



# **SPECIFICATION FOR LCD MODULE**

**MODULE NO: SW160160E**

**Doc.Version:07**

Customer Approval:

☐ Accept

☐ Reject

☐ APPROVAL FOR SPECIFICATIONS ONLY

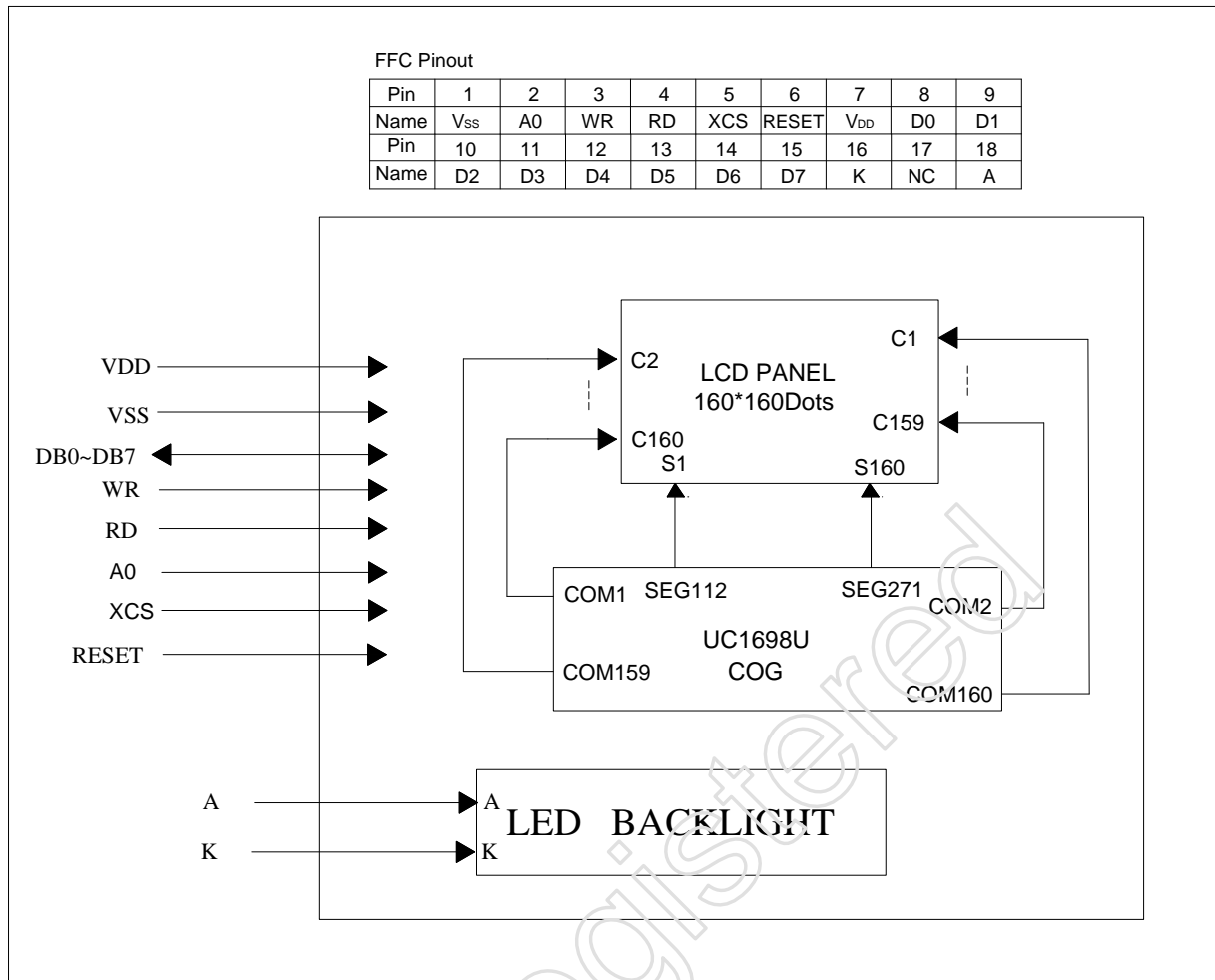
☒ APPROVAL FOR SPECIFICATIONS AND SAMPLE

WIMRD005-02-C

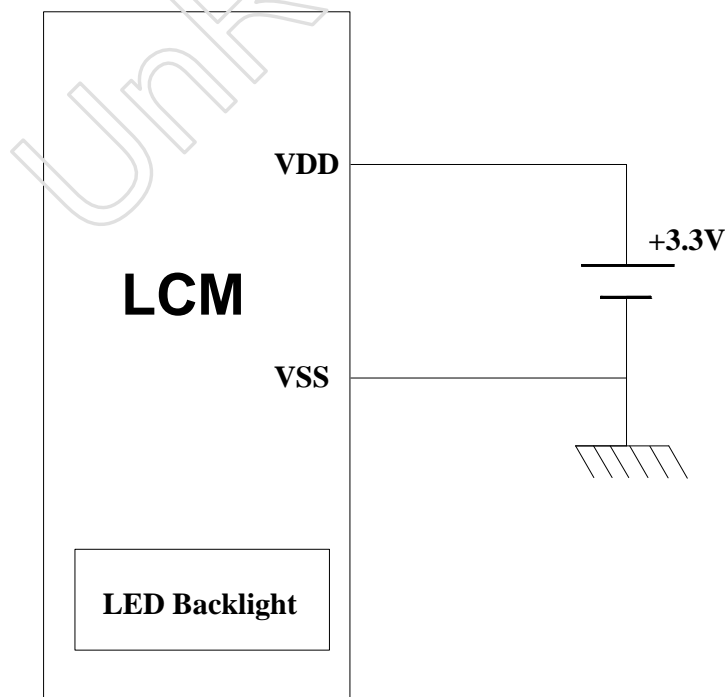
**1.MECHANICAL SPECIFICATIONS**

ITEM	SPECIFICATION
LCD Description	160*160 Dots
Module dimension	83.80(W)*76.50(H)*9.60MAX(T)
LCD Viewing area	60.00(W)*60.00 (H)
LCD Active area	54.38(W)*54.38(H)
Dot pitch	0.34(W)* 0.34(H)
Dot size	0.32(W)* 0.32 (H)
Duty/Bias	1/160duty, 1/10 bias
LCD display mode	FSTN/White-Black mode/Positive/ Transflective
Viewing direction	6 o'clock
Driver IC	UC1698UGAC
Module weight	58.5g

## 2.BLOCK DIAGRAM



## 3.POWER SUPPLY



**4. PIN DESCRIPTION**

Pin no.	Symbol	Function
1	V <sub>SS</sub>	Ground
2	A0	Select control date or display date for read/write operation. "L" Control date; "H" Display date.
3	WR	Write enable clock input pin The data on DB0 to DB7 are latched at the rising edge of the /WR signal.
4	RD	Read enable clock input pin When /RD is "L", DB0 to DB7 are in an output status.
5	XCS	Chip select pin.
6	RESET	Reset input pin
7	V <sub>DD</sub>	Power supply input
8	D0	Display date signal
9	D1	
10	D2	
11	D3	
12	D4	
13	D5	
14	D6	
15	D7	
16	K	Cathode of LED Backlight
17	NC	No connection
18	A	Anode of LED Backlight

**5. ABSOLUTE MAXIMUM RATINGS (Ta=25°C)**

Item	Symbol	Min	Max	Unit
Power supply voltage for logic	V <sub>DD</sub>	-0.3	+4.0	V
LCD driver voltage	V <sub>LCD</sub>	-0.3	19.8	V
Operating temperature	T <sub>OPR</sub>	-25	+70	°C
Storage temperature	T <sub>STG</sub>	-30	+80	°C

Note: Voltage greater than above may damage the module  
All voltages are specified relative to V<sub>SS</sub>=0V

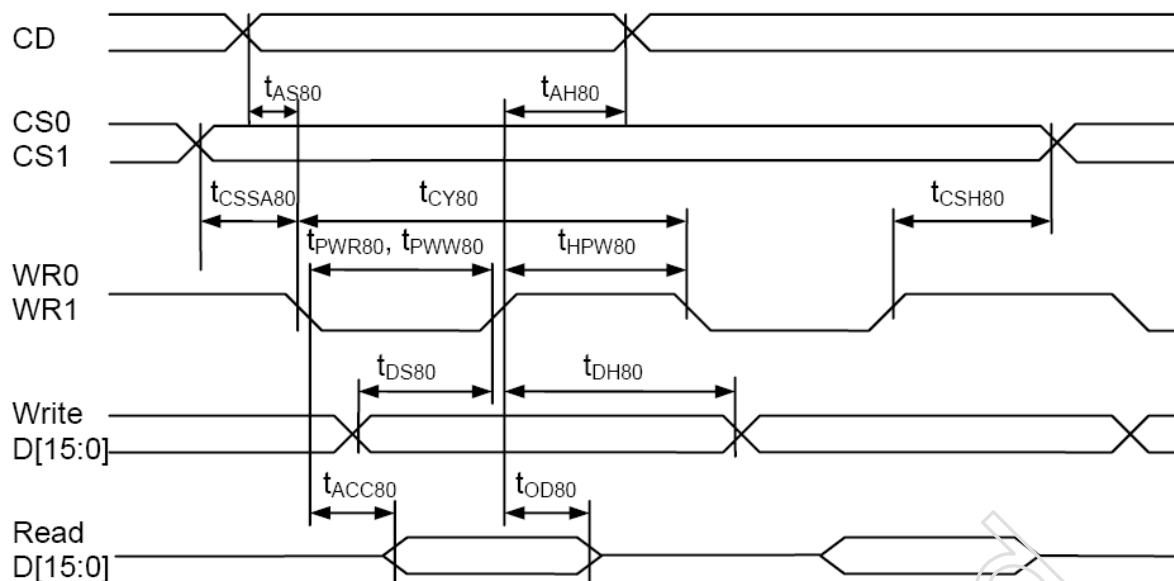
**6.ELECTRICAL CHARACTERISTICS.****6-1DC Characteristics(Ta=25°C)**

