

## PRODUCT SPECIFICATION

**MODEL: SEL035QVAD9**

< ◇ > PRELIMINARY SPECIFICATION

< ◆ > APPROVAL SPECIFICATION

CUSTOMER
APPROVED BY
DATE:

DESIGNED	CHECKED	APPROVED

## REVISION STATUS

Version	Revise Date	Page	Content	Modified by
V1.0	2012.03.09	-	First Issued.	Iris
V1.1	2012.07.04	-	Add note for Black tape .	COLIN
V1.2	2012.10.30	-	Change 3.42+/-0.3 to 2.9+/-0.4 .	COLIN
V1.3	2013.07.01	-	Change design for bezel	COLIN

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## 1. GENERAL DESCRIPTION

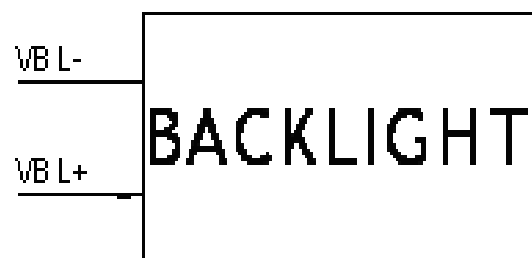
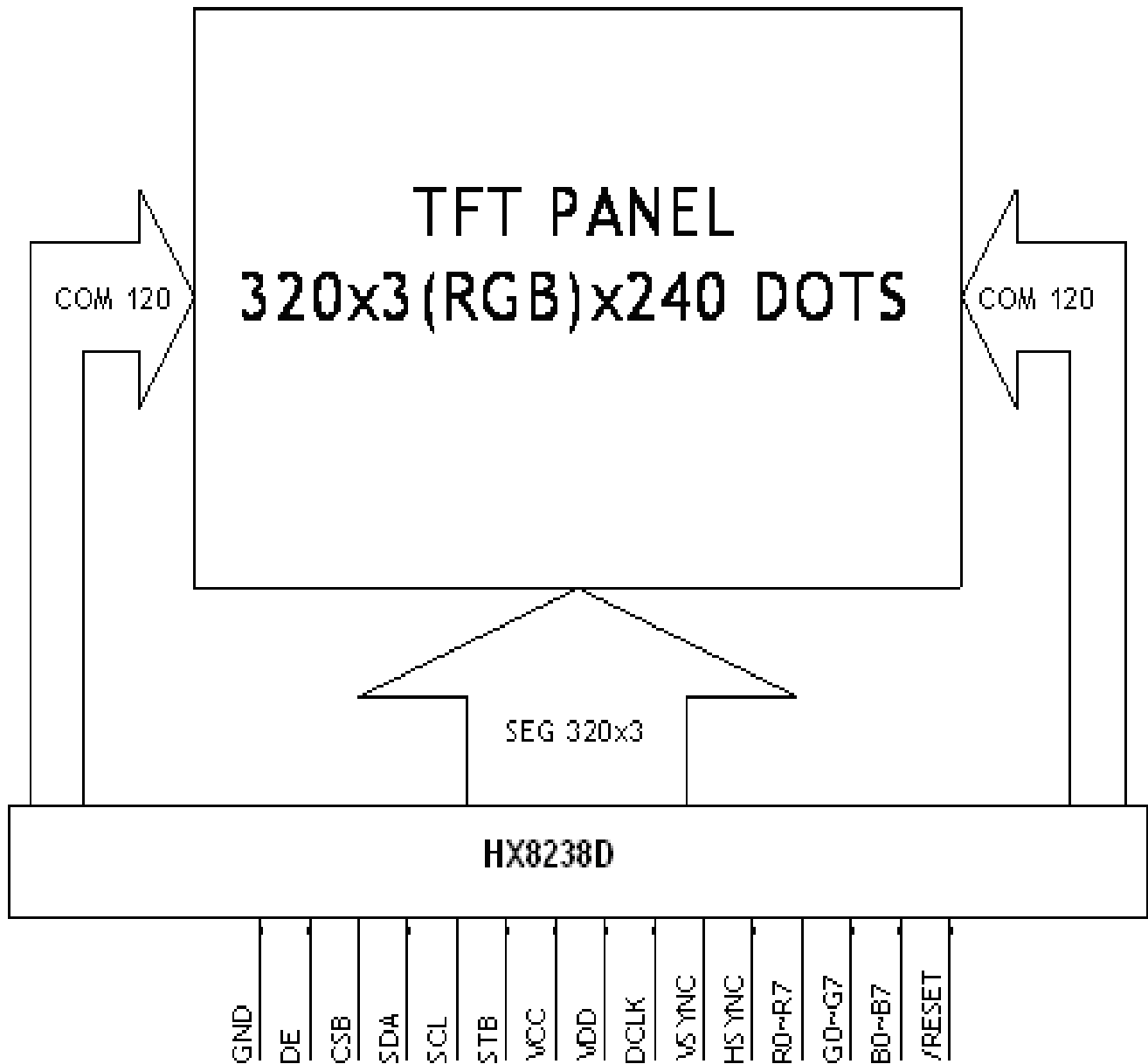
### 1.1 DESCRIPTION

