



WINSTAR Display Co.,Ltd.
華凌光電股份有限公司

SPECIFICATION

CUSTOMER : _____

MODULE NO.: **WO240128B-TFH#**

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

VERSION	DATE	REVISED PAGE NO.	SUMMARY
F	2023/01/18		Modify Backlight Information(Note)

RECORDS OF REVISION**DOC. FIRST ISSUE**

VERSION	DATE	REVISED PAGE NO.	SUMMARY
0	2016/07/25		First issue
A	2016/11/04		Modify IDD.
B	2017/06/23		Correct FPC.
C	2019/08/27		Modify Material List of Components for RoHs
D	2019/12/17		Modify Precautions in use of LCD Modules
E	2021/01/04		Add Interface
F	2023/01/18		Modify Backlight Information(Note)

Contents

- 1.Module Classification Information
- 2.Precautions in use of LCD Modules
- 3.General Specification
- 4.Absolute Maximum Ratings
- 5.Electrical Characteristics
- 6.Optical Characteristics
- 7.Interface Pin Function
- 8.Contour Drawing &Block Diagram
- 9.Reliability
- 10.Backlight Information
- 11.Inspection specification
- 12.Material List of Components for RoHs
- 13.Recommendable Storage
- 14.Initial code

1. Module Classification Information

W O 240128 B — T F H — #
 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 * 128 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

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) 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 128	—
Module dimension	122.2 x 79.8 x 6.5	mm
View area	114.0 x 64.0	mm
Active area	107.98 x 57.58	mm
Dot size	0.43 x 0.43	mm
Dot pitch	0.45 x 0.45	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.)	
Drive Method	1/128D , 1/12B	
View direction	6 o'clock	
Backlight Type	LED, White	
IC	ST7586S	
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	°C
Storage Temperature	T _{ST}	-30	—	+80	°C
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

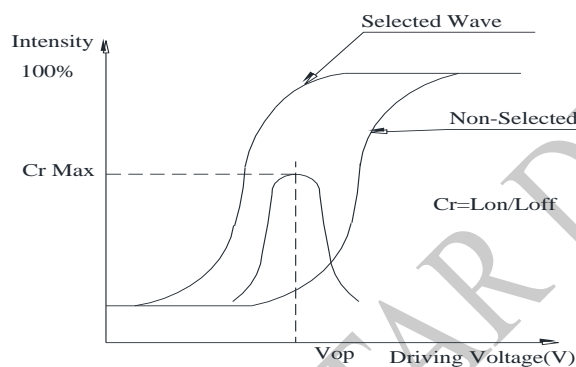
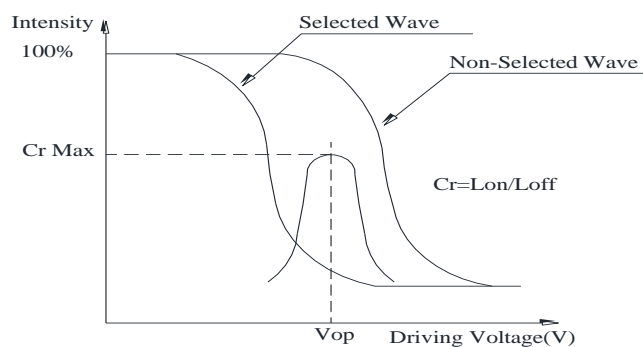
Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	$V_{DD}-V_{SS}$	—	3.0	3.3	3.6	V
Supply Voltage For LCM	VOP	Ta=-20°C	—	—	—	V
		Ta=25°C	14.8	15.0	15.2	V
		Ta=+70°C	—	—	—	V
Input High Volt.	V_{IH}	—	$0.7V_{DD}$	—	V_{DD}	V
Input Low Volt.	V_{IL}	—	V_{SS}	—	$0.3 V_{DD}$	V
Output High Volt.	V_{OH}	—	$0.8 V_{DD}$	—	V_{DD}	V
Output Low Volt.	V_{OL}	—	V_{SS}	—	$0.2V_{DD}$	V
Supply Current	I_{DD}	$V_{DD}=3.3V$	—	2.0	4.0	mA