Item	Symbol	Min	Typ	Max	Unit	Applicable terminal	Test condition
Operating voltage	V <sub>DD</sub>	3.1	3.3	3.4	V	-	-
Supply current	I <sub>DD</sub>	-	1.85	3	mA	-	-
Input voltage	V <sub>IL</sub>	-	-	0.2V <sub>DD</sub>	V	A0, WR RD,D0~D7	-
	V <sub>IH</sub>	0.8 V <sub>DD</sub>	-	-	V		-
Output voltage	V <sub>OL</sub>	-	-	0.2 V <sub>DD</sub>	V	D0~D7	-
	V <sub>OH</sub>	0.8 V <sub>DD</sub>	-	-	V		-
Input leakage current	I <sub>IL</sub>	-1	-	1.5	μA	RD	-
LCD driving voltage	V <sub>LCD</sub>	16.3	16.5	16.7	V	-	Ta=25°C

Optimum LCD driving voltage will varies and control within the above specified range.

**6-2. Backlight Characteristics (Ta=25°C)**

Item	Symbol	Min	Typ	Max	Units	Condition
Forward current	Vf	4.2	4.7	5.2		If =60 mA
Color chromaticity	X	0.24	-	0.32	-	If =60 mA
	Y	0.24	-	0.32	-	
Module luminance	Lv	20	-	-	cd/m²	If =60 mA
Uniformity	Avg	70	-	-	%	
Color	White					

**6-3 AC Characteristics (VDD=3.3V, Ta=25°C).****Read / Write Characteristics (8080-series MPU)**

Symbol	Signal	Description	Condition	Min.	Max.	Units
(2.5V ≤ V <sub>DD</sub> < 3.3V, Ta = -30 to +85°C) (Read / Write)						
$t_{AS80}$	CD	Address setup time		0	—	nS
$t_{AH80}$		Address hold time		0	—	nS
$t_{CY80}$		System cycle time	16-bit bus 8-bit bus LC[7:6]=10b (01b)	200 / 160 130 / 110 (120)	—	nS
$t_{PWR80} / t_{PWW80}$	WR1 / WR0	Pulse width	16-bit bus 8-bit bus LC[7:6]=10b (01b)	85 / 65 50 / 40 (45)	—	nS
$t_{HPW80}$	WR0, WR1	High pulse width	16-bit bus 8-bit bus LC[7:6]=10b (01b)	85 / 65 50 / 40 (45)	—	nS
$t_{DS80}$	D15~D0	Data setup time		30	—	nS
$t_{DH80}$		Data hold time		0	—	nS
$t_{ACC80}$		Read access time	C <sub>L</sub> = 100pF	—	60	nS
$t_{OD80}$		Output disable time		15	30	nS
$t_{CSSA80}$	CS1/CS0	Chip select setup time		5	—	nS
$t_{CSH80}$				5	—	nS



## 7. INSTRUCTION DESCRIPTION

1	Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte	N/A	
2	Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte	N/A	
3	Get Status & PM	0	1	GE	MX	MY	WA	DE	WS	MD	MS	Get {Status, Ver, PMO, Product Code, PID, MID}	N/A	
				Ver	PMO[6:0]									
				Product Code (8h)				PID[1:0]		MID[1:0]				
4	Set Column Address LSB	0	0	0	0	0	0	#	#	#	#	Set CA[3:0]	0	
	Set Column Address MSB	0	0	0	0	0	1	0	#	#	#	Set CA[6:4]	0	
5	Set Temp. Compensation	0	0	0	0	1	0	0	1	#	#	Set TC[1:0]	0	
6	Set Power Control	0	0	0	0	1	0	1	0	#	#	Set PC[1:0]	10b	
7	Set Adv. Program Control (double-byte command)	0	0	0	0	1	1	0	0	0	R	Set APC[R][7:0], R = 0 or 1	N/A	
		0	0	#	#	#	#	#	#	#	#			
8	Set Scroll Line LSB	0	0	0	1	0	0	#	#	#	#	Set SL[3:0]	0	
	Set Scroll Line MSB	0	0	0	1	0	1	#	#	#	#	Set SL[7:4]	0	
9	Set Row Address LSB	0	0	0	1	1	0	#	#	#	#	Set RA[3:0]	0	
	Set Row Address MSB	0	0	0	1	1	1	#	#	#	#	Set RA[7:4]	0	
10	Set V <sub>BIAS</sub> Potentiometer (double-byte command)	0	0	1	0	0	0	0	0	0	1	Set PM[7:0]	40H	
		0	0	#	#	#	#	#	#	#	#			
11	Set Partial Display Control	0	0	1	0	0	0	0	1	0	#	Set LC[8]	0	
12	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]	001b	
13	Set Fixed Lines	0	0	1	0	0	1	0	0	0	0	Set {FLT, FLB}	0	
		0	0	#	#	#	#	#	#	#	#			
14	Set Line Rate	0	0	1	0	1	0	0	0	#	#	Set LC[4:3]	10b	
15	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]	0	
16	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]	0	
17	Set Display Enable	0	0	1	0	1	0	1	#	#	#	Set DC[4:2]	110b	
18	Set LCD Mapping Control	0	0	1	1	0	0	0	#	#	#	Set LC[2:0]	0	
19	Set N-Line Inversion	0	0	1	1	0	0	1	0	0	0	Set NIV[4:0]	1DH	
				-	-	-	#	#	#	#	#			
20	Set Color Pattern	0	0	1	1	0	1	0	0	0	#	Set LC[5]	0 (BGR)	
21	Set Color Mode	0	0	1	1	0	1	0	1	#	#	Set LC[7:6]	10b	
22	Set COM Scan Function	0	0	1	1	0	1	1	#	#	#	Set CSF[2:0]	000b	
23	System Reset	0	0	1	1	1	0	0	0	1	0	System Reset	N/A	
24	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A	
25	Set Test Control (double-byte command)	0	0	1	1	1	0	0	1	1	TT	For testing only. Do not use.	N/A	
		0	0	#	#	#	#	#	#	#	#			
26	Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]	11b: 12	
27	Set COM End	0	0	1	1	1	1	0	0	0	1	Set CEN[6:0]	159	
		0	0	-	#	#	#	#	#	#	#			
28	Set Partial Display Start	0	0	1	1	1	1	0	0	1	0	Set DST[6:0]	0	
		0	0	-	#	#	#	#	#	#	#			
29	Set Partial Display End	0	0	1	1	1	1	0	0	1	1	Set DEN[6:0]	159	
		0	0	-	#	#	#	#	#	#	#			
30	Set Window Program Starting Column Address	0	0	1	1	1	1	0	1	0	0	Shared with MTP commands	Set WPC0	0
		0	0	-	#	#	#	#	#	#	#		Set WPP0	0
31	Set Window Program Starting Row Address	0	0	1	1	1	1	0	1	0	1		Set WPC1	127
		0	0	#	#	#	#	#	#	#	#		Set WPP1	159
		0	0	-	#	#	#	#	#	#	#			
32	Set Window Program Ending Column Address	0	0	1	1	1	1	0	1	1	0	Set AC[3]	0: Inside	
		0	0	-	#	#	#	#	#	#	#			
33	Set Window Program Ending Row Address	0	0	1	1	1	1	0	1	1	1	Set MTPC[4:0]	10H	
		0	0	#	#	#	#	#	#	#	#			
34	Window Program Mode	0	0	1	1	1	1	1	0	0	#			
		0	0	1	0	1	1	1	0	0	0			
35	Set MTP Operation control	0	0	-	-	-	#	#	#	#	#			
		0	0	-	-	-	#	#	#	#	#			



	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default	
36	Set MTP Write Mask	0 0 0	0 0 0	1 - -	0 # -	1 # -	1 # -	1 # -	0 # -	0 # #	1 # #	Set MTPM[6:0] MTPM1[1:0]	0	
37	Set V <sub>MTP1</sub> Potentiometer	0 0 0	0 0 0	1 # #	1 # #	1 # #	1 # #	0 # #	1 # #	0 # #	0 # #			
38	Set V <sub>MTP2</sub> Potentiometer	0 0 0	0 0 0	1 # #	1 # #	1 # #	1 # #	0 # #	1 # #	0 # #	1 # #	Shared with Window Program commands	Set MTP1	N/A
													Set MTP2	N/A
39	Set MTP Write Timer	0 0 0	0 0 0	1 # #	1 # #	1 # #	1 # #	0 # #	1 # #	1 # #	0 # #		Set MTP3	N/A
40	Set MTP Read Timer	0 0 0	0 0 0	1 # #	1 # #	1 # #	1 # #	0 # #	1 # #	1 # #	1 # #		Set MTP4	N/A

**NOTE:**

- All other bit patterns other than commands listed above may result in undefined behavior.
- The interpretation of commands (36)~(40) depends on the setting of register MTPC[3].
  - Commands (37)~(40) are shared with commands (30)~(33). These two sets of commands share exactly the same code and control registers. When MTPC[3]=0, they are interpreted as Window Program commands and registers. When MTPC[3]=1, they function as MTP Control commands and registers.
- After MTP ERASE or PROGRAM operation, before resuming normal operation, please always
  - Remove TST4 power source,
  - Do a full V<sub>DD</sub> ON-OFF-ON cycle.
- Under 16-bit bus mode and CD=0, D[15:8] is ignored and only D[7:0] is used. As a result, the bus cycles for commands under 16-bit bus and 8-bit bus are the same, and double-byte commands still need two bus cycles under 16-bit bus mode.



