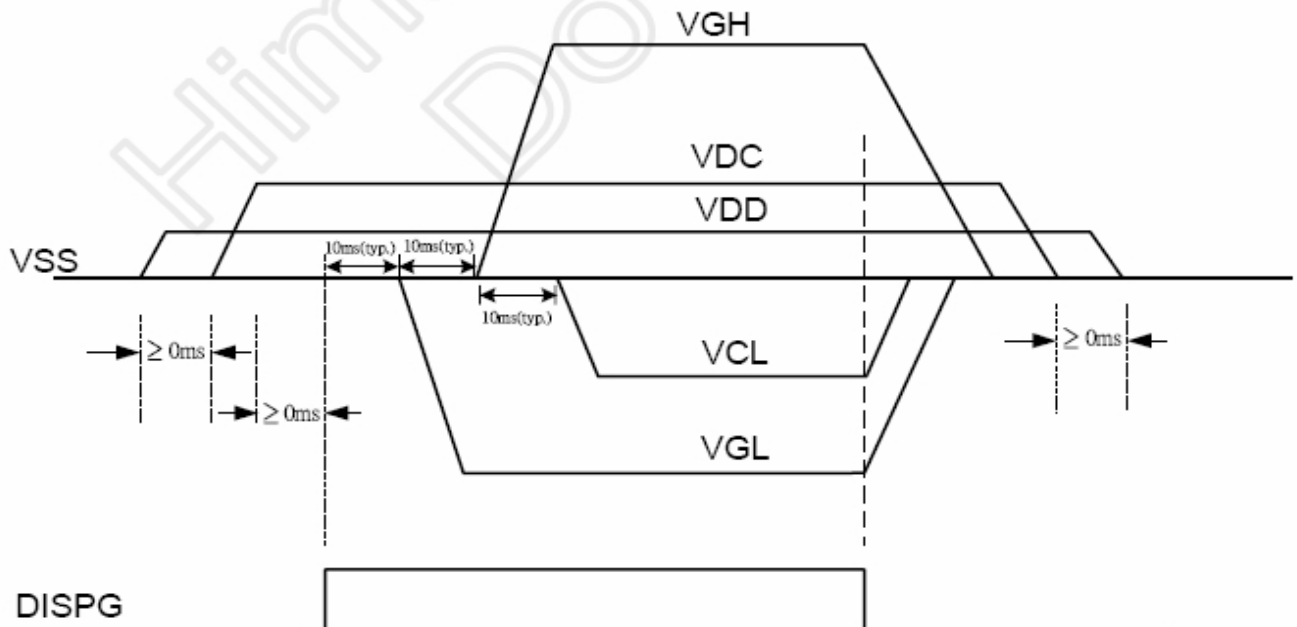
## 8-4. Power circuit set-up sequence

### 8-4-1. Power on/off sequence

#### HX8234 ON/OFF sequence



#### HX8662 ON/OFF sequence



## 9. Quality level

### 9-1. Inspection conditions

9-1-1. The environmental conditions for inspection shall be as follows.

