

User's Guide

NHD-C12864EZ-FSW-FTW-P

LCM (Liquid Crystal Display Graphic Module)

COG- RoHS Compliant

NHD-	Newhaven Display
12864-	128 x 64 Dots
EZ-	Version Line
F-	Transflective
SW-	Side White LED B/L
F-	FSTN (+)
T-	12:00 View
W-	Wide Temperature (-20 ~ +70c)
P-	8- Pin Ribbon

For product support, contact

Newhaven Display International
2511 Technology Drive, #101
Elgin, IL 60124
Tel: (847) 844-8795 Fax: (847) 844-8796

January 14, 2009

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	27-JULY-2007	First issue	

CONTENTS

Item	Page
Functions & Features	3
Mechanical specifications	3
Dimensional Outline	4
Absolute maximum ratings	5
Pin description	5
Optical characteristics	5
Electrical characteristics	6
Absolute Maximum Ratings	6
Timing characteristics	7
Commands	8
Quality Specifications	9-16

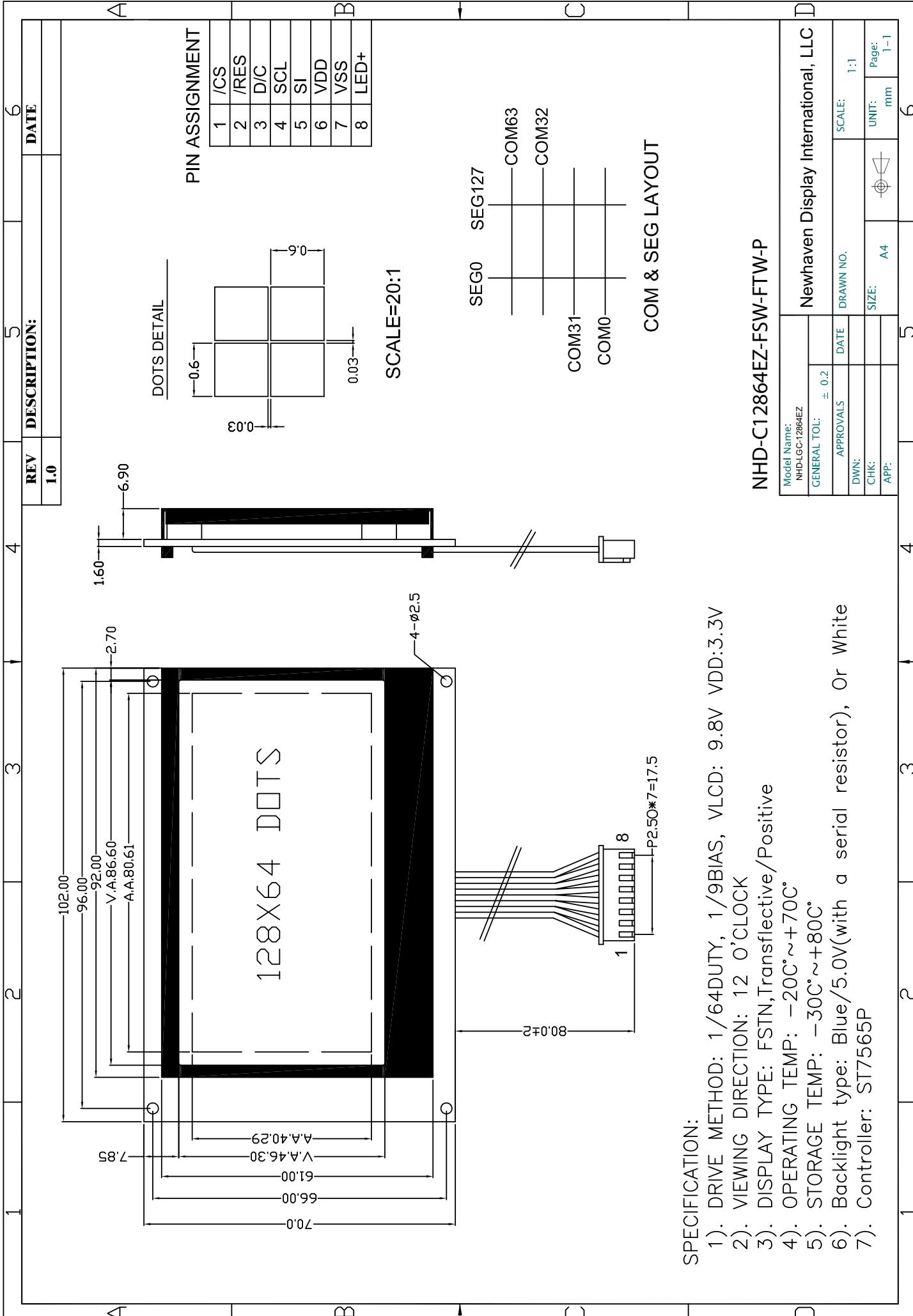
1. Features

1. 128X64 dots
2. Built-in controller (ST7565)
3. +3.3V power supply
4. 1/64 duty cycle; 1/9 bias
5. BKL to be driven by A, K.

LCD type	<input checked="" type="checkbox"/> FSTN positive		<input type="checkbox"/> FSTN Negative
	<input type="checkbox"/> STN Yellow Green	<input type="checkbox"/> STN Gray	<input type="checkbox"/> STN-Blue
View direction	<input checked="" type="checkbox"/> 6 O'clock		<input type="checkbox"/> 12 O'clock
Rear Polarizer	<input type="checkbox"/> Reflective	<input checked="" type="checkbox"/> Transflective	<input type="checkbox"/> Transmissive
Backlight Type	<input checked="" type="checkbox"/> LED	<input type="checkbox"/> EL	<input type="checkbox"/> Internal Power
		<input type="checkbox"/> CCFL	<input checked="" type="checkbox"/> External Power
Backlight Color	<input checked="" type="checkbox"/> White	<input type="checkbox"/> Amber	<input type="checkbox"/> Blue-Green
