WINSTAR

WINSTAR Display Co.,Ltd.
華凌光電股份有限公司

SPECIFICATION

CUSTOMER :

MODULE NO.: **WO24064B-TFH#**

APPROVED BY:		
(FOR CUSTOMER USE ONLY)	PCB VERSION:	DATA:

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

VERSION	DATE	REVISED PAGE NO.	SUMMARY
G	2020/12/30		Add Interface

Winstar Display Co.,

華凌光電股份有限公司

MODLE NO：	

RECORDS OF REVISION	**DOC. FIRST ISSUE**

VERSION	DATE	REVISED PAGE NO.	SUMMARY
0	2014/01/21		First issue
A	2016/01/06		Modify Response Time
B	2016/01/27		Modify Precautions in use of LCD Modules & Static electricity test
C	2016/11/21		Add FPC bending rule
D	2017/03/10		Modify Backlight Information
E	2019/08/27		Modify Material List of Components for RoHs
F	2019/12/17		Modify Precautions in use of LCD Modules
G	2020/12/30		Add Interface

Contents

1.Module Classification Information

<ins>W</ins>	<ins>O</ins>	<ins>24064</ins>	<ins>B</ins>	—	<ins>T</ins>	<ins>F</ins>	<ins>H</ins>	—	<ins>#</ins>
①	②	③	④		⑤	⑥	⑦		⑧

① Brand：WINSTAR DISPLAY CORPORATION

② Display Type：H→Character Type, G→Graphic Type , X→TAB Type, O→COG Type

③ Display Font： 240 * 64 dot

④ Model serials no.

⑤ Backlight Type：

N→Without backlight	T→LED, White	L→LED, Full color
B→EL, Blue green	A→LED, Amber	J→DIP LED,Blue
D→EL, Green	R→LED, Red	K→DIP LED,White
W→EL, White	O→LED, Orange	E→DIP LED, Yellow Green
M→EL, Yellow Green	G→LED, Green	H→DIP LED,Amber
F→CCFL, White	P→LED, Blue	I→DIP LED, Red
Y→LED, Yellow Green	X→LED, Dual color	
G→LED, Green	C→LED, Full color	

⑥ LCD Mode：

B→TN Positive, Gray	V→FSTN Negative, Blue
N→TN Negative,	T→FSTN Negative, Black
L→VA Negative	D→FSTN Negative (Double film)
H→ HTN Positive, Gray	F→FSTN Positive
I→HTN Negative, Black	K→FSC Negative
U→HTN Negative, Blue	S→FSC Positive
M→STN Negative, Blue	E→ISTN Negative, Black
G→STN Positive, Gray	C→CSTN Negative, Black
Y→STN Positive, Yellow Green	A→ASTN Negative, Black

⑦ LCD Polarize Type/ Temperature range/ View direction

A→Reflective, N.T, 6:00	H→Transflective, W.T,6:00
D→Reflective, N.T, 12:00	K→Transflective, W.T,12:00
G→Reflective, W. T, 6:00	C→Transmissive, N.T,6:00
J→Reflective, W. T, 12:00	F→Transmissive, N.T,12:00
B→Transflective, N.T,6:00	I→Transmissive, W. T, 6:00
E→Transflective, N.T.12:00	L→Transmissive, W.T,12:00

⑧ Special Code #：Fit in with the ROHS Directions and regulations

2.Precautions in use of LCD Modules

(1)Avoid applying excessive shocks to the module or making any alterations or modifications to it.

(2)Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD module.

(3)Don't disassemble the LCM.

(4)Don't operate it above the absolute maximum rating.

(5)Don't drop, bend or twist LCM.

(6)Soldering: only to the I/O terminals.

(7)Storage: please storage in anti-static electricity container and clean environment.

(8) Winstar have the right to change the passive components, including R3,R6 & backlight adjust resistors. (Resistors,capacitors and other passive components will have different appearance and color caused by the different supplier.)

(9)Winstar have the right to change the PCB Rev. (In order to satisfy the supplying stability, management optimization and the best product performance...etc, under the premise of not affecting the electrical characteristics and external dimensions, Winstar have the right to modify the version.)

(10) To ensure the stability of the display screen, please apply screen saver after showing 30 mins of fixed display content.

(11) The limitation of FPC bending
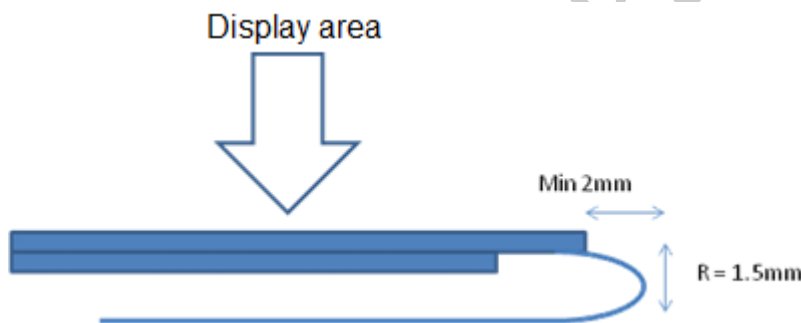
(12)Please heat up a little the tape sticking on the components when removing it; otherwise the components might be damaged.