The specifications is a transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver ICs and a backlight unit. The following table described the features of SEL035QVAD9

### 1.2 FEATURES:

No.	Item	Specification	Unit
1	Panel Size	3.5"	inch
2	Number of Pixels	320(W) × RGB × 240(H)	pixels
3	Active Area	70.08(W) × 52.56(H)	mm
4	Pixel Pitch	0.219(W) × 0.219(H)	mm
5	Outline Dimension	76.9(W) × 63.9(H) × 3.3(D)	mm
6	Number of Colors	16.7M	-
7	Display Mode	TN / Normally White / Transmissive	-
8	Viewing Direction	6 o'clock	-
9	Display Format	RGB Strip type	-
10	Interface	RGB data bus & 24 bit parallel data	-
11	Driver IC	HX8238-D	
12	Backlight	White LED	-
13	Operation Temperature	-20~70	°C
14	Storage Temperature	-30~80	°C
15	Weight	-	g

## 2. FUNCTIONAL BLOCK DIAGRAM





## 4. PIN DESCRIPTION

No.	Symbol	I/O	Function	Remark
1	VBL-	I	Backlight LED Power (-).	
2	VBL-	I	Backlight LED Power (-).	
3	VBL+	I	Backlight LED Power (+).	
4	VBL+	I	Backlight LED Power (+).	
5	Dummy	-	Not Use.	
6	/RESET	I	Reset with a low input Be sure to execute a power-on reset after supplying power .	
7	Dummy	-	Not Use.	
8	Y1	I/O	NC	
9	X1	I/O	NC	
10	Y2	I/O	NC	
11	X2	I/O	NC	
12	B0	I	Blue Data Bit 0.	
13	B1	I	Blue Data Bit 1.	
14	B2	I	Blue Data Bit 2.	
15	B3	I	Blue Data Bit 3.	
16	B4	I	Blue Data Bit 4.	
17	B5	I	Blue Data Bit 5.	
18	B6	I	Blue Data Bit 6.	
19	B7	I	Blue Data Bit 7.	
20	G0	I	Green Data Bit0.	
21	G1	I	Green Data Bit1.	
22	G2	I	Green Data Bit2.	
23	G3	I	Green Data Bit3.	
24	G4	I	Green Data Bit4.	
25	G5	I	Green Data Bit5.	
26	G6	I	Green Data Bit6.	
27	G7	I	Green Data Bit7.	
28	R0	I	Red Data Bit0.	
29	R1	I	Red Data Bit1.	
30	R2	I	Red Data Bit2.	
31	R3	I	Red Data Bit3.	
32	R4	I	Red Data Bit4.	
33	R5	I	Red Data Bit5.	
34	R6	I	Red Data Bit6.	
35	R7	I	Red Data Bit7.	

36	HSYNC	I	Horizontal Sync Input.	
37	VSYNC	I	Vertical Sync Input.	
38	DCLK	I	Dot Data Clock.	
39	Dummy	-	Not Use.	
40	Dummy	-	Not Use.	
41	VCC	P	Digital Power.	
42	VCC	P	Digital Power.	
43	CSB	I	Chip select signal.	
44	Dummy	-	Not Use.	
45	Dummy	-	Not Use.	
46	Dummy	-	Not Use.	
47	Dummy	-	Not Use.	
48	SHUT	I	Operation mode selection: SHUT="H"enter the stand by mode ; SHUT="L"normal operation mode.	
49	SCL	I	SPI interface data clock.	
50	SDA	I	SPI interface data input.	
51	Dummy	-	Not Use.	
52	DE	I	Data enable.	
53	GND	P	Power ground.	
54	GND	P	Power ground.	



## 5. ELECTRICAL CHARACTERISTICS

### 5.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Values		Unit	Remark
		Min	Max.		
Supply Voltage for Source Driver	V <sub>CC</sub>	-0.3	4.6	V	
	V <sub>DD</sub>	-0.3	4.6	V	

### 5.2 DC ELECTRICAL CHARACTERISTICS

#### 5.2. OPERATING CONDITIONS

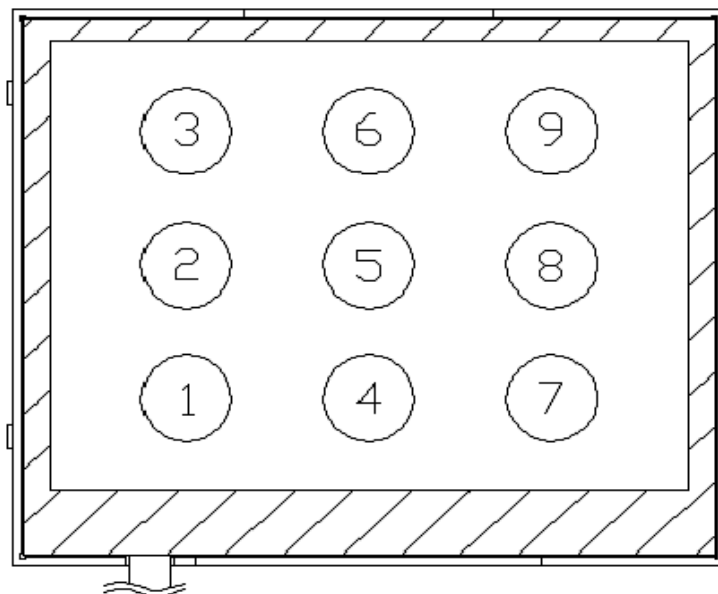
Typical Operating Conditions (Ta=25°C)