Temperature Range	<input type="checkbox"/> Normal		<input checked="" type="checkbox"/> Wide
DC to DC circuit	<input checked="" type="checkbox"/> Build-in		<input type="checkbox"/> Not Build-in
El Driver IC	<input type="checkbox"/> Build-in		<input checked="" type="checkbox"/> Not Build-in
Touch screen	<input type="checkbox"/> With		<input checked="" type="checkbox"/> Without
Font type	<input type="checkbox"/> English-Japanese	<input type="checkbox"/> English-Euro open	<input type="checkbox"/> English-Russian
	<input checked="" type="checkbox"/> ROHS		

2. MECHANICAL SPECIFICATIONS

Module size	102.0mm(L)*70.0mm(W)* Max9.5(H)mm
Viewing area	86.6mm(L)*46.3mm(W)
Dots size	0.60mm(L)*0.60mm(W)
Dots pitch	0.63mm(L)*0.63mm(W)
Weight	Approx.



4. Absolute maximum ratings

Item	Symbol	Standard			Unit
Power voltage	$V_{DD}-V_{SS}$	0.3	-	3.6	V
Input voltage	V_{IN}	V_{SS}	-	V_{DD}	
Operating temperature range	V_{OP}	-20	-	+70	
Storage temperature range	V_{ST}	-30	-	+80	

5. Interface pin description

Pin no.	Symbol	External connection	Function
1	/CS	MPU	Used to enter chip select signal
2	/RESET	MPU	Controller reset (module reset)
3	D/C	MPU	Register select signal
4	SCL	MPU	Serial clock input
5	SI	MPU	Serial data input
6	V_{DD}	Power supply	Power supply for LCM (+3.3V)
7	V_{SS}		Signal ground for logic (GND)
8	LED+	Power supply for BKL	Power supply for BKL (+3.3V)

6. Optical characteristics

FSTN type display module ($T_a=25^\circ C$, $VDD=3.3V$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing angle	θ	$C_r \geq 2$	-60	-	35	deg
	Φ		-40	-	40	
Contrast ratio	C_r		-	6	-	-
Response time (rise)	T_r	-	-	150	250	ms
Response time (fall)	T_r	-	-	150	250	