3.General Specification

Item	Dimension	Unit
Number of dots	240 x 64	—
Module dimension	142.5 x 51.7 x 6.10	mm
View area	129.0 x 37.6	mm
Active area	127.17 x 33.89	mm
Dot size	0.5 x 0.5	mm
Dot pitch	0.53 x 0.53	mm
LCD type	FSTN Positive Transflective (In LCD production, It will occur slightly color difference. We can only guarantee the same color in the same batch.)	
Duty	1/64	
View direction	6 o'clock	
Backlight Type	LED, White	
IC	ST7586S-G4	
Interface	68 series /80 series/3-Line/4-Line	

4.Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T_{OP}	-20	—	+70	℃
Storage Temperature	T_{ST}	-30	—	+80	℃
Digital Power Supply Voltage	VDDI	-0.3	—	3.6	V
Analog Power supply voltage	VDDA	-0.3	—	3.6	V
LCD Power supply voltage	V0-XV0	-0.3	—	19	V
LCD Power supply voltage	VG	-0.3	—	5.5	V

5.Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	V_{DD}-V_{SS}	—	3.0	3.3	3.4	V
Supply Voltage For LCM	V0-XV0	Ta=-20℃	—	—	—	V
		Ta=25℃	9.8	10.0	10.2	V
		Ta=+70℃	—	—	—	V
Input High Volt.	V_{IH}	—	$0.7V_{DD}$	—	V_{DD}	V
Input Low Volt.	V_{IL}	—	Vss	—	$0.3 V_{DD}$	V
Output High Volt.	V_{OH}	—	$0.8 V_{DD}$	—	V_{DD}	V
Output Low Volt.	V_{OL}	—	Vss	—	$0.2V_{DD}$	V
Supply Current(No include LED Backlight)	I_{DD}	V_{DD}=3.3V	—	1.5	—	mA

Please kindly consider to design the Vop to be adjustable while programing the software to match LCD contrast tolerance.
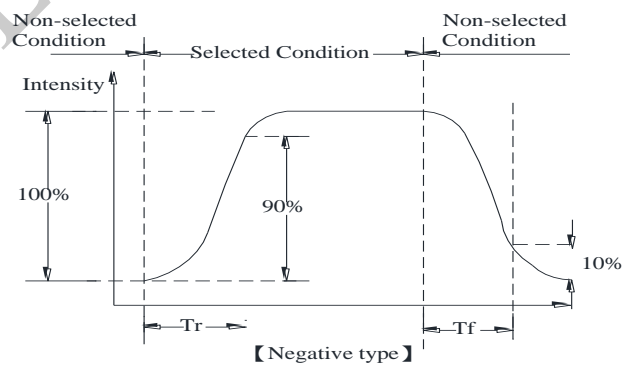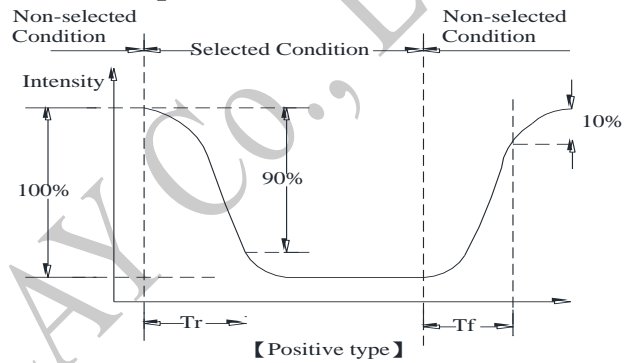
6.Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	θ	CR$\geqq$2	0	—	30	$\phi=180°$
	θ	CR$\geqq$2	0	—	60	$\phi=0°$
	θ	CR$\geqq$2	0	—	45	$\phi=90°$
	θ	CR$\geqq$2	0	—	45	$\phi=270°$
Contrast Ratio	CR	—	—	5	—	—
Response Time	T rise	—	—	200	300	ms
	T fall	—	—	250	350	ms