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

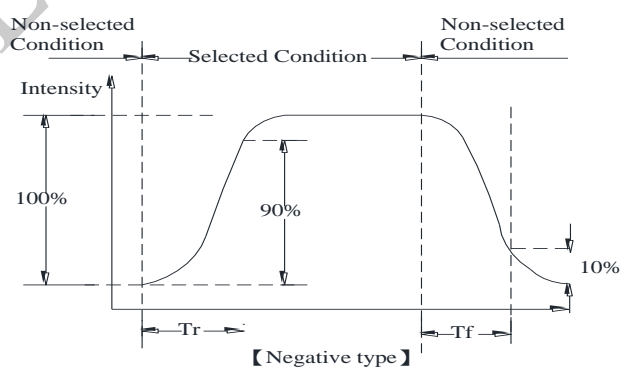
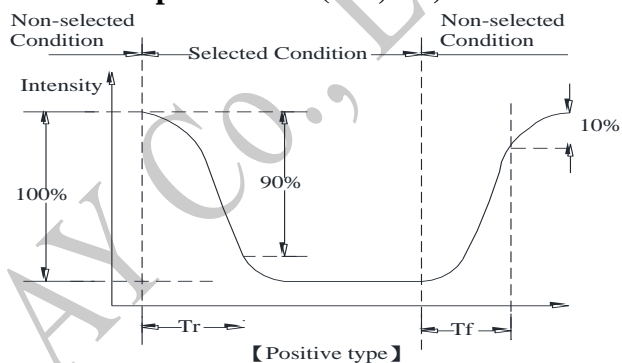
6.Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	θ	$CR \geq 2$	0	—	30	$\phi = 180^\circ$
	θ	$CR \geq 2$	0	—	60	$\phi = 0^\circ$
	θ	$CR \geq 2$	0	—	45	$\phi = 90^\circ$
	θ	$CR \geq 2$	0	—	45	$\phi = 270^\circ$
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 :

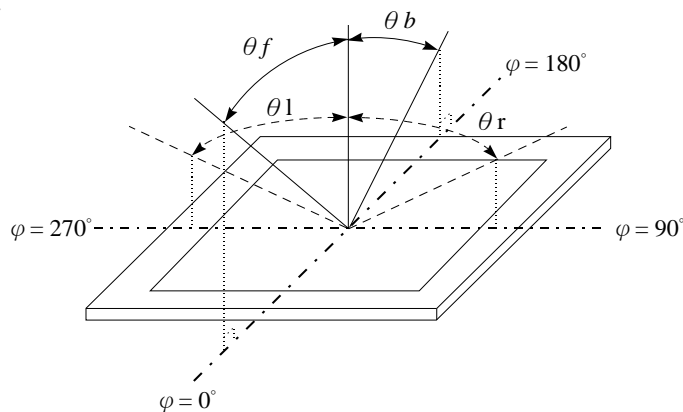
Operating Voltage : Vop

Frame Frequency : 64 HZ

Viewing Angle(θ , ϕ) : 0° , 0°

Driving Waveform : 1/N duty , 1/a bias

Definition of viewing angle($CR \geq 2$)