Room temperature :  $20 \pm 3^{\circ}\text{C}$

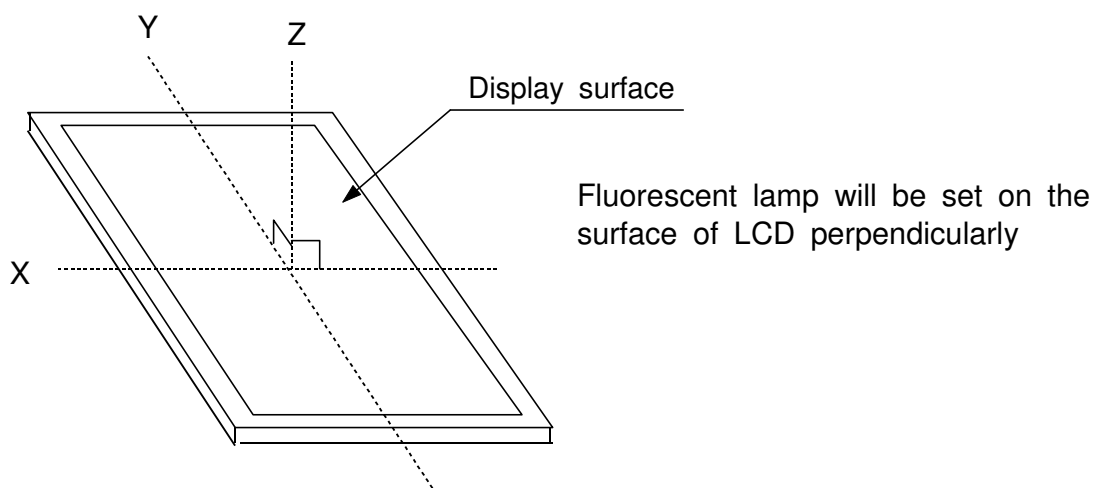
Humidity :  $65 \pm 20\%RH$

### 9-1-2. The external visual inspection

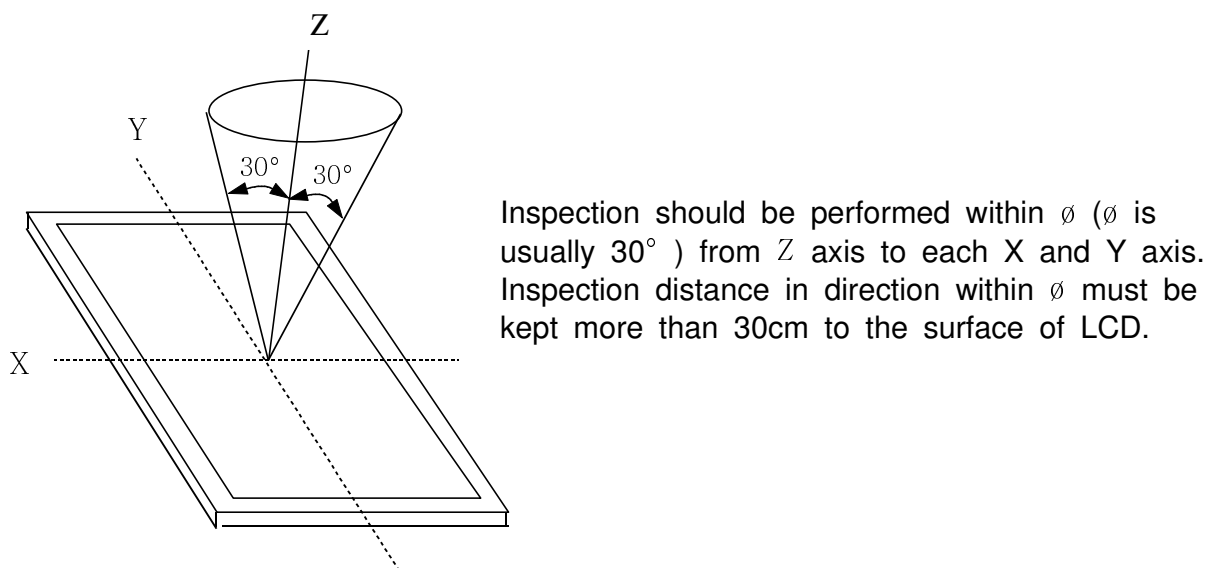
The inspection shall be performed by using a single 20W fluorescent lamp for illumination and the distance should be kept more than 30cm between inspector's eyes and surface of LCD.

### 9-1-3.

#### (1) Light method



#### (2) Inspection distance and angle



## 9-2. Sampling procedures for each item's acceptance level

Defect type	Sampling procedures	AQL
Major defect	MIL-STD-105D Inspection level I normal inspection single sample inspection	0.65
Minor defect	MIL-STD-105D Inspection level I normal inspection single sample inspection	1.5