Definition of Operation Voltage (Vop)
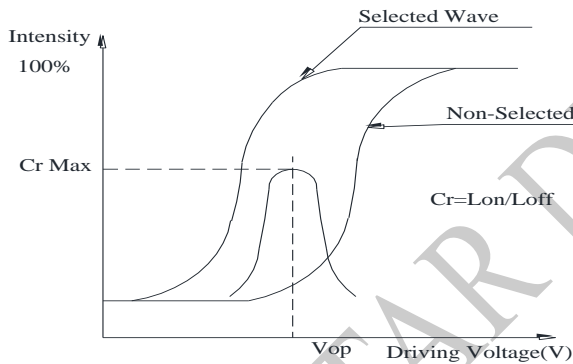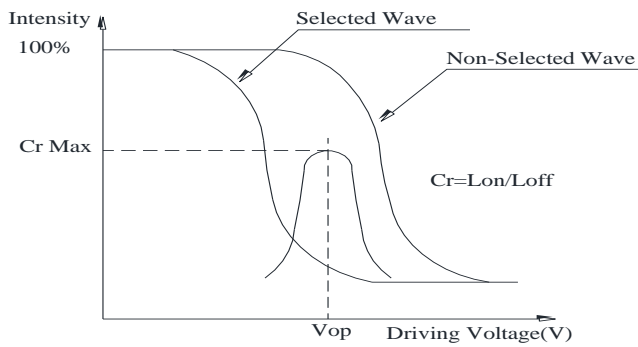
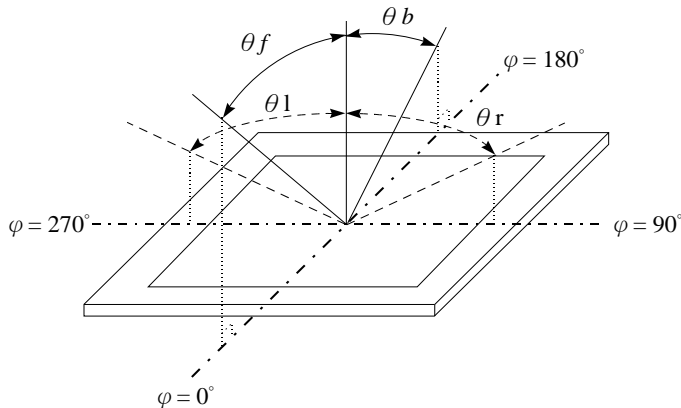**Definition of Response Time (Tr , Tf)**

Conditions :

Operating Voltage : Vop   Viewing Angle(θ , φ) : 0° , 0°
Frame Frequency : 64 HZ   Driving Waveform : 1/N duty , 1/a bias
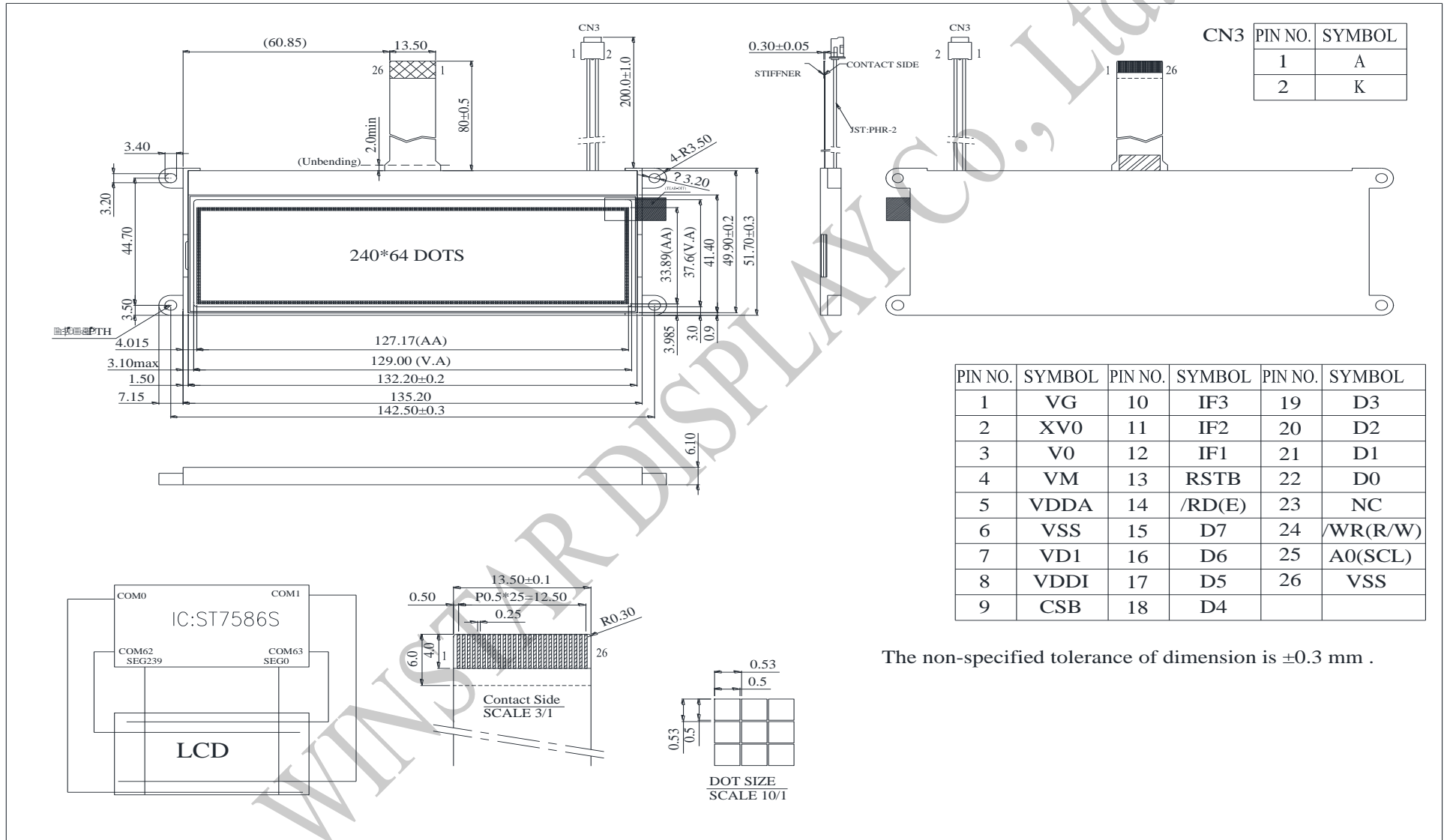
Definition of viewing angle(CR$\geqq$2)