Item		Symbol	Values			Unit	Remark
			Min	Typ	Max.		
Power Supply		V <sub>CC</sub>	3.0	3.3	3.6	V	
Current		I <sub>DD</sub>	-	8.6	10	mA	
Input Signal Voltage	“H” Level	V <sub>IH</sub>	0.7 V <sub>CC</sub>	-	V <sub>CC</sub>	V	
	“L” Level	V <sub>IL</sub>	GND	-	0.3 V <sub>CC</sub>	V	
Output Signal Voltage	“H” Level	V <sub>OH</sub>	V <sub>CC</sub> - 0.4	-	V <sub>CC</sub>		
	“L” Level	V <sub>OL</sub>	GND	-	0.3 V <sub>CC</sub>		

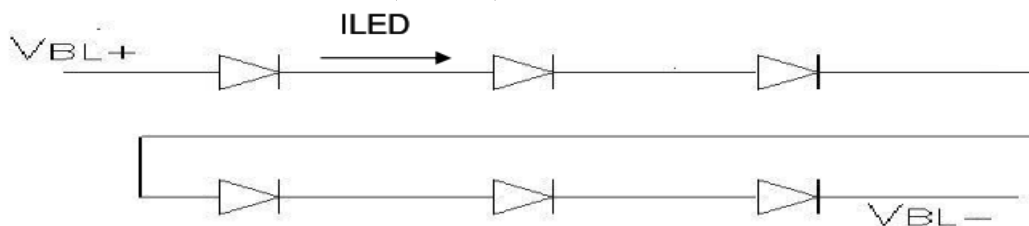
## 5.3 BACKLIGHT UNIT (GND=0V)

Item	Symbol	Values			Unit	Remark
		Min	Typ	Max.		
LED Voltage	$V_L$	18	18.8	21	V	
LED Current	$I_L$	18	20	-	mA	
Power Consumption	$P_{LED}$	324	400	420	mW	

NOTE: SELECTRONIC SUGGEST USING CONSTANT CURRENT DRIVING THIS BACKLIGHT UNIT  
 LIGHTGUIDE SPECIFICATION:



- A. TEST INSTRUMENT: BM-7 (DISTANCE = 500MM; FIELD = 1°)
- B. LIGHT SOURCE: LED \* 6 (WHITE)



- C. CONDITIONS:  $I_F = 20 \text{ mA}$ ,  $V_{LED} (\text{Typ.}) = 18.8 \text{ V}$
- D. MEASURE BRIGHTNESS: 1 ~ 9
- E. UNIFORMITY =  $(\text{MIN. BRIGHTNESS} / \text{MAX. BRIGHTNESS}) * 100\%$
- F. UNIFORMITY  $\geq 70\%$