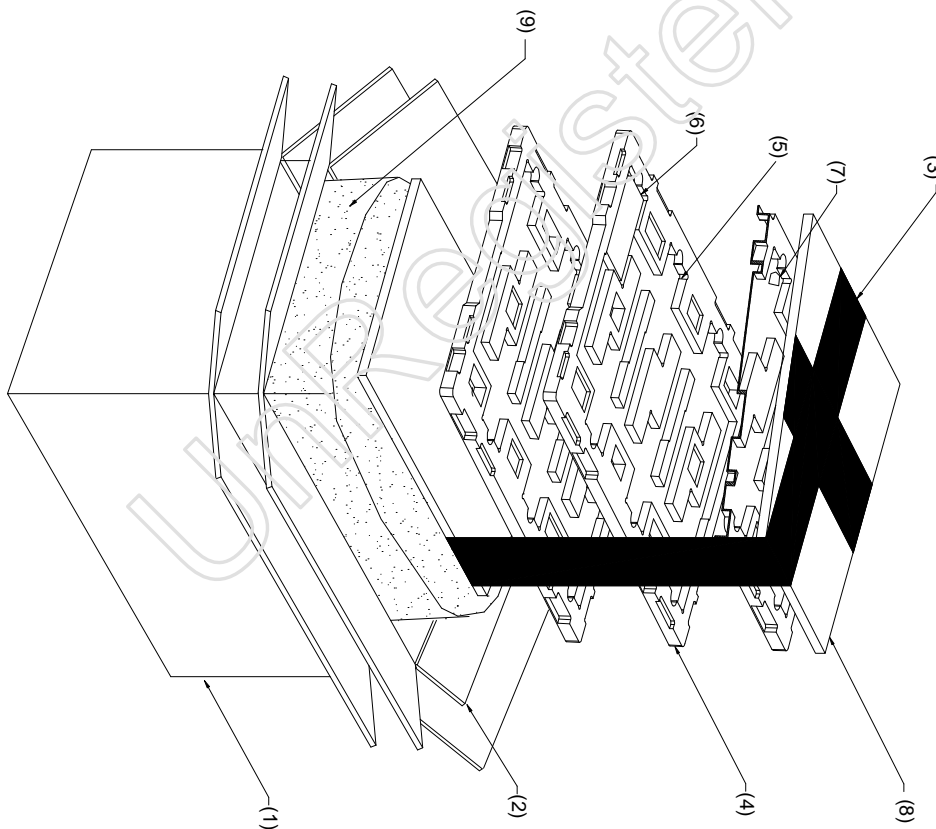
## 8. PACKAGE

NO.	ITEM	UNIT	QTY PER	REMARK
1	CARTON	PCS	1	400*300*285
2	SUB-CARTON	PCS	1	375*270*280
3	ADHESIVE TAP	m	1	++ SHAPE
4	PSPK TRAY	PCS	16	ESD 10 <sup>6</sup> ~10 <sup>7</sup>
5	PEARL PAD	PCS	15	ESD 10 <sup>6</sup> ~10 <sup>7</sup>
6	MODULE	PCS	30	BE CAREFUL INPUT
7	DRYER	PCS	8	
8	PAPER BOARD	PCS	2	
9	PE BAG	PCS	1	ESD 10 <sup>6</sup> ~10 <sup>7</sup>

### Specification:

One sub-carton contains 16 layers packings, 6 modules in each PSPK tray of 15 layers. A stiff board is put on bottom and top side to stiffen the packings and it is adhered together with adhesive tape. Put the whole stack into PE bag and on top put 8 packets of dryers then adhered the PE bag. The sub-carton are placed into the outside carton.

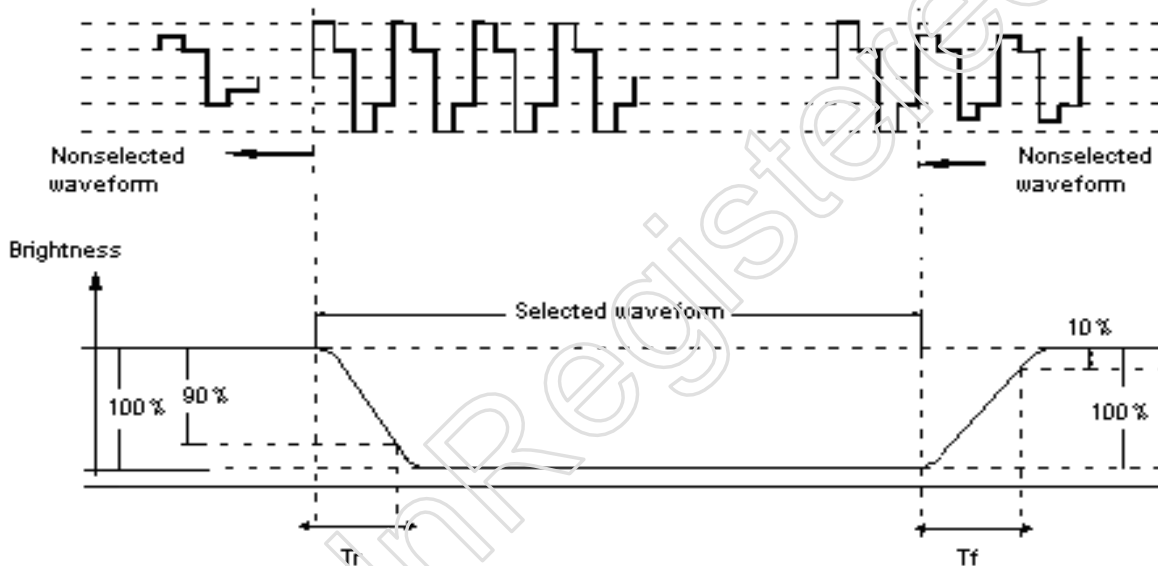
One carton can contain 6\*15=90 modules.



## 9. ELETRO-OPTICAL CHARACTERISTICS

NO	ITEM		Symbol	Temp <sup>o</sup> C	Rating			Unit
					Min	Typ	Max	
1	Response time	Rise time	Tr	25	-	80	400	ms
		Fall time	Tf	25	-	135	400	
2	Operating Frequency		Fr	25	-	78	-	Hz
3	Contrast Rate		Cr	25	2	6	-	-
4	Viewing Direction		6 O'CLOCK					
5	Viewing Angle Cr $\geq$ 2	12H $\psi$ =90 $^{\circ}$	$\theta$ 1	25	30	40	-	Deg
		6H $\psi$ =270 $^{\circ}$	$\theta$ 2		30	40	-	
		3H $\psi$ =0 $^{\circ}$	$\theta$ 3		25	35	-	
		9H $\psi$ =180 $^{\circ}$	$\theta$ 4		25	45	-	
6	Current Consumption		Is	25	-	18.8	28.2	$\mu$ A
7	Capacitance		C	25	-	9.7	-	nF

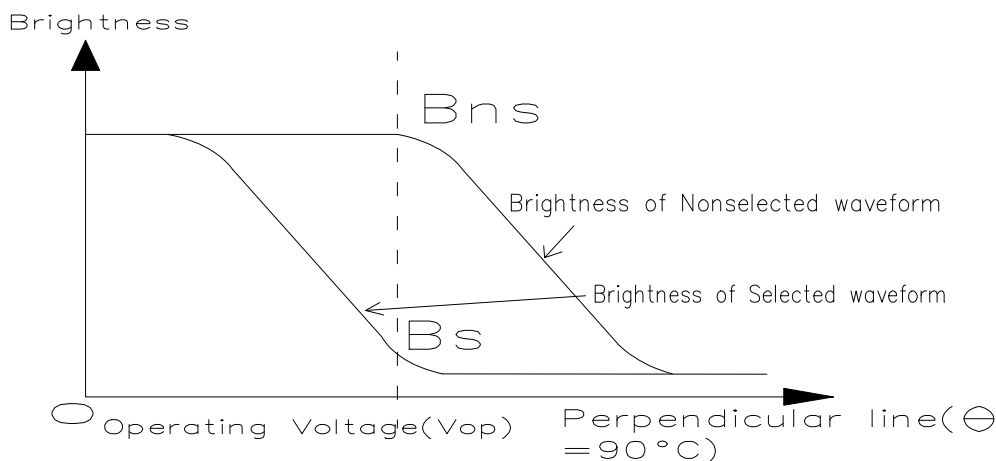
### Response Time



### Measuring Condition:

1. Driving waveform: 1/N Duty, 1/a Bias selected waveform.
2. Driving Frequency: Typical value in Individual specification.
3. Operating Voltage: LCD driving voltage getting maximum contrast rate.
4. Measuring Angle: See Individual Specification.
5. Measuring Temperature: See Individual Specification.