7.Interface Pin Function

Pin No.	Symbol	I/O	Description
1	VG	P	VG is the power of SEG-drivers.
2	XV0	P	Negative operating voltage of COM-drivers.
3	V0	P	Positive operating voltage of COM-drivers. V0O is the output of the positive Vop generator. V0I is the positive Vop supply of LCD drivers. V0S is the sensor of the positive Vop generator. V0O, V0I & V0S should be separated on ITO and be connected together by FPC.
4	VM	P	VM is the non-select voltage level of COM-drivers.
5	VDDA	P	Analog power for internal booster.
6	VSS	P	Ground
7	VD1	P	VD1I is the power source of digital circuits.
8	VDDI	P	Power of interface I/O circuit.
9	CSB	Input	Chip select input pin. CSB="L": This chip is selected and the MPU interface is active.
10	IF3	Input	These pins select interface operation mode. <table><tr><td>IF3</td><td>IF2</td><td>IF1</td><td>MPU interface type</td></tr><tr><td>H</td><td>H</td><td>L</td><td>80 series 8-bit parallel</td></tr><tr><td>H</td><td>L</td><td>L</td><td>68 series 8-bit parallel</td></tr><tr><td>L</td><td>H</td><td>H</td><td>8-bit serial (4-Line)</td></tr><tr><td>L</td><td>H</td><td>L</td><td>9-bit serial (3-Line)</td></tr></table>Note: Refer to "Interface Selection" for detailed information.
11	IF2	Input	
12	IF1	Input	
13	RSTB	Input	Reset input pin. When RSTB is "L", internal initialization procedure is executed.
14	/RD(E)	Input	Read / Write execution control pin. (This pin is only used in parallel interface)
15	D7	I/O	The bi-directional data bus of the MPU interface. When CSB is "H", they are high impedance. If using serial interface: D0 is the SDA signal in 4-Line & 3-Line interface. D1 is the A0 signal in 4-Line interface
16	D6		
17	D5		
18	D4		
19	D3		
20	D2		
21	D1		
22	D0		
23	NC		No connection

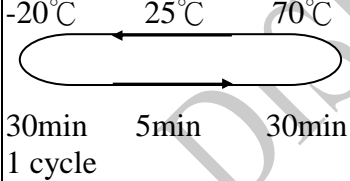| 24	/WR(R/W)	Input	Read / Write execution control pin. (This pin is only used in parallel interface)
25	A0(SCL)	Input	The function of this pin is different in parallel and serial interface. In parallel interface: A0 is register selection input.
26	VSS	P	Ground