## 9-3. Classification of defects

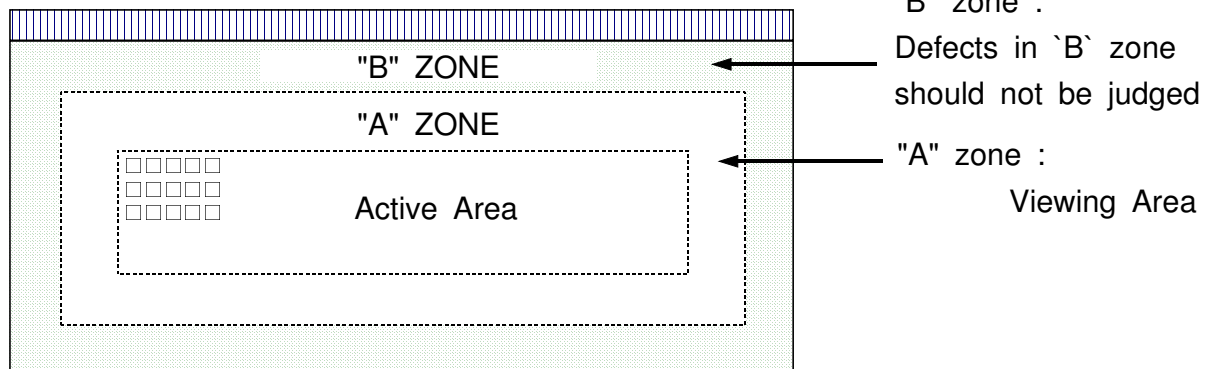
### 9-3-1. Major defect

: A major defect refers to the defect which is considered to substantial degradation to the usability for product application.

### 9-3-2. Minor defect

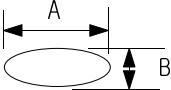
: A minor defect refers to the defect which is not considered to be substantial degradation for product application, or the defect which deviates from the existing standards, and it is almost irrelated to the effective use of the product or its operation.

### 9-3-3. Defect application zone : Viewing Area



## 9-4. Inspection standards

※ All of electrical defects must be judged at the state of optimum voltage that has the best contrast.

ITEM	Criterion for defects	Defect type										
1) Non display	· No non display is allowed	Major										
2) Irregular operating	· No irregular operation is allowed	Major										
3) Short	· No shorts are allowed	Major										
4) Open	· Any segments or common patterns that don't activate are rejectable.	Major										
5) Black/White spot(   )	<table border="1" style="margin: auto;"> <thead> <tr> <th>Size <math>\phi</math> (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.10</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.10 &lt; \phi \leq 0.20</math></td> <td>2</td> </tr> <tr> <td><math>0.20 &lt; \phi \leq 0.25</math></td> <td>1</td> </tr> <tr> <td><math>0.25 &lt; \phi</math></td> <td>0</td> </tr> </tbody> </table>	Size $\phi$ (mm)	Acceptable number	$\phi \leq 0.10$	Ignore	$0.10 < \phi \leq 0.20$	2	$0.20 < \phi \leq 0.25$	1	$0.25 < \phi$	0	Minor
	Size $\phi$ (mm)	Acceptable number										
$\phi \leq 0.10$	Ignore											
$0.10 < \phi \leq 0.20$	2											
$0.20 < \phi \leq 0.25$	1											
$0.25 < \phi$	0											
6) Black/White line(   )	<table border="1" style="margin: auto;"> <thead> <tr> <th>크기(size)</th> <th>허용 개수</th> </tr> </thead> <tbody> <tr> <td><math>W \leq 0.03</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.03 &lt; W \leq 0.05</math> <math>1.0 &lt; L \leq 3.0</math></td> <td>2</td> </tr> <tr> <td><math>0.03 &lt; W \leq 0.05</math> <math>3.0 &lt; L</math></td> <td>0</td> </tr> </tbody> </table>	크기(size)	허용 개수	$W \leq 0.03$	Ignore	$0.03 < W \leq 0.05$ $1.0 < L \leq 3.0$	2	$0.03 < W \leq 0.05$ $3.0 < L$	0	Minor		
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$0.03 < W \leq 0.05$ $1.0 < L \leq 3.0$	2											
$0.03 < W \leq 0.05$ $3.0 < L$	0											
7) Back Light	1) No Lighting is rejectable 2) Flickering and abnormal lighting are rejectable  ※ In case of the model with back light (E/L , LED or CCFT type )	Major										
8) Blemish & Foreign matters Size : $\phi = (A+B) / 2$	<table border="1" style="margin: auto;"> <thead> <tr> <th>Size <math>\phi</math> (mm)</th> <th>Acceptable number</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.10</math></td> <td>ignore</td> </tr> <tr> <td><math>0.10 &lt; \phi \leq 0.20</math></td> <td>2</td> </tr> <tr> <td><math>0.20 &lt; \phi \leq 0.25</math></td> <td>1</td> </tr> <tr> <td><math>0.25 &lt; \phi</math></td> <td>0</td> </tr> </tbody> </table>	Size $\phi$ (mm)	Acceptable number	$\phi \leq 0.10$	ignore	$0.10 < \phi \leq 0.20$	2	$0.20 < \phi \leq 0.25$	1	$0.25 < \phi$	0	Minor
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$0.25 < \phi$	0											
												