## Contrast Ratio Definition



$$\text{Contrast Ratio(Cr)} = \frac{\text{Brightness of non-selected waveform}(B_{ns})}{\text{Brightness of selected waveform}(B_s)}$$

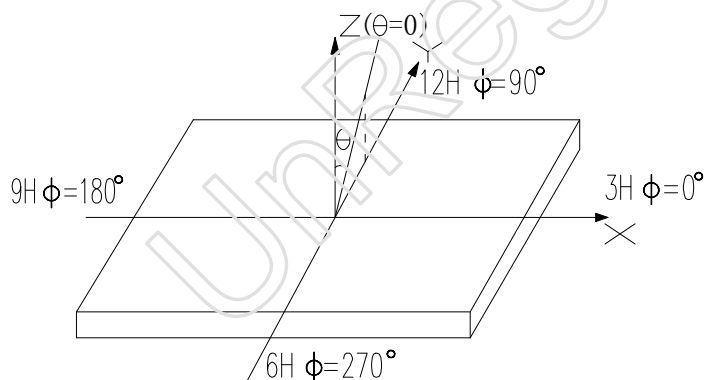
## Viewing Angle

$\theta$ : Angle between Viewer Direction and Normal.

$$(-90^\circ \leq \theta \leq 90^\circ)$$

$\phi$ : Angle between Projection of Viewer Direction to X-Y plane and Y axis.

$$(0^\circ \leq \phi \leq 360^\circ)$$



## Measuring Condition

1. Driving Voltage: Same as  $V_{LCD}$
2. Driving Frequency: Same as Frame Frequency

## 10. QUALITY SPECIFICATION

### 10-1. Specification of quality assurance

#### 10-1-1. Purpose

Standardize the Quality Assurance of LCD module products supply to purchaser by SW

#### 10-1-2. Type of Quality Test

##### a. Inspection:

Before delivering, the supplier should take the following tests, and affirm the quality of product.

##### b. Electro-Optical Characteristics:

Test the product according to the individual specification.

##### c. Test of Appearance Characteristics:

Check the product according to the individual specification.

##### d. Test of Reliability Characteristics:

##### e. Delivery Test:

Before delivering, the supplier should take the delivery test.

( I ) Test method: According to ISO 2859-1.General Inspection Level II take a single time.

( II ) The defects classify of AQL as following:

Major defect: AQL = 0.65%

Minor defect: AQL = 2.5%

Total defects: AQL = 0.65%

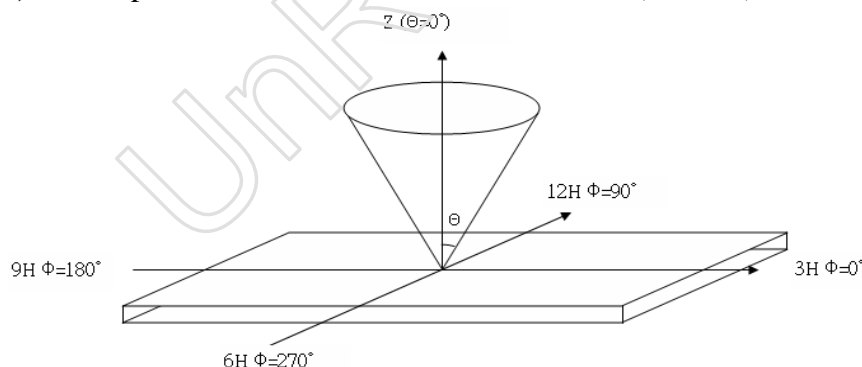
#### 10-1-3. Standard of Product Appearance Inspection

##### a. Conditions of appearance inspection :

( I ) The inspection must be under 20W × 2 or 40W fluorescent light, and the distance of view must be at 30±5cm.

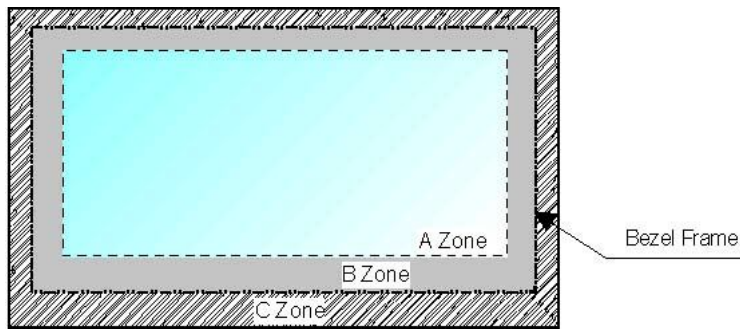
( II ) When inspecting the model of transmissive product must add the reflective plate.

( III ) The inspection direction is 30° off vertical line( $\Theta \leq 30^\circ$ ).



(IV) Temperature: 25±5°C      Humidity: 60±10%RH

(V) Definition of Applicable Zones:



A Zone : Active display area

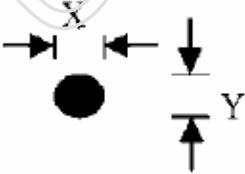
B Zone : Area from outside of "A Zone" to validity viewing area

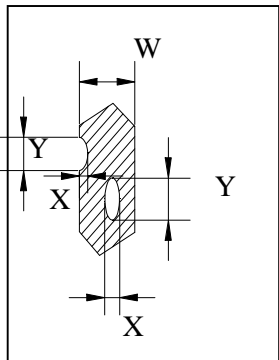
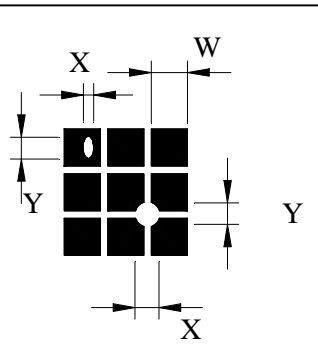
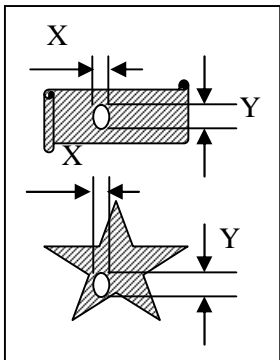
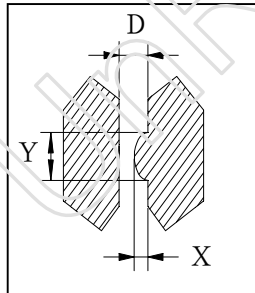
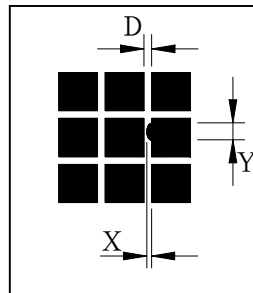
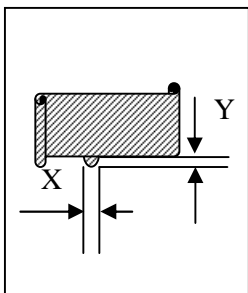
C Zone : Rest parts

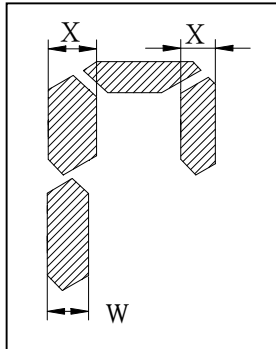
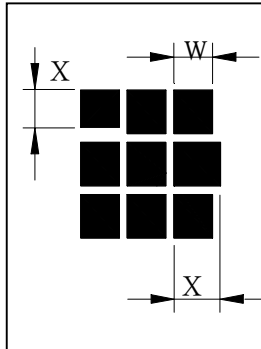
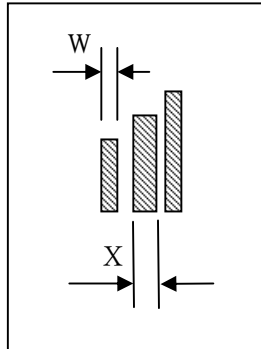
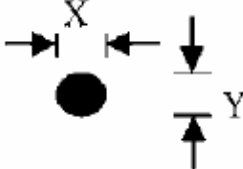
A Zone + B Zone = Validity viewing area