8.Contour Drawing

240*64 DOTS

(60.85)
13.50
3.40
3.20
44.70
3.50
4.015
3.10max
1.50
7.15

127.17(AA)
129.00 (V.A)
132.20±0.2
135.20
142.50±0.3

2.0min
(Unbending)
80±0.5
26   1

CN3
1   2
200.0±1.0

0.30±0.05
STIFFNER
CONTACT SIDE
JST:PHR-2

CN3
2   1

1   26

4-R3.50
?3.20
33.89(AA)
37.6(V.A)
41.40
49.90±0.2
51.70±0.3
3.985
3.0
0.9
6.10

CN3	PIN NO.	SYMBOL
	1	A
	2	K

IC:ST7586S

	COM0	COM1
	COM62 SEG239	COM63 SEG0

LCD

13.50±0.1
0.50
P0.5*25=12.50
0.25
R0.30
6.0
4.0
1   26

Contact Side
SCALE 3/1

0.53
0.5
0.53
0.5

DOT SIZE
SCALE 10/1

PIN NO.	SYMBOL	PIN NO.	SYMBOL	PIN NO.	SYMBOL
1	VG	10	IF3	19	D3
2	XV0	11	IF2	20	D2
3	V0	12	IF1	21	D1
4	VM	13	RSTB	22	D0
5	VDDA	14	/RD(E)	23	NC
6	VSS	15	D7	24	/WR(R/W)
7	VD1	16	D6	25	A0(SCL)
8	VDDI	17	D5	26	VSS
9	CSB	18	D4		

The non-specified tolerance of dimension is ±0.3 mm .

Application schematic

9.Reliability

Content of Reliability Test (Wide temperature, -20℃~70℃)

Environmental Test			
Test Item	**Content of Test**	**Test Condition**	**Note**
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80℃ 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30℃ 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70℃ 200hrs	— —
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20℃ 200hrs	1
High Temperature/ Humidity storage	The module should be allowed to stand at 60℃,90%RH max For 96hrs under no-load condition excluding the polarizer, Then taking it out and drying it at normal temperature.	60℃,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation -20℃ 25℃ 70℃ 30min 5min 30min 1 cycle	-20℃/70℃ 10 cycles	— —
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±600V(contact), ±800v(air), RS=330Ω CS=150pF 10 times	— —

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal

      Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.
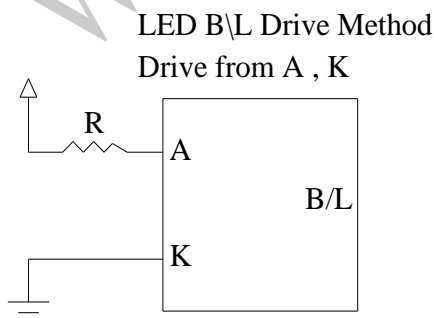
10.Backlight Information

Specification

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION
Supply Current	ILED	35	112	140	mA	V= 3.5 V(Note 1)
Supply Voltage	V	3.3	3.5	3.7	V	－
Reverse Voltage	VR	－	－	5	V	－
Color coordinate	X	0.27	0.30	0.33	－	－
	Y	0.26	0.29	0.32	－	－
Luminance (Without LCD)	IV	560	700	－	CD/M2	ILED= 112 mA
LED Life Time (For Reference only)	－	－	50K	－	Hr.	ILED= 112 mA 25℃,50-60%RH, (Note 2)
Color	White					
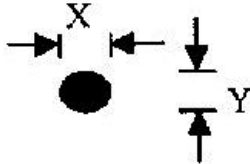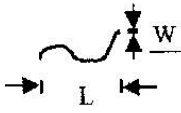
Note: The LED of B/L is drive by current only, drive voltage is for reference only.
　　　drive voltage can make driving current under safety area (current between
　　　minimum and maximum).

Note 1: Supply current minimum value is only for reference since LED brightness efficiency
　　　keeps enhancing. Current consumption becomes less and less to achieve the same
　　　luminance.
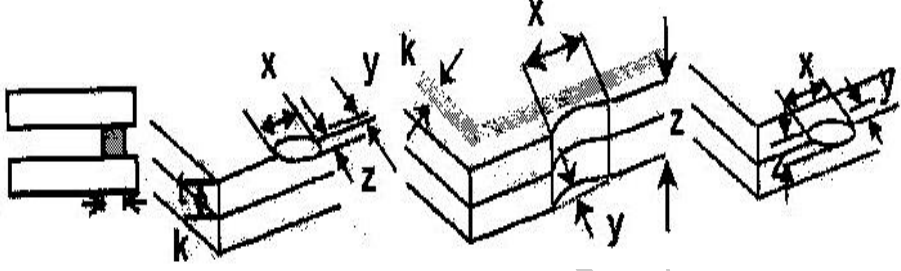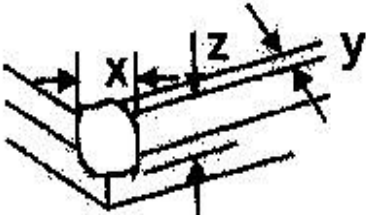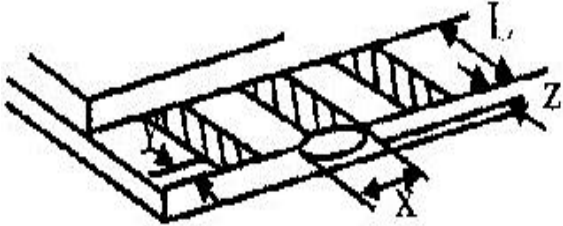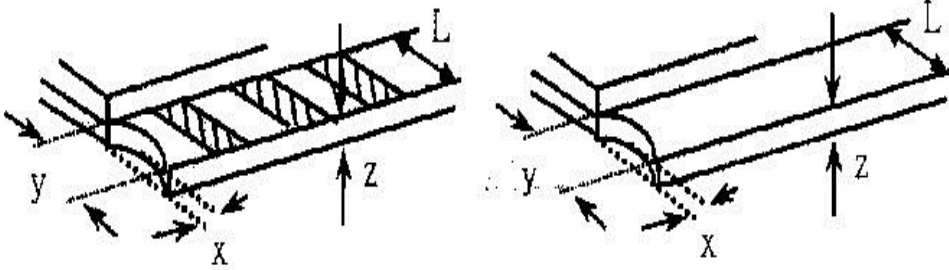
Note 2 :50K hours is only an estimate for reference.