7. Electrical characteristics

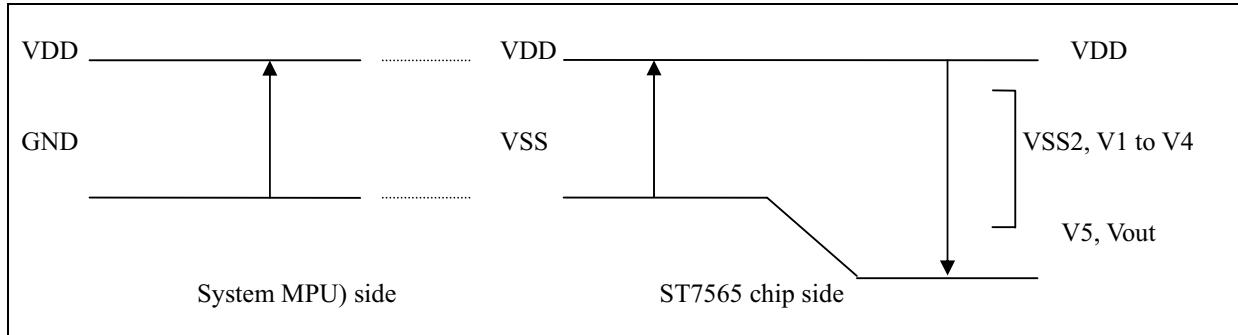
DC characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage for LCD	$V_{DD}-V_0$	$T_a = 25^\circ C$	9.5	9.8	10.2	V
Input voltage	V_{DD}		2.4	3.3	3.3	
Supply current	I_{DD}	$T_a = 25^\circ C$, $V_{DD}=3.3V$	-	-	147	uA
Input leakage current	I_{LKG}		-	-	1.0	uA
“H” level input voltage	V_{IH}		2.2	-	V_{DD}	V
“L” level input voltage	V_{IL}	Twice initial value or less	0	-	0.6	
“H” level output voltage	V_{OH}	$LOH=-0.25mA$	2.4	-	-	
“L” level output voltage	V_{OL}	$LOH=1.6mA$	-	-	0.4	
Backlight supply voltage	V_F		-	3.3	-	mA
Backlight supply current	I_{LED}	$V_F=3.3V$	-	16	-	

8. Absolute Maximum Ratings

(Unless otherwise noted, VSS=0V)

Parameter	Symbol	Conditions	Unit
Power Supply Voltage	VDD	-0.3 to +3.6	V
Power supply voltage (3) (VDD standard)	V5, Vout	-14.5.0 to +0.3	V
Power supply voltage (4) (VDD standard)	V1,V2,V3,V4	V5 to +0.3	V
Input Voltage	Vin	-0.3 to VDD+0.3	V
Output voltage	Vo	-0.3 to VDD+0.3	V
Operating Temp.	Topr	-40 to 80	C
Storage Temp.	Tstr	-40 to +80	C
Bare chip			