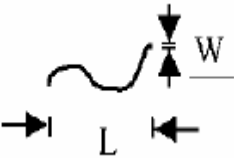
b. Unit of inspection : mm

#### 10-1-4. Defect Inspection Specification

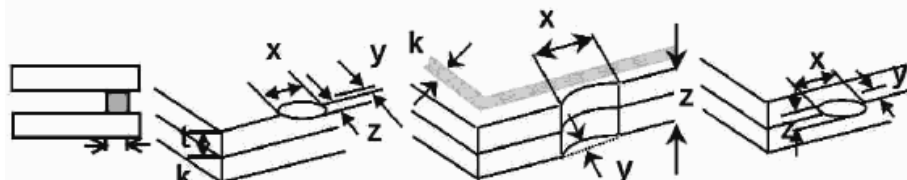
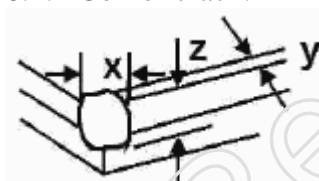
NO	Item	Criterion	AQL								
01	Electrical Testing	1.1 Missing line. 1.2 Missing character, dot or icon. 1.3 Display malfunction. 1.4 No function or no display. 1.5 Current consumption exceeds product specifications. 1.6 LCD viewing angle defect.	0.65								
02	Black or White spots or Bright spots or Color spots on LCD (Display “ON”)	<div><div><math display="block">\Phi = (X+Y) / 2</math></div><table><tr><th>Size(mm)</th><th>Acceptable Q'ty</th></tr><tr><td><math>\Phi \leq 0.15</math></td><td>Accept no dense</td></tr><tr><td><math>0.15 &lt; \Phi \leq 0.3</math></td><td>5</td></tr><tr><td><math>0.3 &lt; \Phi</math></td><td>0</td></tr></table><div><p>* For “Accept no Dense”, no more than five spots within 5mm.</p><p>* The distance between two defects should more than 5mm.</p><p>* Spot during display switching is considered as acceptable.</p></div></div>	Size(mm)	Acceptable Q'ty	$\Phi \leq 0.15$	Accept no dense	$0.15 < \Phi \leq 0.3$	5	$0.3 < \Phi$	0	2.5
Size(mm)	Acceptable Q'ty										
$\Phi \leq 0.15$	Accept no dense										
$0.15 < \Phi \leq 0.3$	5										
$0.3 < \Phi$	0										

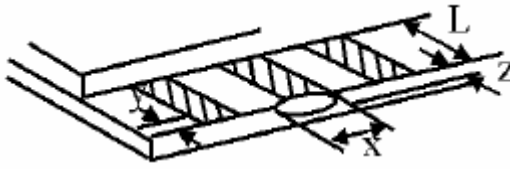
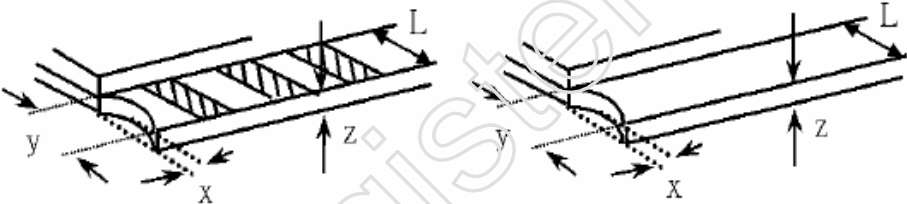
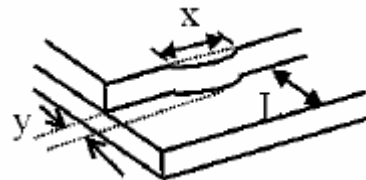
NO	Item	Criterion	AQL												
03	Pin Hole or Distortion	<div>3.1 Pin Hole:</div> <div><div><div>Segment</div></div><div><div>Dot Matrix</div></div><div><div>Pattern</div></div></div> <div><math>\varnothing = (X+Y)/2</math></div> <table><tr><th>Wide (W)</th><th>Dimension (Ø)</th><th>Acceptable Number</th></tr><tr><td>-----</td><td><math>\varnothing &lt; 0.10</math></td><td>Accept no dense</td></tr><tr><td><math>W \leq 0.4</math></td><td><math>\varnothing \leq 0.15</math> and <math>X \leq 1/2W</math></td><td>2</td></tr><tr><td><math>W &gt; 0.4</math></td><td><math>\varnothing \leq 0.20</math> and <math>X \leq 1/3W</math></td><td>2</td></tr></table> <div><div>* For “Accept no Dense”, no more than 3 spots within 5mm.</div><div>* Shall not more than 2 defects and the distance between two defects should more than 10mm.</div></div>	Wide (W)	Dimension (Ø)	Acceptable Number	-----	$\varnothing < 0.10$	Accept no dense	$W \leq 0.4$	$\varnothing \leq 0.15$ and $X \leq 1/2W$	2	$W > 0.4$	$\varnothing \leq 0.20$ and $X \leq 1/3W$	2	2.5
		Wide (W)	Dimension (Ø)	Acceptable Number											
-----	$\varnothing < 0.10$	Accept no dense													
$W \leq 0.4$	$\varnothing \leq 0.15$ and $X \leq 1/2W$	2													
$W > 0.4$	$\varnothing \leq 0.20$ and $X \leq 1/3W$	2													
<div>3.2 Distortion ( Dot Shape)</div> <div><div><div>Segment</div></div><div><div>Dot Matrix</div></div><div><div>Pattern</div></div></div> <div><div>D: Space</div><math>\varnothing = (X+Y)/2</math></div> <table><tr><th>Size (Ø)</th><th>Acceptable Qty</th></tr><tr><td><math>\varnothing &lt; 0.10</math></td><td>Disregard</td></tr><tr><td><math>\varnothing \leq 0.20</math> and <math>X \leq 1/2D</math></td><td>2</td></tr><tr><td><math>\varnothing &gt; 0.20</math> or <math>X &gt; 1/2D</math></td><td>0</td></tr></table> <div>IF <math>Y &gt; 0.5</math> , follow Item 3.3-</div>	Size (Ø)	Acceptable Qty	$\varnothing < 0.10$	Disregard	$\varnothing \leq 0.20$ and $X \leq 1/2D$	2	$\varnothing > 0.20$ or $X > 1/2D$	0	2.5						
Size (Ø)	Acceptable Qty														
$\varnothing < 0.10$	Disregard														
$\varnothing \leq 0.20$ and $X \leq 1/2D$	2														
$\varnothing > 0.20$ or $X > 1/2D$	0														

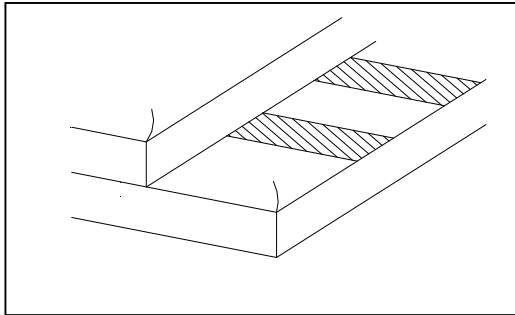
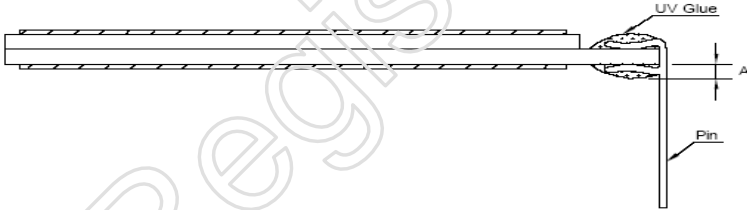
NO	Item	Criterion	AQL												
03	Pin Hole or Distortion	<div> <div> <p>3.3 Distortion (Thick or Thin):</p> <div> <div> <p>Segment</p>  </div> <div> <p>Dot Matrix</p>  </div> <div> <p>Pattern</p>  </div> </div> <table> <tr> <th>Wide(W)</th> <th>Distortion Wide ( X )</th> <th>Acceptable Qty</th> </tr> <tr> <td>-----</td> <td><math> X - W  \leq 0.10</math></td> <td>Disregard</td> </tr> <tr> <td><math>W \leq 4\text{mm}</math></td> <td><math> X - W  \leq 0.20</math> and <math>X \geq 1/2W</math></td> <td>2</td> </tr> <tr> <td><math>W &gt; 4\text{mm}</math></td> <td><math> X - W  \leq 0.30</math></td> <td>2</td> </tr> </table> <div> <p>* Total defects shall not exceed 3.</p> <p>* Distortion thickness cannot over 1/2 width of dot gap.</p> </div> </div> </div>	Wide(W)	Distortion Wide ( X )	Acceptable Qty	-----	$ X - W  \leq 0.10$	Disregard	$W \leq 4\text{mm}$	$ X - W  \leq 0.20$ and $X \geq 1/2W$	2	$W > 4\text{mm}$	$ X - W  \leq 0.30$	2	2.5
Wide(W)	Distortion Wide ( X )	Acceptable Qty													
-----	$ X - W  \leq 0.10$	Disregard													
$W \leq 4\text{mm}$	$ X - W  \leq 0.20$ and $X \geq 1/2W$	2													
$W > 4\text{mm}$	$ X - W  \leq 0.30$	2													
04	LCD and Touch Panel black spots, white spots, contamination (Display “OFF”)	<div> <div> <p>4.1 Round type: As following drawing</p> <math display="block">\Phi = (X+Y) / 2</math>  <table> <tr> <th>Size(mm)</th> <th>Acceptable Q'ty</th> </tr> <tr> <td><math>\Phi \leq 0.1</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>0.1 &lt; \Phi \leq 0.2</math></td> <td>3</td> </tr> <tr> <td><math>0.2 &lt; \Phi \leq 0.25</math></td> <td>2</td> </tr> <tr> <td><math>0.25 &lt; \Phi \leq 0.35</math></td> <td>1</td> </tr> <tr> <td><math>0.35 &lt; \Phi</math></td> <td>0</td> </tr> </table> </div> <div> <p>* For “Accept no Dense”, no more than five spots within 5mm.</p> <p>* The distance between two defects should more than 5mm.</p> <p>* Outside of the V.A. is disregard.</p> </div> </div>	Size(mm)	Acceptable Q'ty	$\Phi \leq 0.1$	Accept no dense	$0.1 < \Phi \leq 0.2$	3	$0.2 < \Phi \leq 0.25$	2	$0.25 < \Phi \leq 0.35$	1	$0.35 < \Phi$	0	2.5
Size(mm)	Acceptable Q'ty														
$\Phi \leq 0.1$	Accept no dense														
$0.1 < \Phi \leq 0.2$	3														
$0.2 < \Phi \leq 0.25$	2														
$0.25 < \Phi \leq 0.35$	1														
$0.35 < \Phi$	0														