LED B\L Drive Method
Drive from A , K
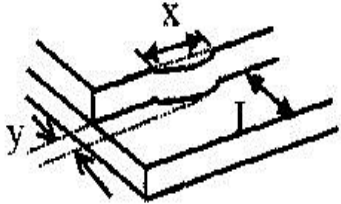
11.Inspection specification

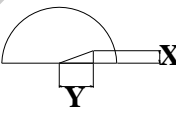| NO	Item	Criterion	AQL
01	Electrical Testing	Missing vertical, horizontal segment, segment contrast defect. Missing character , dot or icon. Display malfunction. No function or no display. Current consumption exceeds product specifications. LCD viewing angle defect. Mixed product types. Contrast defect.	0.65
02	Black or white spots on LCD (display only)	2.1 White and black spots on display $\leqq 0.25$mm, no more than three white or black spots present. 2.2 Densely spaced: No more than two spots or lines within 3mm	2.5
03	LCD black spots, white spots, contamination (non-display)	3.1 Round type : As following drawing $\Phi=(x + y) / 2$ | SIZE	Acceptable Q TY | |---|---| | $\Phi \leqq 0.10$ | Accept no dense | | $0.10 < \Phi \leqq 0.20$ | 2 | | $0.20 < \Phi \leqq 0.25$ | 1 | | $0.25 < \Phi$ | 0 |	2.5

3.1 Round type

$\Phi=(x + y) / 2$

SIZE	Acceptable Q TY
$\Phi \leqq 0.10$	Accept no dense
$0.10 < \Phi \leqq 0.20$	2
$0.20 < \Phi \leqq 0.25$	1
$0.25 < \Phi$	0

3.2 Line type : (As following drawing)

Length	Width	Acceptable Q TY
---	$W \leqq 0.02$	Accept no dense
$L \leqq 3.0$	$0.02 < W \leqq 0.03$	2
$L \leqq 2.5$	$0.03 < W \leqq 0.05$	
---	$0.05 < W$	As round type

AQL: 2.5

04	Polarizer bubbles	If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction.	Size Φ	Acceptable Q TY	2.5
			Φ≦0.20	Accept no dense	
			0.20<Φ≦0.50	3	
			0.50<Φ≦1.00	2	
			1.00<Φ	0	
			Total Q TY	3	

NO	Item	Criterion	AQL
05	Scratches	Follow NO.3 LCD black spots, white spots, contamination	
06	Chipped glass	Symbols Define: x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: LCD side length L: Electrode pad length: 6.1 General glass chip : 6.1.1 Chip on panel surface and crack between panels:	2.5

6.1.1 table:

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	$x \leq 1/8a$

⊙If there are 2 or more chips, x is total length of each chip.

6.1.2 Corner crack:

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	$x \leq 1/8a$

⊙If there are 2 or more chips, x is the total length of each chip.

NO	Item	Criterion	AQL
06	Glass crack	Symbols : x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: LCD side length L: Electrode pad length 6.2 Protrusion over terminal : 6.2.1 Chip on electrode pad : 6.2.2 Non-conductive portion: ⊙If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications. ⊙If the product will be heat sealed by the customer, the alignment mark not be damaged. 6.2.3 Substrate protuberance and internal crack. 	2.5