## 6. TIMING CHARACTERISTICS

### 1. 24-BIT PARALLEL RGB INTERFACE

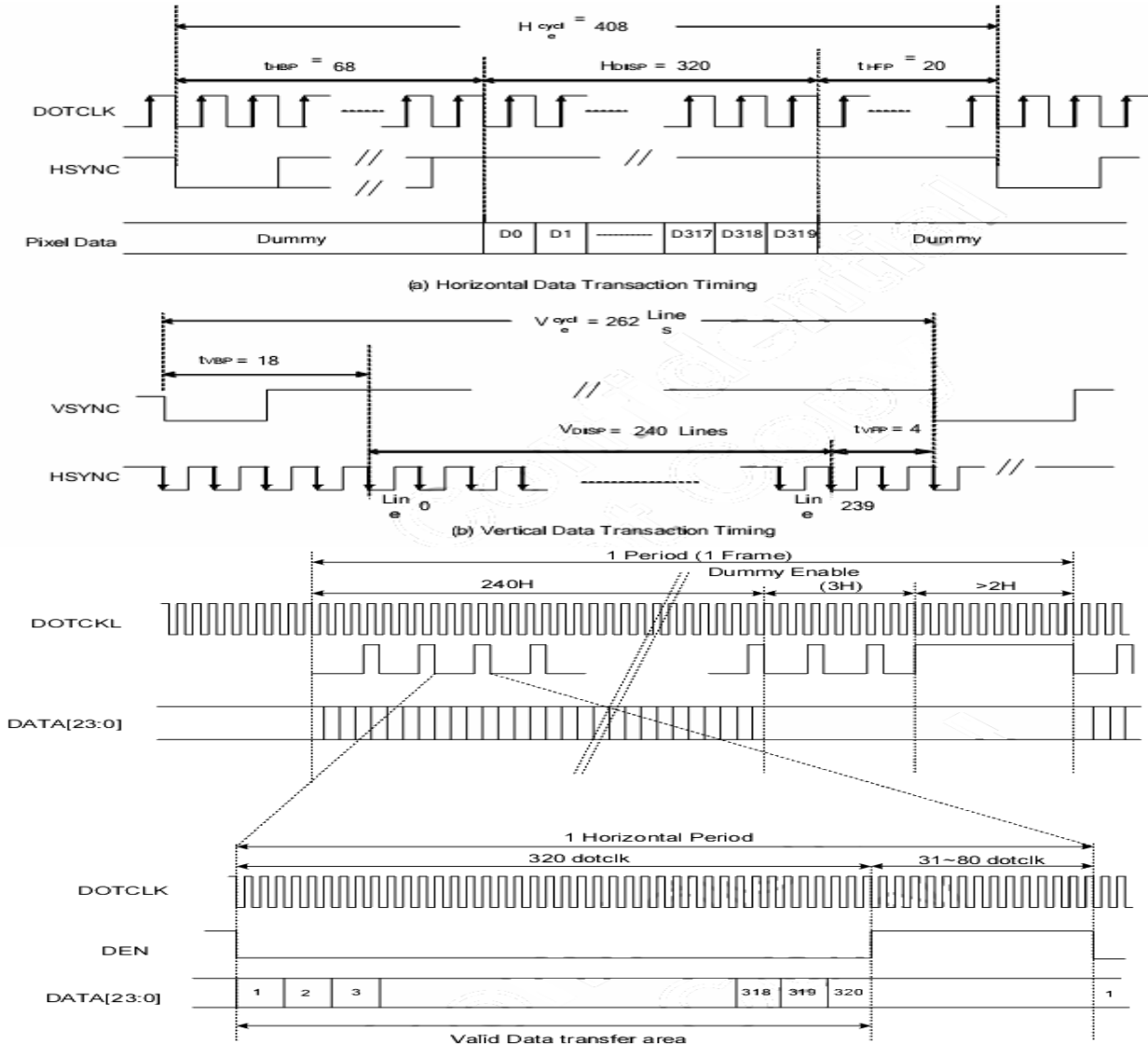


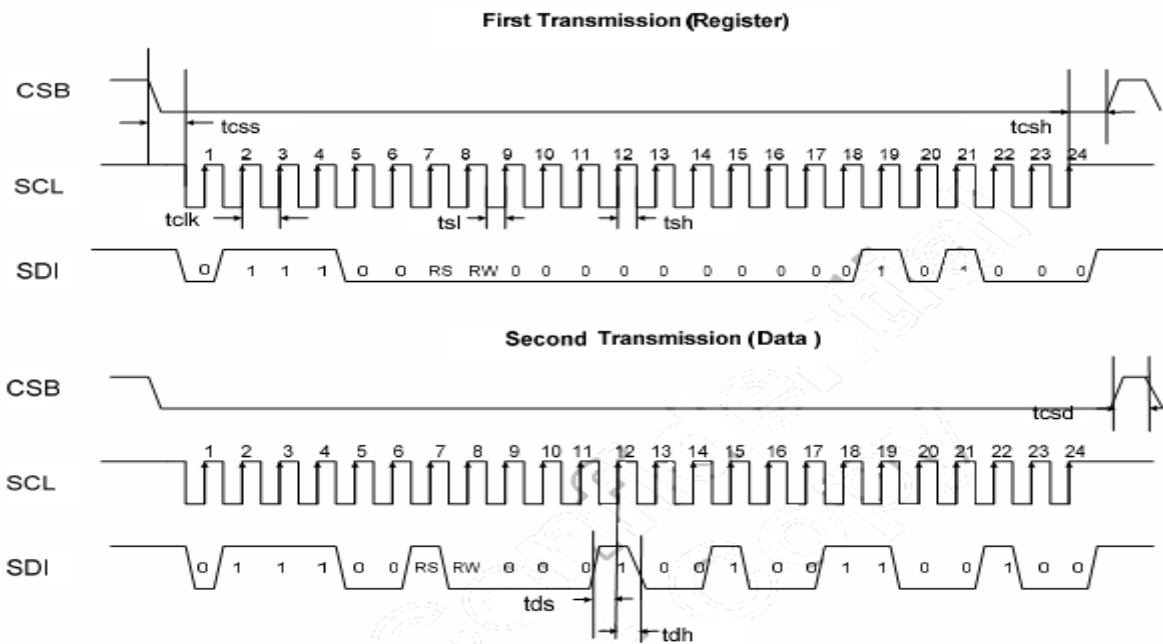
Figure 12.4 Signal Timing in DE Mode

Characteristics	Symbol	Min		Typ		Max		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	fDOTCLK	-	-	6.5	19.5	-	-	MHz
DOTCLK Period	tDOTCLK	100	33.3	154	51.3	-	30	ns
Vertical Sync Setup Time	tvsys	20	10	-	-	-	-	ns
Vertical Sync Hold Time	tvsyh	20	10	-	-	-	-	ns
Horizontal Sync Setup Time	thsys	20	10	-	-	-	-	ns
Horizontal Sync Hold Time	thsyh	20	10	-	-	-	-	ns
Phase difference of Sync Signal Falling Edge	thv	1		-		240		tDOTCLK
DOTCLK Low Period	tCKL	50	15	-	-	-	-	ns
DOTCLK High Period	tCKH	50	15	-	-	-	-	ns
Data Setup Time	tds	12	10	-	-	-	-	ns
Data hold Time	tdh	12	10	-	-	-	-	ns
Reset pulse width	tRES	10		-		-		us

**Note:** External clock source must be provided to DOTCLK pin of HX8238-A. The driver will not operate if absent of the clocking signal.