NO	Item	Criterion	AQL															
04	LCD and Touch Panel black spots, white spots, contamination (Display “OFF”)	<div> <div> 4.2 Line type: (As following drawing) <div>  <table> <tr> <th>Length(mm)</th> <th>Width(mm)</th> <th>Acceptable Q'ty</th> </tr> <tr> <td>---</td> <td><math>W \leq 0.02</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>L \leq 3</math></td> <td><math>0.02 &lt; W \leq 0.05</math></td> <td>2</td> </tr> <tr> <td><math>L \leq 2</math></td> <td><math>0.05 &lt; W \leq 0.08</math></td> <td>1</td> </tr> <tr> <td>---</td> <td><math>0.08 &lt; W</math></td> <td>Rejection</td> </tr> </table> </div> <div> <p>* For “Accept no Dense”, no more than 2 lines within 5mm.</p> <p>* The distance between two defects should more than 5mm</p> <p>* Outside of the V.A. is disregard.</p> </div> </div> </div>	Length(mm)	Width(mm)	Acceptable Q'ty	---	$W \leq 0.02$	Accept no dense	$L \leq 3$	$0.02 < W \leq 0.05$	2	$L \leq 2$	$0.05 < W \leq 0.08$	1	---	$0.08 < W$	Rejection	2.5
Length(mm)	Width(mm)	Acceptable Q'ty																
---	$W \leq 0.02$	Accept no dense																
$L \leq 3$	$0.02 < W \leq 0.05$	2																
$L \leq 2$	$0.05 < W \leq 0.08$	1																
---	$0.08 < W$	Rejection																
05	Polarizer bubbles	<table> <tr> <th>Size <math>\Phi</math>(mm)</th> <th>Acceptable Q'ty</th> </tr> <tr> <td><math>\Phi \leq 0.20</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.50</math></td> <td>3</td> </tr> <tr> <td><math>0.50 &lt; \Phi \leq 1.00</math></td> <td>2</td> </tr> <tr> <td><math>1.00 &lt; \Phi</math></td> <td>0</td> </tr> <tr> <td>Total Q'ty</td> <td>3</td> </tr> </table> <div> <p>* For “Accept no Dense”, no more than 2 bubbles within 5mm.</p> <p>* The distance between two defects should more than 5mm.</p> <p>* Outside of the V.A. is disregard.</p> </div>	Size $\Phi$ (mm)	Acceptable Q'ty	$\Phi \leq 0.20$	Accept no dense	$0.20 < \Phi \leq 0.50$	3	$0.50 < \Phi \leq 1.00$	2	$1.00 < \Phi$	0	Total Q'ty	3	2.5			
Size $\Phi$ (mm)	Acceptable Q'ty																	
$\Phi \leq 0.20$	Accept no dense																	
$0.20 < \Phi \leq 0.50$	3																	
$0.50 < \Phi \leq 1.00$	2																	
$1.00 < \Phi$	0																	
Total Q'ty	3																	
06	Polarizer Scratches/ Puncture	Follow Item 4.	2.5															
07	Polarizer dirt	Dirt on polarizer which can be clean or blow away is acceptable.	2.5															



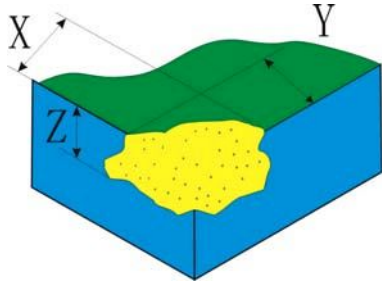
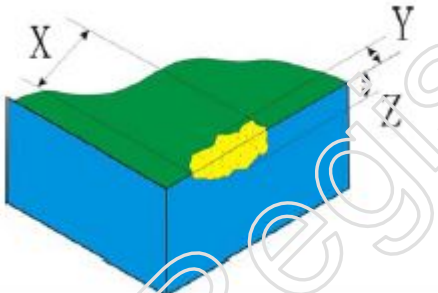
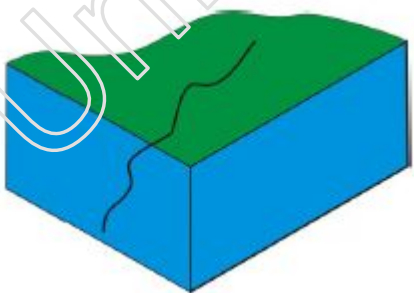
NO	Item	Criterion	AQL																		
08	Chipped glass	<div> <div> <p>Symbols:</p> <p>x: Chip length                      y: Chip width                      z: Chip thickness</p> <p>k: Seal width                      t: Glass thickness                      a: LCD side length</p> <p>L: Electrode pad length</p> <p>8.1 General glass chip:</p> <p>8.1.1 Chip on panel surface and crack between panels:</p>  <table> <tr> <th>z: Chip thickness</th> <th>y: Chip width</th> <th>x: Chip length</th> </tr> <tr> <td><math>Z \leq 1/2t</math></td> <td>Not over viewing area</td> <td><math>x \leq 1/8a</math></td> </tr> <tr> <td><math>1/2t &lt; z \leq 2t</math></td> <td>Not exceed <math>1/3k</math></td> <td><math>x \leq 1/8a</math></td> </tr> </table> <p>◆ Unit: mm</p> <p>◆ If there are 2 or more chips, x is the total length of each chip</p> <p>8.1.2 Corner crack:</p>  <table> <tr> <th>z: Chip thickness</th> <th>y: Chip width</th> <th>x: Chip length</th> </tr> <tr> <td><math>Z \leq 1/2t</math></td> <td>Not over viewing area</td> <td><math>x \leq 1/8a</math></td> </tr> <tr> <td><math>1/2t &lt; z \leq 2t</math></td> <td>Not exceed <math>1/3k</math></td> <td><math>x \leq 1/8a</math></td> </tr> </table> <p>◆ Unit: mm</p> <p>◆ If there are 2 or more chips, x is the total length of each chip</p> </div> </div>	z: Chip thickness	y: Chip width	x: Chip length	$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$	$1/2t < z \leq 2t$	Not exceed $1/3k$	$x \leq 1/8a$	z: Chip thickness	y: Chip width	x: Chip length	$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$	$1/2t < z \leq 2t$	Not exceed $1/3k$	$x \leq 1/8a$	2.5
z: Chip thickness	y: Chip width	x: Chip length																			
$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$																			
$1/2t < z \leq 2t$	Not exceed $1/3k$	$x \leq 1/8a$																			
z: Chip thickness	y: Chip width	x: Chip length																			
$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$																			
$1/2t < z \leq 2t$	Not exceed $1/3k$	$x \leq 1/8a$																			

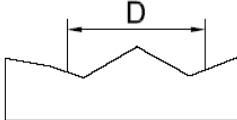
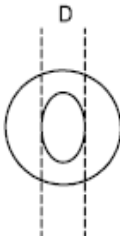
NO	Item	Criterion	AQL																
09	Glass crack	<p>Symbols: x: Chip length                      y: Chip width                      z: Chip thickness k: Seal width                      t: Glass thickness                      a: LCD side length L: Electrode pad length</p> <p>9.1 Protrusion over terminal: 9.1.1 Chip on electrode pad:</p>  <table><tr><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></tr><tr><td><math>y \leq 0.5\text{mm}</math></td><td><math>x \leq 1/8a</math></td><td><math>0 &lt; z \leq t</math></td></tr></table> <p>9.1.2 Non-conductive portion:</p>  <table><tr><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></tr><tr><td><math>y \leq L</math></td><td><math>x \leq 1/8a</math></td><td><math>0 &lt; z \leq t</math></td></tr></table> <p>◆ If there chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications.</p> <p>◆ Heatseal alignment mark must not be damaged.</p> <p>9.1.3 Substrate protuberance and internal crack</p>  <table><tr><td>y: width</td><td>x: length</td></tr><tr><td><math>y \leq 1/3L</math></td><td><math>X \leq a</math></td></tr></table>	y: Chip width	x: Chip length	z: Chip thickness	$y \leq 0.5\text{mm}$	$x \leq 1/8a$	$0 < z \leq t$	y: Chip width	x: Chip length	z: Chip thickness	$y \leq L$	$x \leq 1/8a$	$0 < z \leq t$	y: width	x: length	$y \leq 1/3L$	$X \leq a$	2.5
y: Chip width	x: Chip length	z: Chip thickness																	
$y \leq 0.5\text{mm}$	$x \leq 1/8a$	$0 < z \leq t$																	
y: Chip width	x: Chip length	z: Chip thickness																	
$y \leq L$	$x \leq 1/8a$	$0 < z \leq t$																	
y: width	x: length																		
$y \leq 1/3L$	$X \leq a$																		