9. Timing Characteristics

The Serial Interface

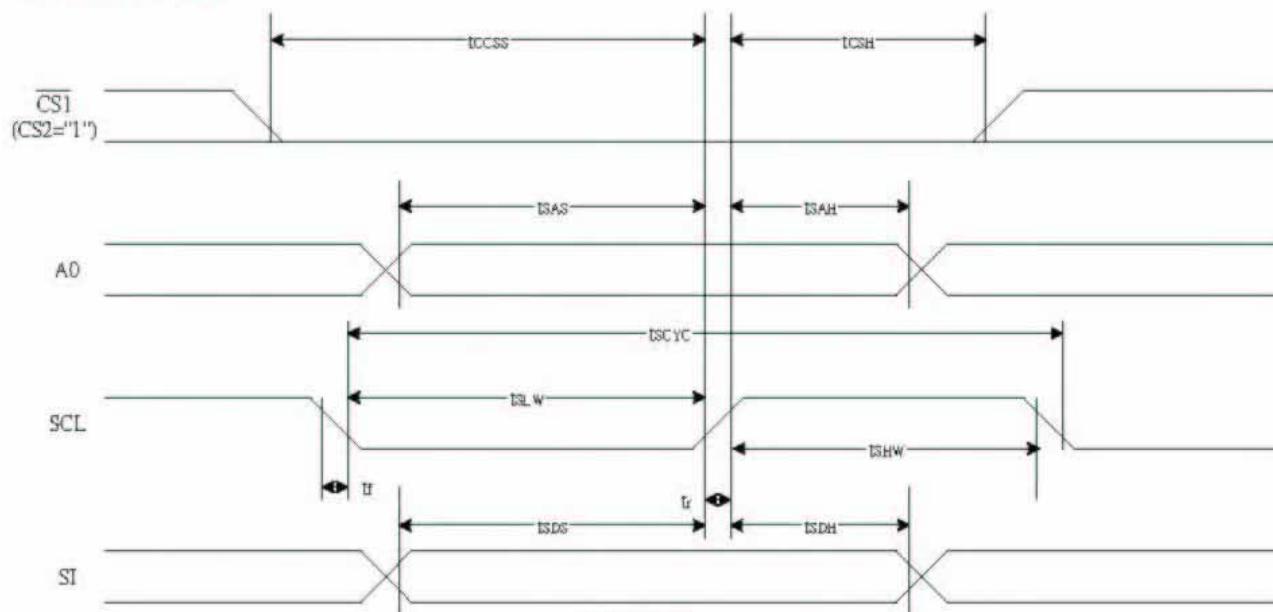


Figure 39

Table 30

 $(V_{DD} = 3.3V, Ta = -30 \text{ to } 85^\circ\text{C})$

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	T_{scyc}		50	—	ns
SCL "H" pulse width		T_{shw}		25	—	
SCL "L" pulse width		T_{SLW}		25	—	
Address setup time	A0	T_{SAS}		20	—	ns
Address hold time		T_{SAH}		10	—	
Data setup time	SI	T_{SDS}		20	—	ns
Data hold time		T_{SDH}		10	—	
CS-SCL time	CS	T_{CSS}		20	—	ns
CS-SCL time		T_{CSH}		40	—	

Table 31

 $(V_{DD} = 2.7V, Ta = -30 \text{ to } 85^\circ\text{C})$

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	T_{scyc}		100	—	ns
SCL "H" pulse width		T_{SHW}		50	—	
SCL "L" pulse width		T_{SLW}		50	—	
Address setup time	A0	T_{SAS}		30	—	ns
Address hold time		T_{SAH}		20	—	
Data setup time	SI	T_{SDS}		30	—	ns
Data hold time		T_{SDH}		20	—	
CS-SCL time	CS	T_{CSS}		30	—	ns
CS-SCL time		T_{CSH}		60	—	

10. Table of LCM commands

Command	Command Code										Function	
	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	1	0	1	0	1	1	1	1	0	1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit	0	1	0	0	0	0	0	Least significant column address				Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								Writes to the display RAM
(7) Display data read	1	0	1	Read data								Reads from the display RAM
(8) ADC select	0	1	0	1	0	0	0	0	0	0	1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/ reverse	0	1	0	1	0	0	1	1	0	1	1	Sets the LCD display normal/reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	0	1	0	0	1	1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	0	0	1	0	1	1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565P)
(12) Read/modify/write	0	1	0	1	1	0	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	0	1	1	1	0	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	0	0	0	*	*	*	1	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) V ₀ voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(R _b /R _a) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1	0	0	0	0	0	0	1	Set the V ₀ output voltage electronic volume register
(19) Static indicator ON/OFF Static indicator register set	0	1	0	1	0	1	1	0	0	1	1	0: OFF, 1: ON Set the flashing mode
(20) Booster ratio set	0	1	0	1	1	1	1	0	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(21) Power saver												Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(23) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