## 2 . SPI

- Write SPI



**Note:** The example writes "0x1264h" to register R28h.  
SPID connected to VSS.

**Figure 12. 12 (a) SPI interface Timing Diagram & Write SPI Example**

**Figure 12. 14 Rising/Falling Time**

Characteristics	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Serial Clock Frequency	fclk	-	-	20	MHz
Serial Clock Cycle Time	tclk	50	-	-	ns
Clock Low Width	tsl	25	-	-	ns
Clock High Width	tsh	25	-	-	ns
Clock Rising Time	trs	-	-	30	ns
Clock Falling Time	tfl	-	-	30	ns
Chip Select Hold Time	tcsh	10	-	-	ns
Chip Select High Delay Time	tcsd	20	-	-	ns
Data Setup Time	tds	5	-	-	ns
Data Hold Time	tdh	10	-	-	ns

**Table 12. 5 SPI Timing**

**Note:** The example Read "0x1264h" from register R28h.

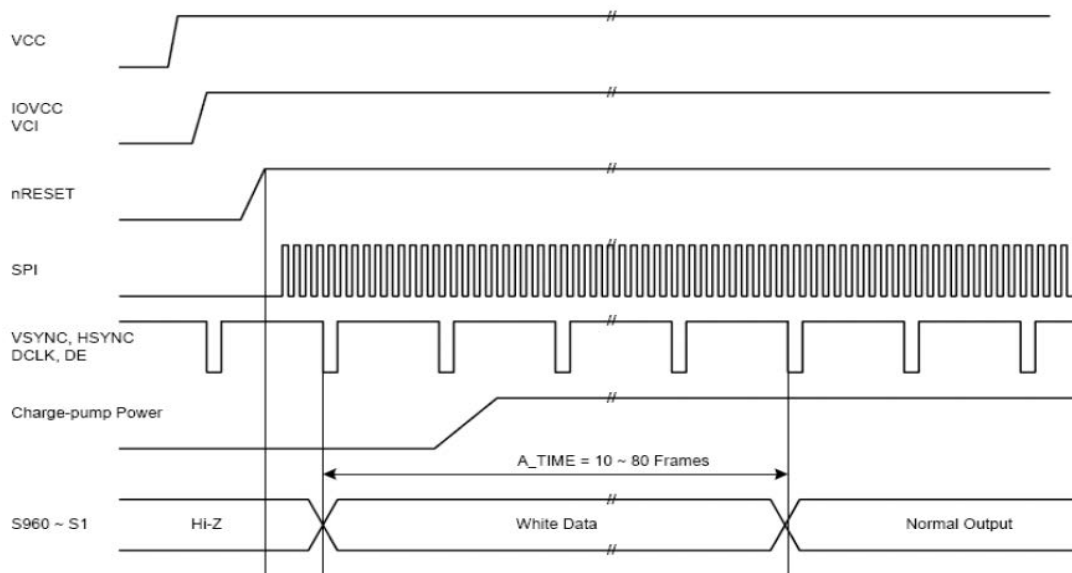
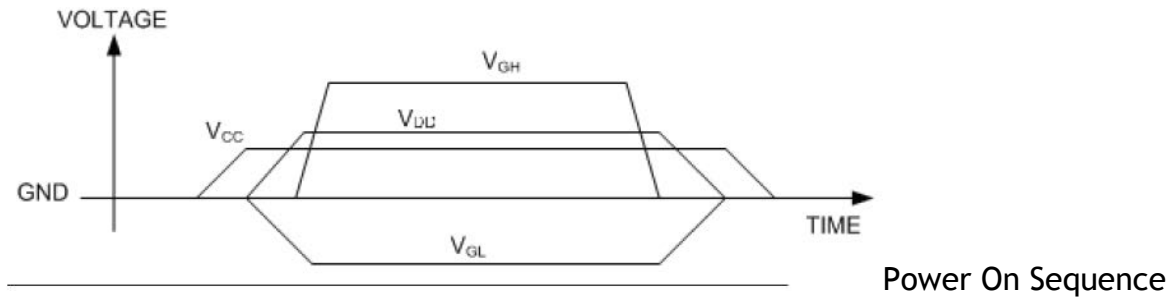
**Figure 12. 13 (b) SPI interface Timing Diagram & Read SPI Example**