NO	Item	Criterion	AQL
10	Progressive crack line	 <p>10.1 Crack is crack line extend to inner edge .  10.2 Crack round epoxy frame will be rejected.  10.3 Crack on the terminal will be rejected: Z=T length &gt;1mm  or Z&lt;T length &gt;2mm  10.4 Crack at ITO will be rejected.</p>	2.5
11	PIN	<p>11.1 PIN slant not per specification. If the specification does not describe this item , the slant of PIN to ITO pad must <math>\leq 0.25\text{mm}</math>.  11.2 The UV glue of PIN cannot higher than upper polarizer.  11.3 The UV glue height of A shall be <math>\leq 2\text{mm}</math></p>  <p>11.4 The terminal of PIN cannot have UV glue.  11.5 Damage of PIN such as scratch affect customer soldering.  11.6 The inclination tolerance of PIN <math>\leq \pm 5^\circ</math> unless otherwise stated.  11.7 Pin type not according to specification sheet.  11.8 LCD pin loose or missing pins.</p>	2.5

NO	Item	Criterion	AQL														
12	Marking (Printing & Silkscreen)	<div> <div> 12.1The marking pattern different from specification. 12.2Marking colour wrong or different from colour limit sample 12.3Marking line not consistence in thickness or broken line 12.4Marking position deviated. Base on tolerance specified and unspecified tolerance base on ±0.20mm. Marking line should not overlap with display unless otherwise specified. 12.5Marking Line Width Criteria: <table> <tr> <td>W: Designed Width</td> <td>P: Actual Width</td> </tr> <tr> <td>W ≤ 0.40</td> <td> W-P  ≤ 1/2W</td> </tr> <tr> <td>W &gt; 0.40</td> <td> W-P  ≤ 0.2</td> </tr> </table> <div>Note: Unless otherwise specified.</div> 12.6Marking Pinhole or Distortion: <table> <tr> <td>Size</td> <td>Accepted Qty</td> </tr> <tr> <td>Ø &lt; 0.10</td> <td>Disregard</td> </tr> <tr> <td>0.10 &lt; Ø ≤ 0.20</td> <td>2</td> </tr> <tr> <td>0.20 &lt; Ø</td> <td>0</td> </tr> </table> <div>Note: The distance between two defects should be greater than 5mm</div> 12.7Marking Black spot or Scratches controlled base on inspection specification Item 4. 12.8Smear allowed: ≤ 0.20mm </div> </div>	W: Designed Width	P: Actual Width	W ≤ 0.40	W-P  ≤ 1/2W	W > 0.40	W-P  ≤ 0.2	Size	Accepted Qty	Ø < 0.10	Disregard	0.10 < Ø ≤ 0.20	2	0.20 < Ø	0	2.5
W: Designed Width	P: Actual Width																
W ≤ 0.40	W-P  ≤ 1/2W																
W > 0.40	W-P  ≤ 0.2																
Size	Accepted Qty																
Ø < 0.10	Disregard																
0.10 < Ø ≤ 0.20	2																
0.20 < Ø	0																
13	Bezel	<div> <div> Bezel not complies with product specifications. <div>Note: Scratch or prick which does not affect customer assembly is considered as acceptable.</div> </div> </div>	2.5														
14	FPC	<div> <div> 14.1 FPC terminal damage ≤ 1/2 FPC terminal width and does not affect functional is considered acceptable. 14.2 FPC alignment hole damage ≤ 1/2 alignment area and does not affect the functional and assembly of customer are considered acceptable. 14.3 Foreign material or dirt on conductor pads which can be clean and does not affect functional is consider acceptable. </div> </div>	2.5														

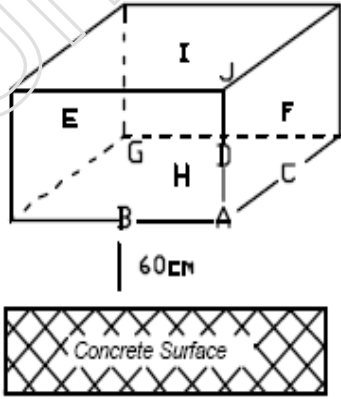
NO	Item	Criterion	AQL
15	SMT、COB	15.1 COB epoxy with pinholes larger than 0.5mm. 15.2 COB epoxy with exposed IC. 15.3 The height of the COB should not exceed the height indicated in the assembly diagram. 15.4 Epoxy encap exceed more than 3mm of the silkscreen printing 15.5 Wrong parts, missing parts or excess parts. 15.6 Jumper on the PCBA not conformed to the product characteristic chart. 15.7 PCBA cosmetic control base on latest IPC standard, IPC-A-610, acceptable limit of grade 2. 15.8 Cold solder joints, missing solder connections. 15.9 Short circuits in components on PCB or FPC. 15.10 Bezel loose assembly Note: Bend angle for bezel assembly should be within the range of 15° ~60°	2.5 0.65 2.5 2.5 0.65 0.65 2.5 0.65 0.65 0.65 2.5
16	Backlight	16.1 Spots or scratches that appear when backlight on to be reviewed using Item .4 standards. 16.2 Backlight unable to light-up.	2.5
17	TAB	Oxidation on pin surface that result solderability issue Note: a) Solderability condition: 310°C±10°C, 3sec (hand solder) or 280°C±10°C, 3sec (DIP) b) Wrinkles on TAB pin but not broken is consider as acceptable.	2.5

NO	Item	Criterion	AQL
18	Touch Panel Chipped glass	<p>18.1 Chip And Crack            Corner crack: <math>X &lt; 3.0\text{mm}</math> and <math>Y &lt; 3.0\text{mm}</math> and <math>Z &lt; \text{GT}</math> ignored            18.1.1 Corner crack in the golden finger that seriously affects the product function.            18.1.2 Corner crack in the circuit that seriously affects product function .</p>  <p>GT : Glass Thickness</p> <p>18.2 Side crack: <math>X &lt; 4.0\text{mm}</math> and <math>Y &lt; 2.0\text{mm}</math> and <math>Z &lt; \text{GT}</math> ignored            18.2.1 Side crack in the golden finger that seriously affects the product function.            18.2.2 Side crack in the circuit that seriously affects product function</p>  <p>18.3 Progressive crack line.</p> 	2.5

NO	Item	Criterion	AQL										
19	Touch Panel(Fish eye、dent and bubble on film)	<table> <tr> <th>SIZE(mm)</th> <th>Acceptable Qty</th> </tr> <tr> <td><math>\Phi \leq 0.2</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>0.2 &lt; D \leq 0.4</math></td> <td>5</td> </tr> <tr> <td><math>0.4 &lt; D \leq 0.5</math></td> <td>2</td> </tr> <tr> <td><math>0.5 &lt; D</math></td> <td>0</td> </tr> </table> <div>   </div>	SIZE(mm)	Acceptable Qty	$\Phi \leq 0.2$	Accept no dense	$0.2 < D \leq 0.4$	5	$0.4 < D \leq 0.5$	2	$0.5 < D$	0	2.5
SIZE(mm)	Acceptable Qty												
$\Phi \leq 0.2$	Accept no dense												
$0.2 < D \leq 0.4$	5												
$0.4 < D \leq 0.5$	2												
$0.5 < D$	0												
20	Touch Panel Newton ring	Newton ring dimension < 1/2 touch panel area and affect font and line distortion(<1.5%).	2.5										
21	Touch Panel Linearity	Linearity <2.0% .	2.5										
22	General appearance	<p>22.1 Product packaging not the same as the Specification</p> <p>22.2 Product dimension and structure not conform to product specification sheet.</p> <p>Note:</p> <ul style="list-style-type: none"> <li>a) Wrinkles on protective tape or corner lifted <math>\leq 5\text{mm}</math> is considered acceptable.</li> <li>b) Dirt or scratches on protective film which does not transfer to polarizer is consider as acceptable</li> <li>c) Datecode position unless otherwise specified by customer, SW will decide for it.</li> <li>d) Datecode on module which is slight blur but still can be differentiated is considered as acceptable.</li> </ul>	2.5										

## 10.2 Standard Specification for Reliability

### 10.2 – 1. Standard Specifications for Reliability of LCD Module

Item	Description	
	Condition	Time (hrs)
High temp. (Storage)	80°C	240
High temp. (Operating)	70°C	240
Low temp. (Storage)	-30°C	240
Low temp. (Operating)	-25°C	240
High temp and high humidity .(Storage)	40°C/ 90%RH	240
Thermal shock (Storage)	-30°C → 20°C→80°C → 20°C (30 min → 5 min → 30 min →5 min)	10 cycles
Packing vibration	Frequency range : 10Hz ~ 55Hz Amplitude of vibration : 1.5mm Sweep time: 12 min X,Y,Z direction each 2 hours .	
Packing drop test	<p>To be measured after dropping from 60cm high on the concrete surface in packing state.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>Dropping method:</p> <p>Corner dropping : A Corner : once</p> <p>Edge dropping : B,C,D edge : once</p> <p>Face dropping: E, F, G, H, I, J face : once</p> </div> </div>	
Electrical Static Discharge	Air: ±6KV 150pF/330Ω 5 times Contact: ±4KV 150pF/330Ω 5 times	



**10.2 - 2. Testing Conditions and Inspection Criteria**

For the final test the testing sample must be stored at room temperature for 4 hours, after the tests listed in Table 10.2-1, Standard specifications for Reliability have been executed in order to ensure stability.