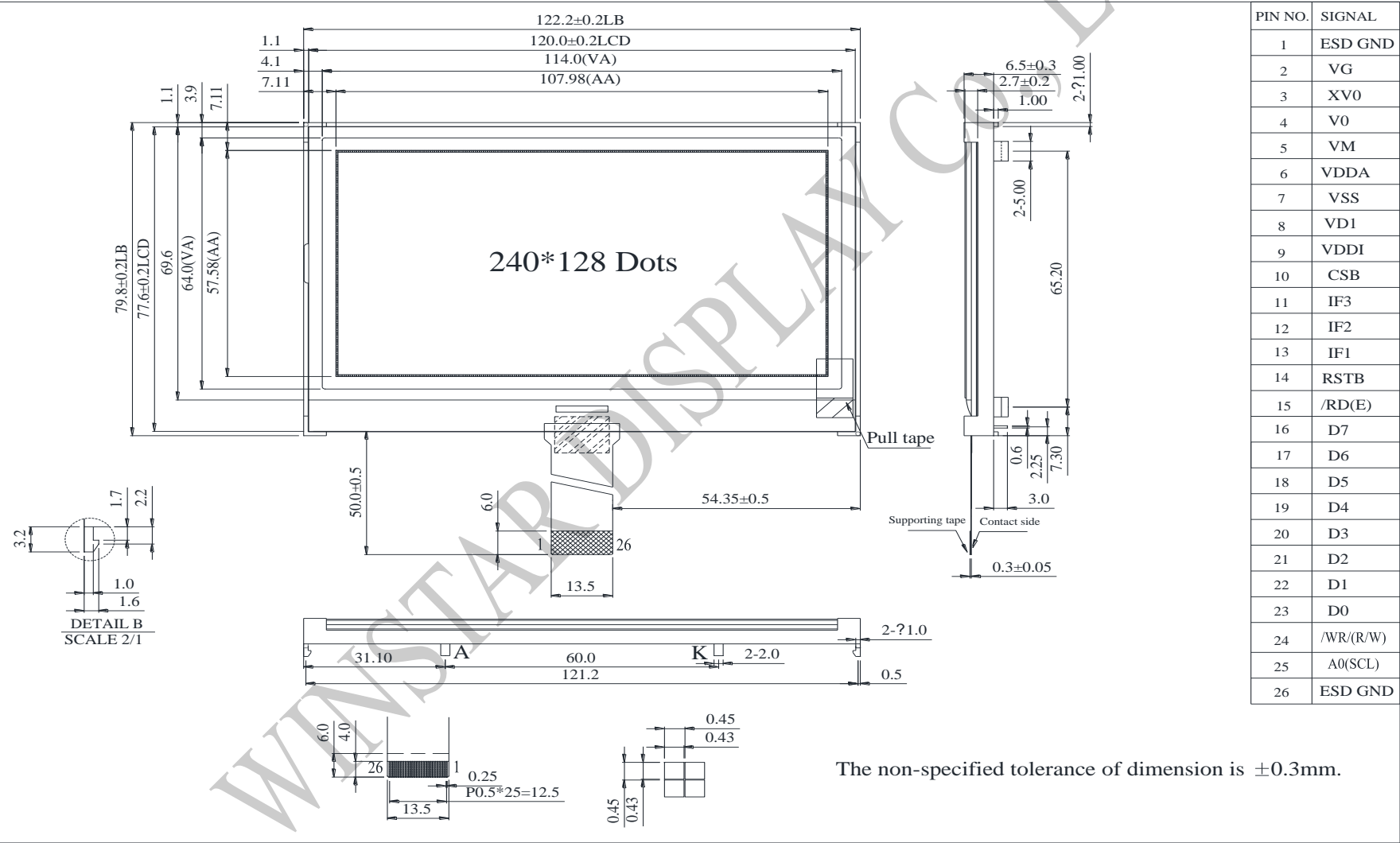


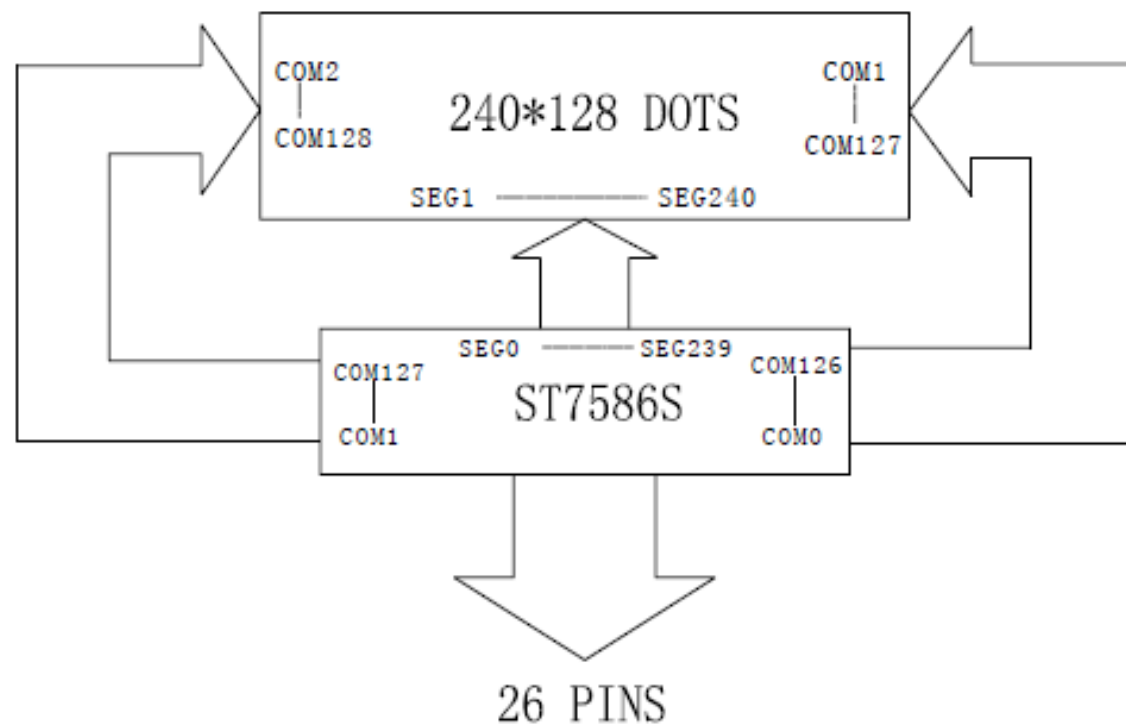
7.Interface Pin Function

Pin No.	Symbol	Description																				
1	ESD GND	Electro-Static discharge																				
2	VG	VG is the power of SEG-drivers																				
3	XV0	Negative operating voltage of COM-drivers																				
4	V0	Positive operating voltage of COM-drivers																				
5	VM	VM is the non-select voltage level of COM-drivers																				
6	VDDA	Power supply																				
7	VSS	Ground																				
8	VD1	Digital power source selection																				
9	VDDI	VDD1 is the power of interface I/O circuit																				
10	CSB	Chip select input pin CSB="L": This chip is selected and the MPU interface is active CSB="H": This chip is not selected and the MPU interface is disabled (D[7:0] are high impedance)																				
11	IF3	These pins select interface operation mode																				
12	IF2	<table><tr><th>IF3</th><th>IF2</th><th>IF1</th><th>MPU interface type</th></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>	IF3	IF2	IF1	MPU interface type	H	H	L	80 series 8-bit parallel	H	L	L	68 series 8-bit parallel	L	H	H	8-bit serial (4-Line)	L	H	L	9-bit serial (3-Line)
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L	H	H	8-bit serial (4-Line)																			
L	H	L	9-bit serial (3-Line)																			
13	IF1	Note: Refer to "Interface Selection" for detailed information																				
14	RSTB	Reset input pin. When RSTB is "L", internal initialization procedure is executed																				
15	/RD(E)	Read / Write execution control pin. (This pin is only used in parallel interface) <table><tr><th>MPU Type</th><th>ERD</th><th>Description</th></tr><tr><td>6800-series</td><td>E</td><td>Read / Write control input pin. R/W = "H": When E is "H", data bus is in output status. R/W = "L": The data are latched at the falling edge of the E signal.</td></tr><tr><td>8080-series</td><td>/RD</td><td>Read enable input pin. When /RD is "L", data bus is in output status.