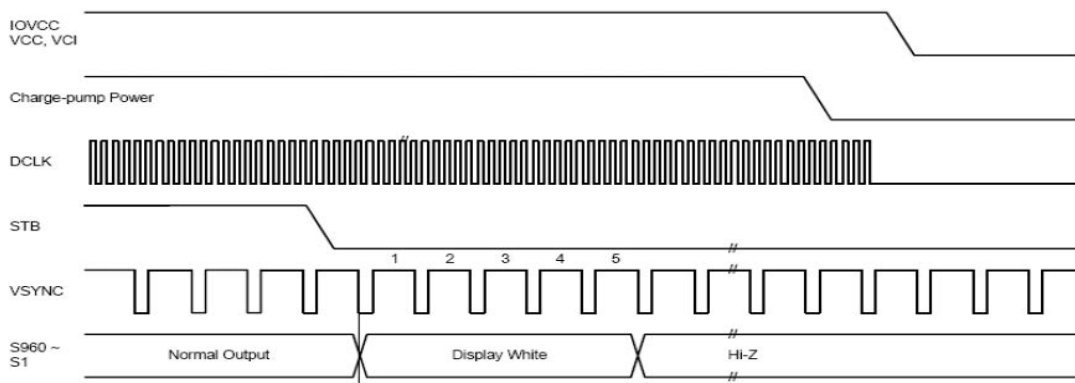
## 7. Power Sequence

The LCD panel adopts high voltage driver ICs, so it could be permanently damaged if a wrong power on/off sequence is used. When powering on the LCD, VCC should go up firstly, and then turn on VGL and VDD, and finally VGH. Turn off the LCD panel with reversed order or shut off all the power supplies simultaneously.

### Power On Sequence



### Power Off Sequence



## 8. OPTICAL CHARACTERISTICS

### 8.1 SPECIFICATION

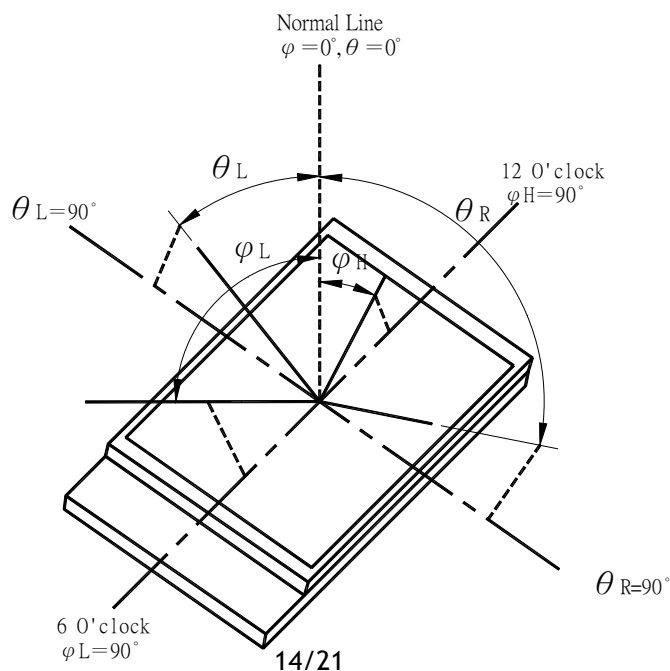
The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note.1.

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	Horizontal	-	$CR \geq 10$	-	120	-	degree	Note.3
	Vertical	-		-	100	-		
Response Time( $T_r+T_f$ )			$\theta=0$	-	25	-	ms	Note.4
Brightness			Center	500	540	-	$cd/m^2$	Note.6
Contrast Ratio		CR	At optimized viewing angle	200	300	-	-	Note.5
Color Chromaticity	White	$X_w$	Viewing normal angle $\Phi, \theta=0$	0.273	0.313	0.353	-	Note.6
		$Y_w$		0.289	0.329	0.369		

Note.1: After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7(fast) with a viewing angle of  $1^\circ$  at a distance of 50cm and normal direction.

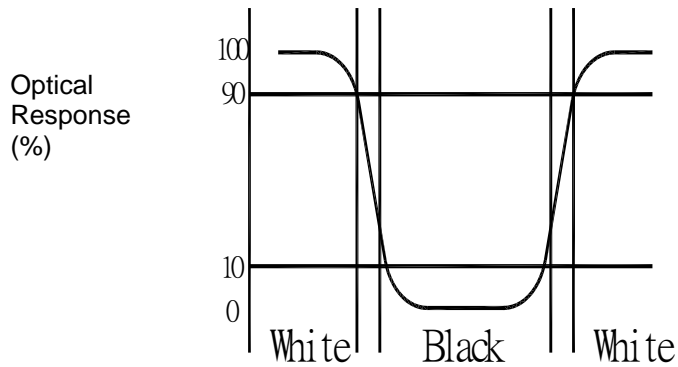
Note.2:  $\Delta B=B(\min)/B(\max)$

Note.3: Definition of Viewing Angle: Refer to figure as below:



**Note.4: Definition of Response Time: TR and TF**

The figure below is the output signal of the photo detector.