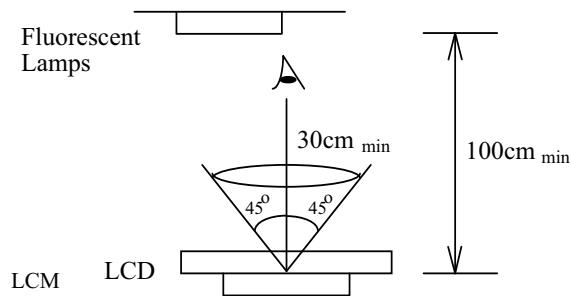
11.QUALITY SPECIFICATIONS

11.1 Standard of the product appearance test

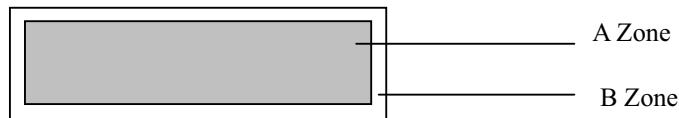
Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps.

Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.



Definition of zone:



A Zone: Active display area (minimum viewing area).

B Zone: Non-active display area (outside viewing area).

11.2 Specification of quality assurance

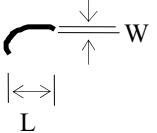
AQL inspection standard

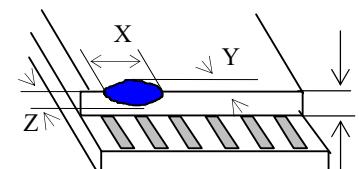
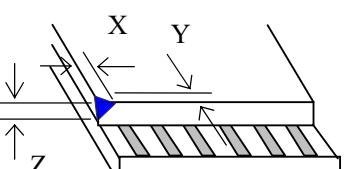
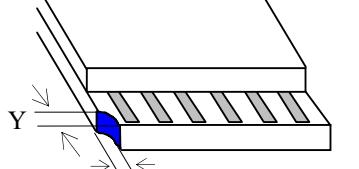
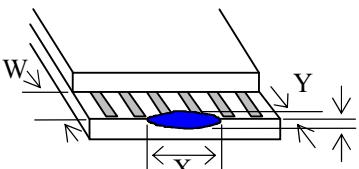
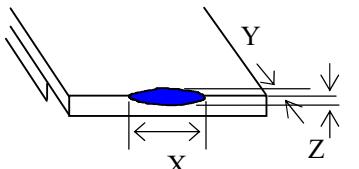
Sampling method: MIL-STD-105E, Level II, single sampling

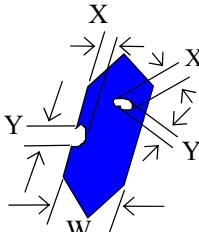
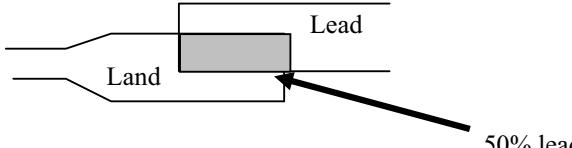
Defect classification **(Note: * is not including)**

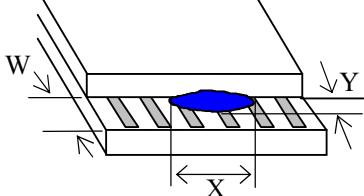
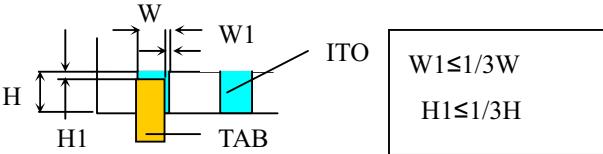
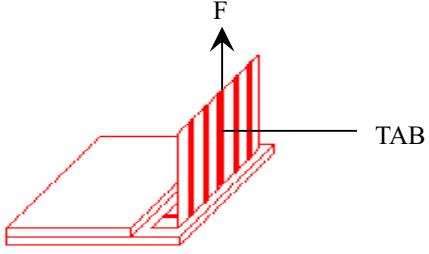
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
	Back-light		1,8	
Minor	Non-display	Flat cable or pin reverse	10	1.0
		Wrong or missing component	11	
	Display state	Background color deviation	2	
		Black spot and dust	3	
		Line defect, Scratch	4	
		Rainbow	5	
		Chip	6	
		Pin hole	7	
	Polarizer	Protruded	12	
		Bubble and foreign material	3	
	Soldering	Poor connection	9	
	Wire	Poor connection	10	
	TAB	Position, Bonding strength	13	