</td></tr></table> This pin is not used in serial interfaces and should be connected to VDD1	MPU Type	ERD	Description	6800-series	E	Read / Write control input pin. R/W = "H": When E is "H", data bus is in output status. R/W = "L": The data are latched at the falling edge of the E signal.	8080-series	/RD	Read enable input pin. When /RD is "L", data bus is in output status.											
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16~23	D7~D0	<p>The bi-directional data bus of the MPU interface. When CSB is “H”, they are high impedance</p> <p>If using serial interface:</p> <p>D0 is the SDA signal in 4-Line & 3-Line interface</p> <p>D1 is the A0 signal in 4-Line interface</p>									
24	/WR/(R/W)	<p>Read / Write execution control pin. (This pin is only used in parallel interface)</p> <table border="1"> <thead> <tr> <th>MPU Type</th><th>RWR</th><th>Description</th></tr> </thead> <tbody> <tr> <td>6800-series</td><td>R/W</td><td>Read / Write control input pin R/W = “H” : read R/W = “L” : write</td></tr> <tr> <td>8080-series</td><td>/WR</td><td>Write enable clock input pin. The data are latched at the rising edge of the /WR signal.</td></tr> </tbody> </table> <p>This pin is not used in serial interfaces and should be connected to VDD1</p>	MPU Type	RWR	Description	6800-series	R/W	Read / Write control input pin R/W = “H” : read R/W = “L” : write	8080-series	/WR	Write enable clock input pin. The data are latched at the rising edge of the /WR signal.
MPU Type	RWR	Description									
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8080-series	/WR	Write enable clock input pin. The data are latched at the rising edge of the /WR signal.									
25	A0(SCL)	<p>The function of this pin is different in parallel and serial interface</p> <p>In parallel interface: A0 is register selection input</p> <p>A0 = “H”: inputs on data bus are display data</p> <p>A0 = “L”: inputs on data bus are command</p> <p>In serial interface: this pad will be used as SCL (serial-clock) input</p>									
26	ESD GND	Electro-Static discharge									