6.2.1 Chip on electrode pad:

y: Chip width	x: Chip length	z: Chip thickness
y ≦ 0.5mm	x ≦ 1/8a	0 ＜ z ≦ t

6.2.2 Non-conductive portion:

y: Chip width	x: Chip length	z: Chip thickness
y ≦ L	x ≦ 1/8a	0 ＜ z ≦ t

6.2.3 Substrate protuberance and internal crack.

y: width	x: length
y ≦ 1/3L	x ≦ a

NO	Item	Criterion	AQL
07	Cracked glass	The LCD with extensive crack is not acceptable.	2.5
08	Backlight elements	8.1 Illumination source flickers when lit.	0.65
		8.2 Spots or scratched that appear when lit must be judged. Using LCD spot, lines and contamination standards.	2.5
		8.3 Backlight doesn't light or color wrong.	0.65
09	Bezel	9.1 Bezel may not have rust, be deformed or have fingerprints, stains or other contamination.	2.5
		9.2 Bezel must comply with job specifications.	0.65
10	PCB、COB	10.1 COB seal may not have pinholes larger than 0.2mm or contamination.	2.5
		10.2 COB seal surface may not have pinholes through to the IC.	2.5
		10.3 The height of the COB should not exceed the height indicated in the assembly diagram.	0.65
		10.4 There may not be more than 2mm of sealant outside the seal area on the PCB. And there should be no more than three places.	2.5
		10.5 No oxidation or contamination PCB terminals.	2.5
		10.6 Parts on PCB must be the same as on the production characteristic chart. There should be no wrong parts, missing parts or excess parts.	0.65
		10.7 The jumper on the PCB should conform to the product characteristic chart.	0.65
		10.8 If solder gets on bezel tab pads, LED pad, zebra pad or screw hold pad, make sure it is smoothed down.	2.5
		10.9 The Scraping testing standard for Copper Coating of PCB $X * Y <= 2mm^2$	2.5
11	Soldering	11.1 No un-melted solder paste may be present on the PCB.	2.5
		11.2 No cold solder joints, missing solder connections, oxidation or icicle.	2.5
		11.3 No residue or solder balls on PCB.	2.5
		11.4 No short circuits in components on PCB.	0.65

NO	Item	Criterion	AQL
12	General appearance	12.1 No oxidation, contamination, curves or, bends on interface Pin (OLB) of TCP.	2.5
		12.2 No cracks on interface pin (OLB) of TCP.	0.65
		12.3 No contamination, solder residue or solder balls on product.	2.5
		12.4 The IC on the TCP may not be damaged, circuits.	2.5
		12.5 The uppermost edge of the protective strip on the interface pin must be present or look as if it cause the interface pin to sever.	2.5
		12.6 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.	2.5
		12.7 Sealant on top of the ITO circuit has not hardened.	2.5
		12.8 Pin type must match type in specification sheet.	0.65
		12.9 LCD pin loose or missing pins.	0.65
		12.10 Product packaging must the same as specified on packaging specification sheet.	0.65
		12.11 Product dimension and structure must conform to product specification sheet.	0.65
		12.12 Visual defect outside of VA is not considered to be rejection.	0.65

12.Material List of Components for RoHs

1. WINSTAR Display Co., Ltd hereby declares that all of or part of products (with the mark "#"in code), including, but not limited to, the LCM, accessories or packages, manufactured and/or delivered to your company (including your subsidiaries and affiliated company) directly or indirectly by our company (including our subsidiaries or affiliated companies) do not intentionally contain any of the substances listed in all applicable EU directives and regulations, including the following substances.

Exhibit A：The Harmful Material List

Material	Cd	Pb	Hg	Cr6+	PBB	PBDE	DEHP	BBP	DBP	DIBP
Limited Value	100 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm	1000 ppm
Above limited value is set up according to RoHS.										

2.Process for RoHS requirement：**(only for RoHS inspection)**

  (1) Use the Sn/Ag/Cu soldering surface；the surface of Pb-free solder is rougher than we used before.

  (2) Heat-resistance temp.：

    Reflow：250℃,30 seconds Max.；

    Connector soldering wave or hand soldering：320℃, 10 seconds max.

  (3) Temp. curve of reflow, max. Temp.：235±5℃；

    Recommended customer's soldering temp. of connector：280℃, 3 seconds.

13.Recommendable Storage

1. Place the panel or module in the temperature 25°C±5°C and the humidity below 65% RH

2. Do not place the module near organics solvents or corrosive gases.

3. Do not crush, shake, or jolt the module.

winstar **<u>LCM Sample Estimate Feedback Sheet</u>**

Module Number： _____   **Page: 1**

1、<u>Panel Specification</u>：

  1. Panel Type： ☐ Pass ☐ NG , _____
  2. View Direction： ☐ Pass ☐ NG , _____
  3. Numbers of Dots： ☐ Pass ☐ NG , _____
  4. View Area： ☐ Pass ☐ NG , _____
  5. Active Area： ☐ Pass ☐ NG , _____
  6. Operating Temperature： ☐ Pass ☐ NG , _____
  7. Storage Temperature： ☐ Pass ☐ NG , _____
  8. Others： _____