Note on defect classification

No.	Item	Criterion																		
1	Short or open circuit LC leakage Flickering No display Wrong viewing direction Wrong Back-light	Not allow																		
2	Contrast defect Background color deviation	Refer to approval sample																		
3	Point defect, Black spot, dust (including Polarizer) $\phi = (X+Y)/2$	 <table border="1"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty.</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 0.10$</td> <td>Disregard</td> </tr> <tr> <td>$0.10 < \phi \leq 0.20$</td> <td>3</td> </tr> <tr> <td>$0.20 < \phi \leq 0.25$</td> <td>2</td> </tr> <tr> <td>$0.25 < \phi \leq 0.30$</td> <td>1</td> </tr> <tr> <td>$\phi > 0.30$</td> <td>Unit : mm₀</td> </tr> </tbody> </table>	Point Size	Acceptable Qty.	$\phi \leq 0.10$	Disregard	$0.10 < \phi \leq 0.20$	3	$0.20 < \phi \leq 0.25$	2	$0.25 < \phi \leq 0.30$	1	$\phi > 0.30$	Unit : mm ₀						
Point Size	Acceptable Qty.																			
$\phi \leq 0.10$	Disregard																			
$0.10 < \phi \leq 0.20$	3																			
$0.20 < \phi \leq 0.25$	2																			
$0.25 < \phi \leq 0.30$	1																			
$\phi > 0.30$	Unit : mm ₀																			
4	Line defect, Scratch	 <table border="1"> <thead> <tr> <th>Line</th> <th>Acceptable Qty.</th> </tr> </thead> <tbody> <tr> <td>L</td> <td>W</td> </tr> <tr> <td>---</td> <td>$0.015 \geq W$</td> <td>Disregard</td> </tr> <tr> <td>$3.0 \geq L$</td> <td>$0.03 \geq W$</td> <td rowspan="2">2</td> </tr> <tr> <td>$2.0 \geq L$</td> <td>$0.05 \geq W$</td> </tr> <tr> <td>$1.0 \geq L$</td> <td>$0.1 > W$</td> <td>1</td> </tr> <tr> <td>---</td> <td>$0.05 < W$</td> <td>Applied as point defect</td> </tr> </tbody> </table> <p>Unit: mm</p>	Line	Acceptable Qty.	L	W	---	$0.015 \geq W$	Disregard	$3.0 \geq L$	$0.03 \geq W$	2	$2.0 \geq L$	$0.05 \geq W$	$1.0 \geq L$	$0.1 > W$	1	---	$0.05 < W$	Applied as point defect
Line	Acceptable Qty.																			
L	W																			
---	$0.015 \geq W$	Disregard																		
$3.0 \geq L$	$0.03 \geq W$	2																		
$2.0 \geq L$	$0.05 \geq W$																			
$1.0 \geq L$	$0.1 > W$	1																		
---	$0.05 < W$	Applied as point defect																		
5	Rainbow	Not more than two color changes across the viewing area.																		