8.Contour Drawing & Block Diagram





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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℃ 96hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30℃ 96hrs	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℃ 96hrs	— —
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20℃ 96hrs	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 <div style="text-align: center;"> <p>-20℃ 25℃ 70℃</p> <p>30min 5min 30min</p> <p>1 cycle</p> </div>	-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

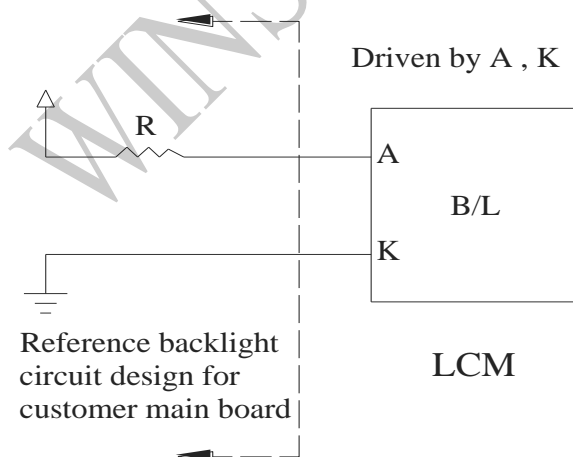
Specification

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	I _{LED}	—	144	180	mA	V=3.5V
Supply Voltage	V	3.4	3.5	3.6	V	—
Reverse Voltage	V _R	—	—	5	V	—
Color coordinate	X	0.244	0.264	0.284		I _{LED} =144mA
	Y	0.264	0.284	0.304		
Luminance (Without LCD)	I _V	750	940	—	cd/m ²	I _{LED} =144mA
LED Life Time (For Reference only)	—	—	50K	—	Hr.	I _{LED} =144mA 25°C,50-60%RH, (Note 1)
Color	White					

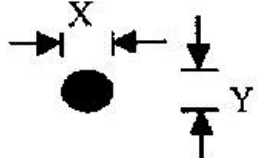
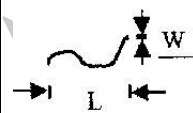
Note: A backlight driven by voltage will keep the drive current under the safe area (current between minimum and maximum).

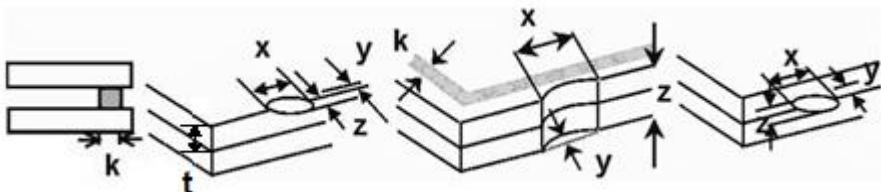
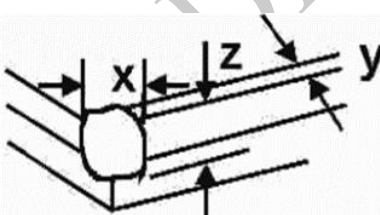
If the B/L LED is driven by current only, the drive voltage cannot be considered as a reference value.