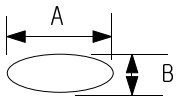
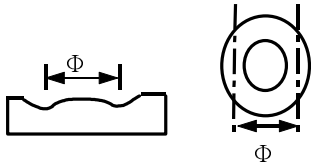
ITEM	Criterion for defects	Defect type																		
9) Scratch on Polarizer, Line shape	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">width (mm)</th> <th style="width: 33%;">Length (mm)</th> <th style="width: 33%;">Acceptable number</th> </tr> </thead> <tbody> <tr> <td><math>W \leq 0.03</math></td> <td>Ignore</td> <td>3</td> </tr> <tr> <td><math>0.03 &lt; W \leq 0.05</math></td> <td><math>L \leq 2.0</math></td> <td>2</td> </tr> <tr> <td><math>0.05 &lt; W \leq 0.08</math></td> <td><math>L \leq 1.0</math></td> <td>1</td> </tr> <tr> <td></td> <td>Note (1)</td> <td>1</td> </tr> <tr> <td><math>0.08 &lt; W</math></td> <td></td> <td>Note(1)</td> </tr> </tbody> </table>	width (mm)	Length (mm)	Acceptable number	$W \leq 0.03$	Ignore	3	$0.03 < W \leq 0.05$	$L \leq 2.0$	2	$0.05 < W \leq 0.08$	$L \leq 1.0$	1		Note (1)	1	$0.08 < W$		Note(1)	Minor
	width (mm)	Length (mm)	Acceptable number																	
$W \leq 0.03$	Ignore	3																		
$0.03 < W \leq 0.05$	$L \leq 2.0$	2																		
$0.05 < W \leq 0.08$	$L \leq 1.0$	1																		
	Note (1)	1																		
$0.08 < W$		Note(1)																		
Note (1) Regard as a blemish																				
10) Bubble in polarizer, Dent	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Size <math>\phi</math> (mm)</th> <th style="width: 50%;">Acceptable number</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.10</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.10 &lt; \phi \leq 0.20</math></td> <td>2</td> </tr> <tr> <td><math>0.15 &lt; \phi \leq 0.25</math></td> <td>1</td> </tr> <tr> <td><math>0.25 &lt; \phi</math></td> <td>0</td> </tr> </tbody> </table>	Size $\phi$ (mm)	Acceptable number	$\phi \leq 0.10$	Ignore	$0.10 < \phi \leq 0.20$	2	$0.15 < \phi \leq 0.25$	1	$0.25 < \phi$	0	Minor								
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$0.25 < \phi$	0																			
11) Stains on LCD panel surface	Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning too are rejectable.	Minor																		
12) Rust in Bezel	Rust which is visible in the bezel is rejectable.	Minor																		
13) Defect of land surface contact (Poor soldering)	Evident crevices which is visible are rejectable.	Minor																		
14) Parts alignment	(1) LSI, IC lead width is more than 50% beyond pad outline.	Minor																		
	(2) Chip component is off center and more than 50% of the leads is off the pad outline.	Minor																		
15) Conductive foreign matter (Solder ball, Solder chips)	(1) $0.45 < \phi$ , $N \geq 1$ (2) $0.30 < \phi \leq 0.45$ , $N \geq 1$ $\phi$ : Average diameter of solder ball (unit::mm) (3) $0.50 < L$ , $N \geq 1$ $L$ : Average length of solder chip (unit::mm)	Minor Minor Minor																		