No	Item	Test Model	In section Criteria
01	Current Consumption	Refer To Specification	The current consumption should conform to the product specification.
02	Contrast	Refer To Specification	After the tests have been executed, the contrast ratio must be larger than 2.
03	Appearance	Visual inspection	Defect free.
04	ESD	Function test	After reset, no abnormalities in functions.

**10.2 - 3. MTBF**

MTBF	Functions, performance, appearance, etc. shall be free from remarkable deterioration within 100,000 hours under ordinary operating and storage conditions room temperature ( $25\pm5^{\circ}\text{C}$ ), normal humidity ( $50\pm10\%$ RH), and in area not exposed to direct sun light.
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**10.3.Warranty**

This product has been manufactured to specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we will not take responsibility if the product is used in medical devices, nuclear power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

1. We cannot accept responsibility for any defect arise after additional process of the product (including disassembly and reassembly), after product delivery.
2. We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.
3. We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed your company's acceptance inspection procedures.
4. We cannot accept responsibility for industrial property, which may arise through the use of your product, with exception to those issues relating directly to the structure or method of manufacturing of our product one year from SW production.
5. For Heatseal Product which required to heatseal by customer side, parts must be used within three months after delivery from factory.
6. For TAB Product which required to solder by customer side, parts must be used within three months after delivery from factory.

7. The liability of SW is limited to repair or replacement on the terms set forth below. SW will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between SW and the customer, SW will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with SW.

## 10.4 Precautions in Use of LCM

### 10.4-1 Handling of LCM

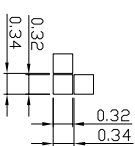
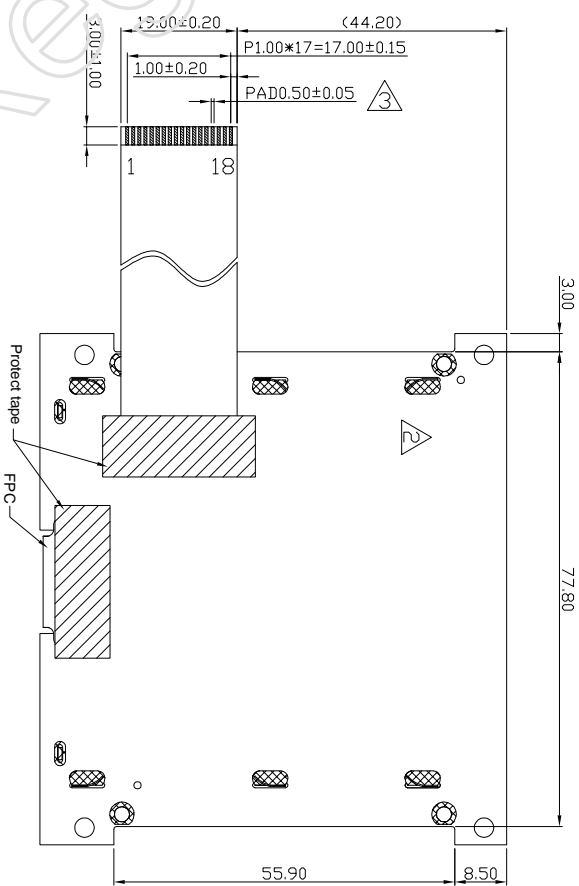
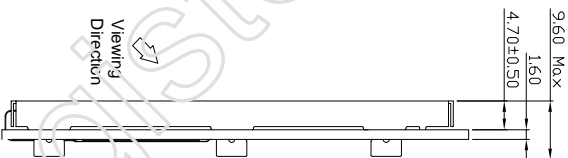
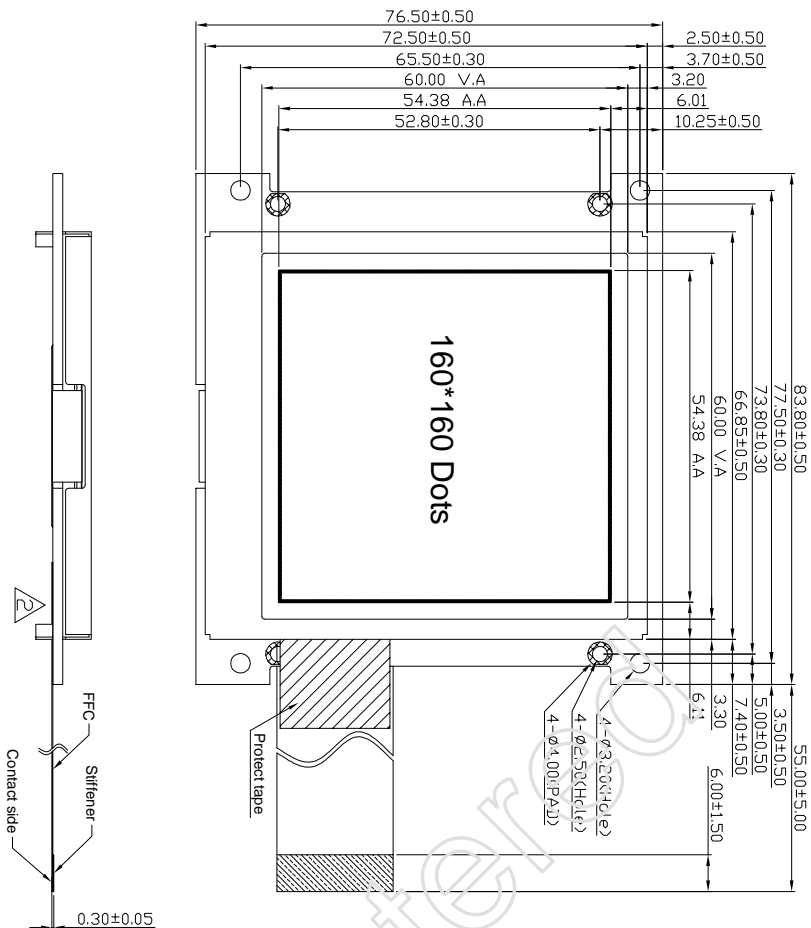
- Do not give external shock.
- Do not apply excessive force on the surface.
- Liquid Crystal in LCD is hazardous substance. Do not swallow it and when contact to hand, skin, cloth etc. Wash it out thoroughly and immediately.
- Do not operate it above the absolute maximum rating.
- Do not disassemble the LCM.
- The operators should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.
- The modules should be kept in antistatic bags or other containers resistant to static for storage.
- The module is coated with a film to protect the display surface. Be careful when peeling off this protective film as static electricity may be generated.

### 10.4-2 Storage

- Store in ambient temperature of  $25\pm5^{\circ}\text{C}$ , and relative humidity of  $50\pm10\%\text{RH}$ . Do not expose to sunlight or fluorescent light.
- Storage in a clean environment, free from dust, active gas, and solvent.
- Store in anti-static electricity container.
- Store without any physical load.
- Heat-seal must be stored at  $25^{\circ}\text{C}$  or less and 50% R.H. or less in a sealed condition, and must be used within three months after delivery from our factory.

### 10.4-3 Soldering

- Use only soldering irons with proper grounding and no leakage.
- Soldering: Not higher than  $310\pm10^{\circ}\text{C}$  and less than 3 sec during for hand soldering.
- Resoldering: no more than 2 times.



## Specification:

1. Display mode: FSTN/White-Black mode /Positive/Transflective(High Transmissive)
2. Drive condition: 1/160 Duty, 1/10Bias, V<sub>DD</sub>=3.3V, V<sub>LCD</sub>=16.5V
3. Viewing direction: 6 O'clock
4. Operating temperature: -25°C to +70°C
5. Storage temperature: -30°C to +80°C
6. Drive IC is: UC1698UGAC-NOP
7. Backlight color: White
8. Unspecified tolerance:  $\pm 0.30\text{mm}$ .
8. ROHS compliant

SOWAR				MOD. Name		SW160160-7				Sheet	1
DESIGNED				CHECKED		VERIFIED		APPROVED		Of	1
SCALE				FILE NAME		CS					
UNIT				SIZE		SCALE					
mm				A4							