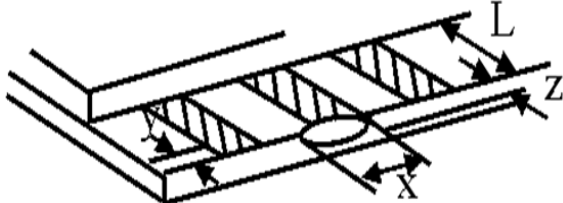
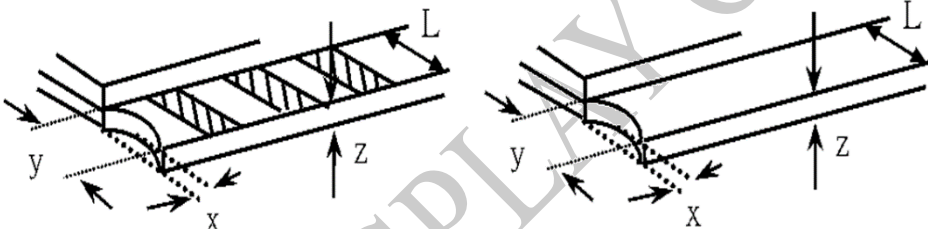
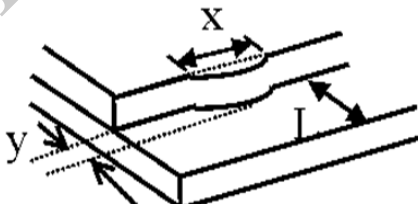
Note 1:50K hours is only an estimate for reference.

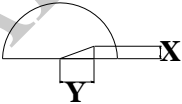


11. Inspection specification

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 $\leq 0.25\text{mm}$, 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 $\Phi=(x+y)/2$  <table><thead><tr><th>Size</th><th>Acceptable QTY</th></tr></thead><tbody><tr><td>$\Phi \leq 0.10$</td><td>Accept no dense</td></tr><tr><td>$0.10 < \Phi \leq 0.20$</td><td>2</td></tr><tr><td>$0.20 < \Phi \leq 0.25$</td><td>1</td></tr><tr><td>$0.25 < \Phi$</td><td>0</td></tr></tbody></table>	Size	Acceptable QTY	$\Phi \leq 0.10$	Accept no dense	$0.10 < \Phi \leq 0.20$	2	$0.20 < \Phi \leq 0.25$	1	$0.25 < \Phi$	0	2.5				
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$0.10 < \Phi \leq 0.20$	2																
$0.20 < \Phi \leq 0.25$	1																
$0.25 < \Phi$	0																
		3.2 Line type : (As following drawing)  <table><thead><tr><th>Length</th><th>Width</th><th>Acceptable QTY</th></tr></thead><tbody><tr><td>---</td><td>$W \leq 0.02$</td><td>Accept no dense</td></tr><tr><td>$L \leq 3.0$</td><td>$0.02 < W \leq 0.03$</td><td rowspan="2">2</td></tr><tr><td>$L \leq 2.5$</td><td>$0.03 < W \leq 0.05$</td></tr><tr><td>---</td><td>$0.05 < W$</td><td>As round type</td></tr></tbody></table>	Length	Width	Acceptable QTY	---	$W \leq 0.02$	Accept no dense	$L \leq 3.0$	$0.02 < W \leq 0.03$	2	$L \leq 2.5$	$0.03 < W \leq 0.05$	---	$0.05 < W$	As round type	2.5
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$L \leq 2.5$	$0.03 < W \leq 0.05$																
---	$0.05 < W$	As round type															
04	Polarizer bubbles	If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction. <table><thead><tr><th>Size Φ</th><th>Acceptable QTY</th></tr></thead><tbody><tr><td>$\Phi \leq 0.20$</td><td>Accept no dense</td></tr><tr><td>$0.20 < \Phi \leq 0.50$</td><td>3</td></tr><tr><td>$0.50 < \Phi \leq 1.00$</td><td>2</td></tr><tr><td>$1.00 < \Phi$</td><td>0</td></tr><tr><td>Total QTY</td><td>3</td></tr></tbody></table>	Size Φ	Acceptable QTY	$\Phi \leq 0.20$	Accept no dense	$0.20 < \Phi \leq 0.50$	3	$0.50 < \Phi \leq 1.00$	2	$1.00 < \Phi$	0	Total QTY	3	2.5		
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$1.00 < \Phi$	0																
Total QTY	3																