No	Item	Criterion																													
6	<p>Chip</p> <p>Remark:</p> <p>X: Length direction</p> <p>Y: Short direction</p> <p>Z: Thickness direction</p> <p>t: Glass thickness</p> <p>W: Terminal Width</p>  <p>Acceptable criterion</p> <table border="1"> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> <tr> <td>≤ 2</td> <td>0.5mm</td> <td>$\leq t/2$</td> </tr> </table>  <p>Acceptable criterion</p> <table border="1"> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> <tr> <td>≤ 2</td> <td>0.5mm</td> <td>$\leq t$</td> </tr> </table>  <p>Acceptable criterion</p> <table border="1"> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> <tr> <td>≤ 3</td> <td>≤ 2</td> <td>$\leq t$</td> </tr> </table> <p>shall not reach to ITO</p>  <p>Acceptable criterion</p> <table border="1"> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> <tr> <td>Disregard</td> <td>≤ 0.2</td> <td>$\leq t$</td> </tr> </table>  <p>Acceptable criterion</p> <table border="1"> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> <tr> <td>≤ 5</td> <td>≤ 2</td> <td>$\leq t/3$</td> </tr> </table>	X	Y	Z	≤ 2	0.5mm	$\leq t/2$	X	Y	Z	≤ 2	0.5mm	$\leq t$	X	Y	Z	≤ 3	≤ 2	$\leq t$	X	Y	Z	Disregard	≤ 0.2	$\leq t$	X	Y	Z	≤ 5	≤ 2	$\leq t/3$
X	Y	Z																													
≤ 2	0.5mm	$\leq t/2$																													
X	Y	Z																													
≤ 2	0.5mm	$\leq t$																													
X	Y	Z																													
≤ 3	≤ 2	$\leq t$																													
X	Y	Z																													
Disregard	≤ 0.2	$\leq t$																													
X	Y	Z																													
≤ 5	≤ 2	$\leq t/3$																													

No.	Item	Criterion								
7	Segment pattern W = Segment width $\phi = (X+Y)/2$	<p>(1) Pin hole $\phi < 0.10\text{mm}$ is acceptable.</p>  <table border="1"> <thead> <tr> <th>Point Size</th><th>Acceptable Qty</th></tr> </thead> <tbody> <tr> <td>$\phi \leq 1/4W$</td><td>Disregard</td></tr> <tr> <td>$1/4W < \phi \leq 1/2W$</td><td>1</td></tr> <tr> <td>$\phi > 1/2W$</td><td>0</td></tr> </tbody> </table>	Point Size	Acceptable Qty	$\phi \leq 1/4W$	Disregard	$1/4W < \phi \leq 1/2W$	1	$\phi > 1/2W$	0
Point Size	Acceptable Qty									
$\phi \leq 1/4W$	Disregard									
$1/4W < \phi \leq 1/2W$	1									
$\phi > 1/2W$	0									
8	Back-light	<p>(1) The color of backlight should correspond its specification. (2) Not allow flickering</p>								
9	Soldering	<p>(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land.</p> 								
10	Wire	<p>(1) Copper wire should not be rusted (2) Not allow crack on copper wire connection. (3) Not allow reversing the position of the flat cable. (4) Not allow exposed copper wire inside the flat cable.</p>								
11*	PCB	<p>(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.</p>								

No	Item	Criterion
12	Protruded W: Terminal Width	 <p>Acceptable criteria: $Y \leq 0.4$</p>
13	TAB	<p>1. Position</p>  <div style="border: 1px solid black; padding: 5px; display: inline-block;"> $W_1 \leq 1/3W$ $H_1 \leq 1/3H$ </div> <p>2 TAB bonding strength test</p>  <p>$P (=F/TAB bonding width) \geq 650\text{gf/cm}$, (speed rate: 1mm/min) 5pcs per SOA (shipment)</p>
14	Total no. of acceptable Defect	<p>A. Zone</p> <p>Maximum 2 minor non-conformities per one unit.</p> <p>Defect distance: each point to be separated over 10mm</p> <p>B. Zone</p> <p>It is acceptable when it is no trouble for quality and assembly in customer's end product.</p>

11.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	No abnormalities in functions and appearance
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	
Low temp. Operating	-20°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	0°C ← 25°C → 50°C (30 min ← 5 min → 30min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20 \pm 8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

11.4 Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isopropyl alcohol, ethyl alcohol or trichlorotrifluoroethane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting Newhaven Display.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not 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.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
 1. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: 280°C+10°C
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage V_o .
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

Newhaven Display LCDs and modules are not consumer products, but may be incorporated by Newhaven's customers into consumer products or components thereof. Newhaven does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of Newhaven is limited to repair or replacement on the terms set forth below. Newhaven 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 Newhaven and the customer, Newhaven will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with Newhaven general LCD inspection standard. (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.