ITEM	Criterion for defects	Defect type											
16) Flicker of TFT LCD	Flicker of TFT LCD is not the item of the rejection.												
17) Dot Defect	<table border="1" style="margin-bottom: 10px; width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">ITEM <sup>1)2)</sup></th> <th colspan="2" style="text-align: center;">Specifications</th> </tr> <tr> <td></td> <th style="width: 40%;">Number of missing dots</th> <th style="width: 35%;">Total</th> </tr> </thead> <tbody> <tr> <td>Bright dots <sup>3)</sup></td> <td style="text-align: center;">2</td> <td rowspan="2" style="text-align: center;">2</td> </tr> <tr> <td>Dark dots <sup>4)</sup></td> <td style="text-align: center;">2</td> </tr> </tbody> </table> <p>Irregular light emissions by individual dots, caused by failures in TFT array, are counted as dot defects.</p> <p>Note 1) Any missing dots in TFT array are counted as bright dots.</p> <p>Note 2) Any un conspicuous dot defect shall not be counted as a defect.</p> <p>Note 3) A bright dot refers to a bright dot at gradation level(black)</p> <p>Note 4) A dark dot refers a dark dot at gradation level L63(R,G,B)</p>	ITEM <sup>1)2)</sup>	Specifications			Number of missing dots	Total	Bright dots <sup>3)</sup>	2	2	Dark dots <sup>4)</sup>	2	Minor
ITEM <sup>1)2)</sup>	Specifications												
	Number of missing dots	Total											
Bright dots <sup>3)</sup>	2	2											
Dark dots <sup>4)</sup>	2												

**[ Connector connection. ]**

By the foreign material or the operator's mis-alignment, when assemble LCD module into the set with connector, the connection can be poor. So it needs to contact several time when abnormal display or no display.

## 9-5. TOUCH PANEL Inspection standards

ITEM	Criterion for defects	Defect type												
1) Scratch Line shape	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Width W (mm)</th> <th style="width: 33%;">Length L (mm)</th> <th style="width: 34%;">Acceptable number</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><math>w &lt; 0.03</math></td> <td style="text-align: center;">-</td> <td style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;"><math>0.03 &lt; w \leq 0.05</math></td> <td style="text-align: center;">3 &gt; L</td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;"><math>0.05 &lt; w \leq 0.08</math></td> <td style="text-align: center;">2 &gt; L</td> <td style="text-align: center;">2</td> </tr> </tbody> </table>	Width W (mm)	Length L (mm)	Acceptable number	$w < 0.03$	-	Ignore	$0.03 < w \leq 0.05$	3 > L	3	$0.05 < w \leq 0.08$	2 > L	2	Minor
	Width W (mm)	Length L (mm)	Acceptable number											
$w < 0.03$	-	Ignore												
$0.03 < w \leq 0.05$	3 > L	3												
$0.05 < w \leq 0.08$	2 > L	2												
2) Blemish & Foreign matters	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Size <math>\phi</math> (mm)</th> <th style="width: 50%;">Acceptable number</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><math>\phi &lt; 0.10</math></td> <td style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;"><math>0.10 &lt; \phi \leq 0.20</math></td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;"><math>0.20 &lt; \phi \leq 0.30</math></td> <td style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;"><math>0.30 &lt; \phi \leq 0.40</math></td> <td style="text-align: center;">1</td> </tr> </tbody> </table>	Size $\phi$ (mm)	Acceptable number	$\phi < 0.10$	Ignore	$0.10 < \phi \leq 0.20$	3	$0.20 < \phi \leq 0.30$	2	$0.30 < \phi \leq 0.40$	1	Minor		
Size $\phi$ (mm)	Acceptable number													
$\phi < 0.10$	Ignore													
$0.10 < \phi \leq 0.20$	3													
$0.20 < \phi \leq 0.30$	2													
$0.30 < \phi \leq 0.40$	1													
Size : $\phi = (A+B) / 2$ 	3) FISH EYE PET BUBBLE, FILM DENT	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Size <math>\phi</math> (mm)</th> <th style="width: 50%;">Acceptable number</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><math>\phi &lt; 0.10</math></td> <td style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;"><math>0.20 &lt; \phi \leq 0.30</math></td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;"><math>0.30 &lt; \phi \leq 0.40</math></td> <td style="text-align: center;">2</td> </tr> </tbody> </table> <div style="text-align: center; margin-top: 10px;">  </div>	Size $\phi$ (mm)	Acceptable number	$\phi < 0.10$	Ignore	$0.20 < \phi \leq 0.30$	3	$0.30 < \phi \leq 0.40$	2	Minor			
Size $\phi$ (mm)	Acceptable number													
$\phi < 0.10$	Ignore													
$0.20 < \phi \leq 0.30$	3													
$0.30 < \phi \leq 0.40$	2													
4) NEWTON RING	In case of Newton's ring, judged by limit sample.	Major												

## 10. Reliability

### 10-1. Items of reliability

: All test result of items should be judged in 12 hour recovery time at Room temperature.