No	Item	Criterion	AQL																		
05	Scratches	Follow NO.3 LCD black spots, white spots, contamination																			
06	Chipped glass	<p>Symbols Define:</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>6.1 General glass chip :</p> <p>6.1.1 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>$Z \leq 1/2t$</td><td>Not over viewing area</td><td>$x \leq 1/8a$</td></tr><tr><td>$1/2t < z \leq 2t$</td><td>Not exceed 1/3k</td><td>$x \leq 1/8a$</td></tr></table> <p>⊙ If there are 2 or more chips, x is total length of each chip.</p> <p>6.1.2 Corner crack:</p>  <table><tr><th>z: Chip thickness</th><th>y: Chip width</th><th>x: Chip length</th></tr><tr><td>$Z \leq 1/2t$</td><td>Not over viewing area</td><td>$x \leq 1/8a$</td></tr><tr><td>$1/2t < z \leq 2t$</td><td>Not exceed 1/3k</td><td>$x \leq 1/8a$</td></tr></table> <p>⊙ If there are 2 or more chips, x is the total length of each chip.</p>	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
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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																
06	Glass crack	<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>6.2 Protrusion over terminal :</p> <p>6.2.1 Chip on electrode pad :</p>  <table><tr><th>y: Chip width</th><th>x: Chip length</th><th>z: Chip thickness</th></tr><tr><td>$y \leq 0.5\text{mm}$</td><td>$x \leq 1/8a$</td><td>$0 < z \leq t$</td></tr></table> <p>6.2.2 Non-conductive portion:</p>  <table><tr><th>y: Chip width</th><th>x: Chip length</th><th>z: Chip thickness</th></tr><tr><td>$y \leq L$</td><td>$x \leq 1/8a$</td><td>$0 < z \leq t$</td></tr></table> <p>○If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications.</p> <p>○If the product will be heat sealed by the customer, the alignment mark not be damaged.</p> <p>6.2.3 Substrate protuberance and internal crack.</p> <table><tr><th>y: width</th><th>x: length</th></tr><tr><td>$y \leq 1/3L$</td><td>$x \leq a$</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
07	Cracked glass	The LCD with extensive crack is not acceptable.	2.5
08	Backlight elements	8.1 Illumination source flickers when lit. 8.2 Spots or scratched that appear when lit must be judged. Using LCD spot, lines and contamination standards. 8.3 Backlight doesn't light or color wrong.	0.65 2.5 0.65
09	Bezel	9.1 Bezel may not have rust, be deformed or have fingerprints, stains or other contamination. 9.2 Bezel must comply with job specifications.	2.5 0.65
10	PCB 、 COB	10.1 COB seal may not have pinholes larger than 0.2mm or contamination. 10.2 COB seal surface may not have pinholes through to the IC. 10.3 The height of the COB should not exceed the height indicated in the assembly diagram. 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. 10.5 No oxidation or contamination PCB terminals. 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. 10.7 The jumper on the PCB should conform to the product characteristic chart. 10.8 If solder gets on bezel tab pads, LED pad, zebra pad or screw hold pad, make sure it is smoothed down. 10.9 The Scraping testing standard for Copper Coating of PCB  $X * Y \leq 2\text{mm}^2$	2.5 2.5 0.65 2.5 2.5 0.65 0.65 2.5 2.5
11	Soldering	11.1 No un-melted solder paste may be present on the PCB. 11.2 No cold solder joints, missing solder connections, oxidation or icicle. 11.3 No residue or solder balls on PCB. 11.4 No short circuits in components on PCB.	2.5 2.5 2.5 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 $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$ 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 DISPLAY Co., Ltd.