**Note.5: Definition of Contrast Ratio (CR)**

Ratio of gray max (G max )& gray min(G min)

Contrast ratio (CR) =(G max) / (G min)

(G max)=luminance with all pixel white

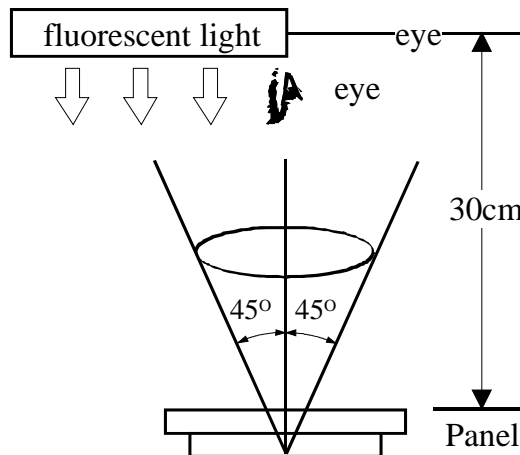
(G min)=luminance with all pixel black

**Note.6:** Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

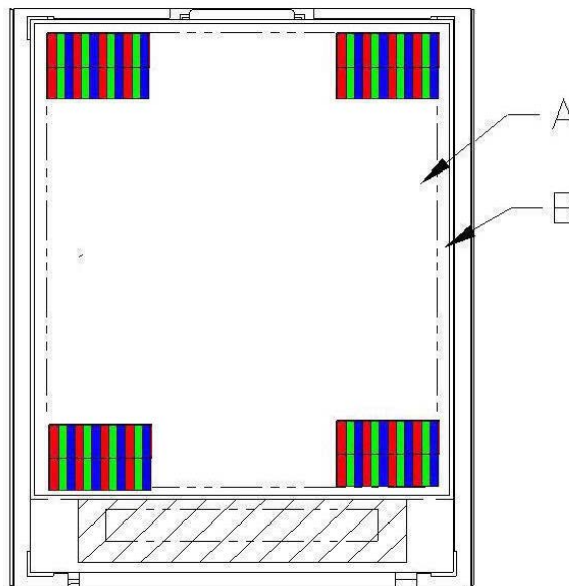
## 9. QUALITY SPECIFICATIONS

### 9.1 INSPECTION CONDITION

- (1) Inspect under 300~500Lux fluorescent light, leaving 30~35cm between panels and eyes, and between panels and lights.
- (2) Inspection condition is  $23\pm 5^{\circ}\text{C}$ ,  $50\pm 20\%\text{RH}$  maximum.



### 9.2 DEFINITION OF AREA

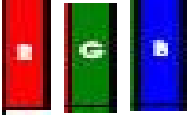
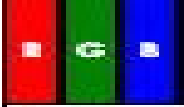



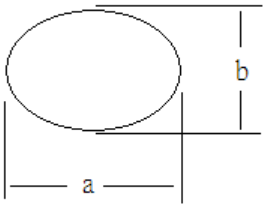
A Area : Viewing area.

B Area : Out of viewing. (outside viewing area)



## 9.3 INSPECTION SPECIFICATION

NO	Item	Acceptable specification	Judgment Criterion
1	Electrical Testing	<p>1-1 sub pixel classification</p> <ul style="list-style-type: none"> <li>● Sub Pixel: Number of sub pixel doesn't exceed one dot.</li> </ul> <div style="text-align: center;">  <p>Sub Pixel (Dot)</p> </div> <p>a&gt; Dark dot ----one Allowed b&gt; Bright dot ---- one Allowed</p> <ul style="list-style-type: none"> <li>● Pixel : Three dots link together doesn't exceed ones</li> </ul> <div style="text-align: center;">  <p>Pixel</p> </div> <p>1-2 Leakage to light</p> <ul style="list-style-type: none"> <li>● Leakage to light be not allowed.</li> </ul> <p>1-3 Picture to shake</p> <ul style="list-style-type: none"> <li>● Picture had shake, twinkle and noise etc. instable of defect that be not allowed.</li> </ul> <p>1-4 Function</p> <ul style="list-style-type: none"> <li>● No display or No function.</li> <li>● Source Line, Gate Line.</li> <li>● Contrast Ratio</li> <li>● Current consumption exceeds product specifications.</li> <li>● Display malfunction.</li> </ul>	<p><math>N \leq 1</math></p> <p><math>N \leq 0</math></p> <p><math>N=0</math></p> <p><math>N=0</math></p> <p><math>N=0</math></p>
2	Mechanical Dimension	<p>2-1 Mechanical Dimension exceeds product specifications.</p> <p>2-2 Out of frame and boss of plastic changed shape that be not allowed</p>	<p><math>N=0</math></p>

					Criterion	
3	Cosmetic Inspection	<b>3-1 Blemish: Line shapes of defect</b>				
		Length	Width	Acceptable number	Mini. space	
		---	$W \leq 0.03$	Ignore	5 m m	
		$L \leq 2.5$	$0.03 < W \leq 0.05$	3		
		$L \leq 2.5$	$0.05 < W \leq 0.1$	2		
		--	$W > 0.1$	Not allowed	---	
		L: length(mm) W: width(mm)				
						
		<b>3-2 Blemish: dot shapes of defect.</b>				
				Dimension	Acceptable number	Mini. Space
		$\Phi \leq 0.10$	Ignore	---		
		$0.10 < \Phi \leq 0.15$	2	5 m m		
		$0.15 < \Phi \leq 0.25$	1			
		$\Phi > 0.25$	0	---		
<b>3-3 Polarizer Bubble</b>						
		Dimension	Acceptable number	Mini. Space		
		$\Phi \leq 0.20$	Ignore	---		
		$0.20 < \Phi \leq 0.30$	2	15 m m		
		$\Phi > 0.30$	0	---		
<b>Foreign Substances</b>						
						