2、<u>Mechanical Specification</u>：

  1. PCB Size： ☐ Pass ☐ NG , _____
  2. Frame Size： ☐ Pass ☐ NG , _____
  3. Materal of Frame： ☐ Pass ☐ NG , _____
  4. Connector Position： ☐ Pass ☐ NG , _____
  5. Fix Hole Position： ☐ Pass ☐ NG , _____
  6. Backlight Position： ☐ Pass ☐ NG , _____
  7. Thickness of PCB： ☐ Pass ☐ NG , _____
  8. Height of Frame to PCB： ☐ Pass ☐ NG , _____
  9. Height of Module： ☐ Pass ☐ NG , _____
  10. Others： ☐ Pass ☐ NG , _____

3、<u>Relative Hole Size</u>：

  1. Pitch of Connector： ☐ Pass ☐ NG , _____
  2. Hole size of Connector： ☐ Pass ☐ NG , _____
  3. Mounting Hole size： ☐ Pass ☐ NG , _____
  4. Mounting Hole Type： ☐ Pass ☐ NG , _____
  5. Others： ☐ Pass ☐ NG , _____

4、<u>Backlight Specification</u>：

  1. B/L Type： ☐ Pass ☐ NG , _____
  2. B/L Color： ☐ Pass ☐ NG , _____
  3. B/L Driving Voltage (Reference for LED Type)： ☐ Pass ☐ NG , _____
  4. B/L Driving Current： ☐ Pass ☐ NG , _____
  5. Brightness of B/L： ☐ Pass ☐ NG , _____
  6. B/L Solder Method： ☐ Pass ☐ NG , _____
  7. Others： ☐ Pass ☐ NG , _____

＞＞ **Go to page 2** ＜＜

5、<u>Electronic Characteristics of Module</u>：

1. Input Voltage：   □ Pass   □ NG , _____

2. Supply Current：   □ Pass   □ NG , _____

3. Driving Voltage for LCD：   □ Pass   □ NG , _____

4. Contrast for LCD：   □ Pass   □ NG , _____

5. B/L Driving Method：   □ Pass   □ NG , _____

6. Negative Voltage Output：   □ Pass   □ NG , _____

7. Interface Function：   □ Pass   □ NG , _____

8. LCD Uniformity：   □ Pass   □ NG , _____

9. ESD test：   □ Pass   □ NG , _____

10. Others：   □ Pass   □ NG , _____

6、<u>Summary</u>：

Sales signature： _____

Customer Signature： _____   <u>**Date**： / / </u>

14.Initial code

```
void initial()
{
                RES=1;
                Delay_ms(120);
                RES=0;
                Delay_ms(10);
                RES=1;
                Delay_ms(120);

                write_com(0xD7);        // Disable Auto Read
                write_dat(0x9F);

                write_com(0xE0);        // Enable OTP Read
                write_dat(0x00);
                Delay_ms(10);

                write_com(0xE3);        // OTP Up-Load
                Delay_ms(20);

                write_com(0xE1);        // OTP Control Out

                write_com(0x11);        // Sleep Out

                write_com(0x28);        // Display OFF
                Delay_ms(50);

                write_com(0xC0);        // Set Vop
                write_dat(0xA1);        //
                write_dat(0x00);        //

                write_com(0xC3);        // BIAS System
                write_dat(0x05);        //

                write_com(0xC4);        // Booster Level
                write_dat(0x05);

                write_com(0xD0);        // Enable Analog Circuit
                write_dat(0x1D);



                write_com(0xB5);        // N-Line Inversion
                write_dat(0x00);        //



                write_com(0x39);        // Display Mode

                write_com(0xF1);        // Frame Rate (Monochrome Mode)
                write_dat(0x06);        //
                write_dat(0x0B);        //
```

```
        write_dat(0x0D);        //
        write_dat(0x10);        //


        write_com(0x3A);        // Enable DDRAM Interface
        write_dat(0x02);

        write_com(0x36);        // Display Control
        write_dat(0xC8);        //


        write_com(0xB0);        // Display Duty
        write_dat(0x3F);        //

        write_com(0x20);        // Inverse Display

        write_com(0x37);        // Start Line
        write_dat(0x00);        //

        write_com(0xB1);        // First Output COM
        write_dat(0x00);        //


        write_com(0xB3);        // FOSC Divider
        write_dat(0x01);


        write_com(0x2A);        // Set Column Address
        write_dat(0x00);        //
        write_dat(48);          //
        write_dat(0x00);        //
        write_dat(127);                 //

        write_com(0x2B);        // Set Row Address
        write_dat(0x00);        //
        write_dat(96);                  //
        write_dat(0x00);        //
        write_dat(159);                 //


        write_com(0xC4);        // Booster Level
        write_dat(0x07);


        write_com(0x29);        // Display ON
}
```