Module Number : _____

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1、Panel Specification :

- | | | |
|----------------------------|-------------------------------|-------------------------------------|
| 1. Panel Type : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. View Direction : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Numbers of Dots : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. View Area : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Active Area : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. Operating Temperature : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Storage Temperature : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 8. Others : | _____ | |

2、Mechanical Specification :

- | | | |
|-----------------------------|-------------------------------|-------------------------------------|
| 1. PCB Size : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. Frame Size : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Material of Frame : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. Connector Position : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Fix Hole Position : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. Backlight Position : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Thickness of PCB : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 8. Height of Frame to PCB : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 9. Height of Module : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 10. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

3、Relative Hole Size :

- | | | |
|-----------------------------|-------------------------------|-------------------------------------|
| 1. Pitch of Connector : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. Hole size of Connector : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Mounting Hole size : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. Mounting Hole Type : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

4、Backlight Specification :

- | | | |
|---|-------------------------------|-------------------------------------|
| 1. B/L Type : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. B/L Color : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. B/L Driving Voltage (Reference for LED Type) : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. B/L Driving Current : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Brightness of B/L : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. B/L Solder Method : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

>> Go to page 2 <<

Module Number : _____

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5、Electronic Characteristics of Module :

- | | | |
|------------------------------|-------------------------------|-------------------------------------|
| 1. Input Voltage : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. Supply Current : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Driving Voltage for LCD : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. Contrast for LCD : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. B/L Driving Method : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. Negative Voltage Output : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Interface Function : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 8. LCD Uniformity : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 9. ESD test : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 10. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

6、Summary :

Sales signature : _____

Customer Signature : _____

Date : / /

14.Initial code

//WO240128B 2016.06.17 Winstar

//For FSTN White

```
void initial()
```

```
{
```

```
    RES=1;
```

```
    delay(200);
```

```
    RES=0;
```

```
    delay(200);
```

```
    RES=1;
```

```
    delay(200);
```

```
    write_com(0xD7);    // Disable Auto Read
```

```
    write_dat(0x9F);
```

```
    write_com(0xE0);    // Enable OTP Read
```

```
    write_dat(0x00);
```

```
    delay(20);
```

```
    write_com(0xE3);    // OTP Up-Load
```

```
    delay(20);
```

```
    write_com(0xE1);    // OTP Control Out
```

```
    write_com(0x11);    // Sleep Out
```

```
    write_com(0x28);    // Display OFF
```

```
    delay(50);
```

```
    write_com(0xC0);    //----- Vop = 0X11Dh -----
```

```
    write_dat(0x1D);    //
```

```
    write_dat(0x01);    //
```

```
    write_com(0xC3);    // BIAS = 1/12 -----
```

```
    write_dat(0x02);    //
```

```
    write_com(0xC4);    // Set Booster
```

```
    write_dat(0x07);
```

```
    write_com(0xD0);    // Enable Analog Circuit
```

```
    write_dat(0x1D);
```

```

write_com(0xB5);      // N-Line = 0 ; Frame inversion
write_dat(0x00);

write_com(0x39);      //Display Mode : Monochrome mode(B/W Mode)

//----- FSTN White Temperature Compensation
write_com(0xF1);      // Frame Rate (Monochrome Mode)
write_dat(0x06);      //
write_dat(0x0B);      //
write_dat(0x0D);
write_dat(0x12);      //

//----- FSTN White Temperature Compensation
write_com(0xF4);      //Temperature Gradient Compensation
write_dat(0x7F);      //MT1 , MT0
write_dat(0x22);      //MT3 , MT2
write_dat(0x11);      //MT5 , MT4
write_dat(0x02);      //MT7 , MT6
write_dat(0x00);      //MT9 , MT8
write_dat(0x32);      //MTB , MTA
write_dat(0x82);      //MTD , MTC
write_dat(0xB6);      //MTF , MTE

//-----

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

write_com(0x36);      // Scan Direction Setting/Display Control
write_dat(0x00);

write_com(0xB0);      // Duty Setting -----
write_dat(0x7F);      // 1/128Duty

//////////

write_com(0x20);      // Normal 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(0x00);    //

write_com(0x2A);    // Column Address Setting
write_dat(0x00);
write_dat(0x00);
write_dat(0x00);
write_dat(79);      //

write_com(0x2B);    // Row Address Setting
write_dat(0x00);
write_dat(0x00);
write_dat(0x00);
write_dat(127);     //

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