				$\Phi = (a+b)/2$		

NO	Item	Acceptable specification	Judgment Criterion																					
3	Cosmetic Inspection	<p>3-4 Scratch</p> <ul style="list-style-type: none"> <li>● Sensate scratch not allowed.</li> <li>● Impassive scratch as below.</li> </ul> <p style="text-align: right;">Unit:mm</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th data-bbox="357 707 620 786">Length</th> <th data-bbox="620 707 927 786">Width</th> <th data-bbox="927 707 1136 786">Acceptable number</th> <th data-bbox="1136 707 1299 786">Mini. space</th> </tr> </thead> <tbody> <tr> <td data-bbox="357 786 620 864">-----</td> <td data-bbox="620 786 927 864"><math>W \leq 0.03</math></td> <td data-bbox="927 786 1136 864">Ignore</td> <td data-bbox="1136 786 1299 1149" rowspan="3">5 m m</td> </tr> <tr> <td data-bbox="357 864 620 931"><math>L \leq 2.5</math></td> <td data-bbox="620 864 927 931"><math>0.03 &lt; W \leq 0.05</math></td> <td data-bbox="927 864 1136 931">3</td> </tr> <tr> <td data-bbox="357 931 620 999"><math>L \leq 2.5</math></td> <td data-bbox="620 931 927 999"><math>0.05 &lt; W \leq 0.1</math></td> <td data-bbox="927 931 1136 999">2</td> </tr> <tr> <td data-bbox="357 999 620 1066">----</td> <td data-bbox="620 999 927 1066"><math>0.1 &lt; W</math></td> <td data-bbox="927 999 1136 1066">Not allowed</td> <td data-bbox="1136 999 1299 1149" rowspan="2">---</td> </tr> <tr> <td data-bbox="357 1066 620 1149"><math>L &gt; 2.5</math></td> <td data-bbox="620 1066 927 1149">----</td> <td data-bbox="927 1066 1136 1149">Not allowed</td> </tr> </tbody> </table>	Length	Width	Acceptable number	Mini. space	-----	$W \leq 0.03$	Ignore	5 m m	$L \leq 2.5$	$0.03 < W \leq 0.05$	3	$L \leq 2.5$	$0.05 < W \leq 0.1$	2	----	$0.1 < W$	Not allowed	---	$L > 2.5$	----	Not allowed	
Length	Width	Acceptable number	Mini. space																					
-----	$W \leq 0.03$	Ignore	5 m m																					
$L \leq 2.5$	$0.03 < W \leq 0.05$	3																						
$L \leq 2.5$	$0.05 < W \leq 0.1$	2																						
----	$0.1 < W$	Not allowed	---																					
$L > 2.5$	----	Not allowed																						
4	Package	<p>4-1 Mixed product types</p> <p>4-2 Shipping q'ty should be the same as "shipping notice form" q'ty.</p> <p>4-3 Outer box can't broken.</p>	N=0																					

## 10. RELIABILITY

### 1.MTTF .

The LCD module shall be designed to meet a minimum MTTF value of 50,000 hours with normal condition. (25°C in the room without sunlight; not include life time of backlight)

### 2. TESTS.

Test Item	Test Condition
High Temperature Operation	70°C for 240 hours
Low Temperature Operation	-20°C for 240 hours
High Temperature Storage	80°C for 240 hours
Low Temperature Storage	-30°C for 240 hours
High Temperature Operation Humidity Operation	60°C , 90%RH for 240 hours
Thermal Shock	-30°C (30min) ~+25°C (5min)~ +80°C (30min) for 100 cycles
Vibration Test (No Operation)	Frequency: 10~55Hz Amplitude:1.0mm Sweep Time: 11min Test Period: 6 Cycles for each direction of X, Y, Z
Electrostatic Discharge Test (No Operation)	150pF, 330Ω Air: ±15KV; Contact: ±8KV 10 times/point; 4 points/panel face

## 11. HANDLING PRECAUTION

### 11.1 SAFETY

- (1) Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
- (2) If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
- (3) If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

### 11.2 STORAGE CONDITIONS

- (1) Store the panel or module in a dark place where the temperature is  $23\pm 5^{\circ}\text{C}$  and the humidity is below  $50\pm 20\% \text{RH}$ .
- (2) Store in anti-static electricity container.
- (3) Store in clean environment, free from dust, active gas, and solvent.
- (4) Do not place the module near organics solvents or corrosive gases.
- (5) Do not crush, shake, or jolt the module.

### 11.3 HANDLING PRECAUTIONS

- (1) Avoid static electricity which can damage the CMOS LSI.
- (2) The polarizing plate of the display is very fragile. So, please handle it very carefully.
- (3) Do not give external shock.
- (4) Do not apply excessive force on the surface.
- (5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- (6) Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
- (7) Do not operate it above the absolute maximum rating.
- (8) Do not remove the panel or frame from the module.

### 11.4 WARRANTY

The period is within twelve months since the date of shipping out under normal using and storage conditions.