ITEM	Condition	Criterion
1) High temperature operating	60℃ 48 hrs	<ul style="list-style-type: none"> <li>· After testing, cosmetic defects should not happen.</li> <li>· Contrast ratio should not happen lower than 10% of initial value</li> <li>· Total current consumption should not be over 10% of initial value.</li> </ul> Polarizers may fail in humidity test, but only this failure is allowable.
2) Low temperature operating	-20℃ 48 hrs	
3) Humidity	40℃, 90%RH, 48 hrs	
4) High temperature storage	70℃ 48 hrs	
5) Low temperature storage	-30℃ 48 hrs	
6) Thermal shock	25℃ → -30℃ → 25℃ → 70℃ 5(min) 30(min) 5(min) 30(min) 5 cycle, 55~60%RH	
7) Temperature humidity cycle	JIS.C.0028.1 5 cycle	
8) Vibration	10~55~10Hz amplitude : 1.5mm 2hrs for each direction (X, Y, Z)	<ul style="list-style-type: none"> <li>· Not allowed cosmetic and electrical defects.</li> </ul> (note) test will be performed at state of carton box, not each of the modules
9) Static Electricity	150pF 330Ω ±8kV 10 times air discharge.	<ul style="list-style-type: none"> <li>· After testing ,cosmetic and electrical defects should not happen.</li> <li>· Total current consumption should be below double of initial value.</li> </ul>

(Note1)

In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

## 11. Handling precautions

### 11-1. Mounting method

The LCD panel of SAMSUNG SDI LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board. Extreme care should be needed when handling the LCD modules.

### 11-2. Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly

- ◎ Isopropyl alcohol
- ◎ Ethyl alcohol
- ◎ Trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- ◎ Water
- ◎ Ketone
- ◎ Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns.

Do not use the following solvent on the pad or prevent it from being contaminated :

- ◎ HCFC
- ◎ Soldering flux
- ◎ Chlorine(Cl), Sulfur(S)
- ◎ Spittle, Fingerprint( It contains Cl )

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

SAMSUNG SDI would like to propose that the Customer conduct the Silicon coating unless the goods supplied without Silicon coating.

If ITO corrosion happens by mis-handling or using some materials such as Chlorine(Cl), Sulfur(S) from customer, Responsibility is on customer.

## 11-3. Caution against static charge

The LCD module use C-MOS LSI drivers, so we recommended that you; Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

## 11-4. Packing

- ◎ Module employ LCD elements, and must be treated as such.  
Avoid intense shock and falls from a height.
- ◎ To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity.

## 11-5. Caution for operation

- ◎ It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.  
An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- ◎ Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's show dark color in them.  
However those phenomena do not mean malfunction or out of order with LCD's, Which will come back in the specified operating temperature.
- ◎ If the display area is pushed hard during operation, Some font will be abnormally displayed but it resumes normal condition after turning off once.
- ◎ A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.  
Usage under the maximum operating temperature,50%RH or less is required.

## 11-6. Storage

In the case of storing for a long period of time [for instance, for years for the purpose or replacement use, The following ways are recommended.

- ◎ Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with no desiccant.

- ◎ Placing in a dark place where neither exposure to direct sunlight nor light's Keeping the storage temperature range.
- ◎ Storing with no touch on polarizer surface by the anything else.  
[It is recommended to store them as they have been contained in the inner container at the time of delivery from us.]

## 11-7. Safety

- ◎ It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, Which should be burned up later.
- ◎ When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

## 12. Precaution for use

- 12-1. A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity.  
Judgement by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.
- 12-2. On the following occasions, the handling of problem should be decided through discussion and agreement between responsible of the both parties.
- ◎ When a question is arisen in this specifications.
  - ◎ When a new problem is arisen which is not specified in this specifications.
  - ◎ When an inspection specifications change or operating condition change in customer is reported to SDI, and some problem is arisen in this specification due to the change.
  - ◎ When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

## 13. Dimensional Outline

See to next page





## CAUTION

Do not disassemble, nor repair LCD module without permission because you may be traumatized by the edge or the sharp point of LCD module.

When LCD is broken and the liquid crystal leaks, it may be harmful to skin.

if you touch the liquid crystal, wash it in water.

Do not handle LCD module with a bare hand.

When you do that, you may receive an electrical shock by ESD.

