User's Guide

NHD-C12864CZ-FSW-GBW

LCM (Liquid Crystal Display Graphic Module)

COG- RoHS Compliant

NHD-	Newhaven Display
12864-	128 Lines x 64 Characters
CZ-	Version Line
F-	Transflective
SW-	Side White LED B/L
G-	STN- Gray
B-	6:00 View
W-	Wide Temperature (-20 ~ +70c)

For product support, contact

DOCUMENT REVISION HISTORY

| Version	DATE	DESCRIPTION	CHANGED BY
00	May-20-2008	First issue	

CONTENTS

1.Features

1. 128X64 dots
2. Built-in controller (SPLC501C)
3. +5.0V power supply
4. 1/64 duty cycle;1/9bias
5. BKL to be driven by A, K.

LCD type	☐FSTN positive		☐FSTN Negative	
	☐STN Yellow Green	☑STN Gray		☐STN-Blue
View direction	☑6 O'clock		☐12 O'clock	
Rear Polarizer	☐Reflective		☑Transflective	☐Transmissive
Backlight Type	☑LED	☐EL	☐Internal Power	☐4.2V input
		☐CCFL	☑External Power	☑3.0 input
Backlight Color	☐Yellow Green	☐Amber	☐Blue-Green	☑White
Temperature Range	☑Normal		☐Wide	☐Super Wide
DC to DC circuit	☑Build-in		☐Not Build-in	
El Driver IC	☐Build-in		☑Not Build-in	
Touch screen	☑With		☐Without	
Font type	☐English-Japanese	☐English-European	☐English-Russian	☑other

## 2. MECHANICAL SPECIFICATIONS

Module size	71.3mm(L)*54.9mm(W)* Max5.9(H)mm
Viewing area	65.5mm(L)*40.0mm(W)
Dots size	0.42mm(L)*0.51mm(W)
Dots pitch	0.46mm(L)*0.56mm(W)
Weight	Approx.
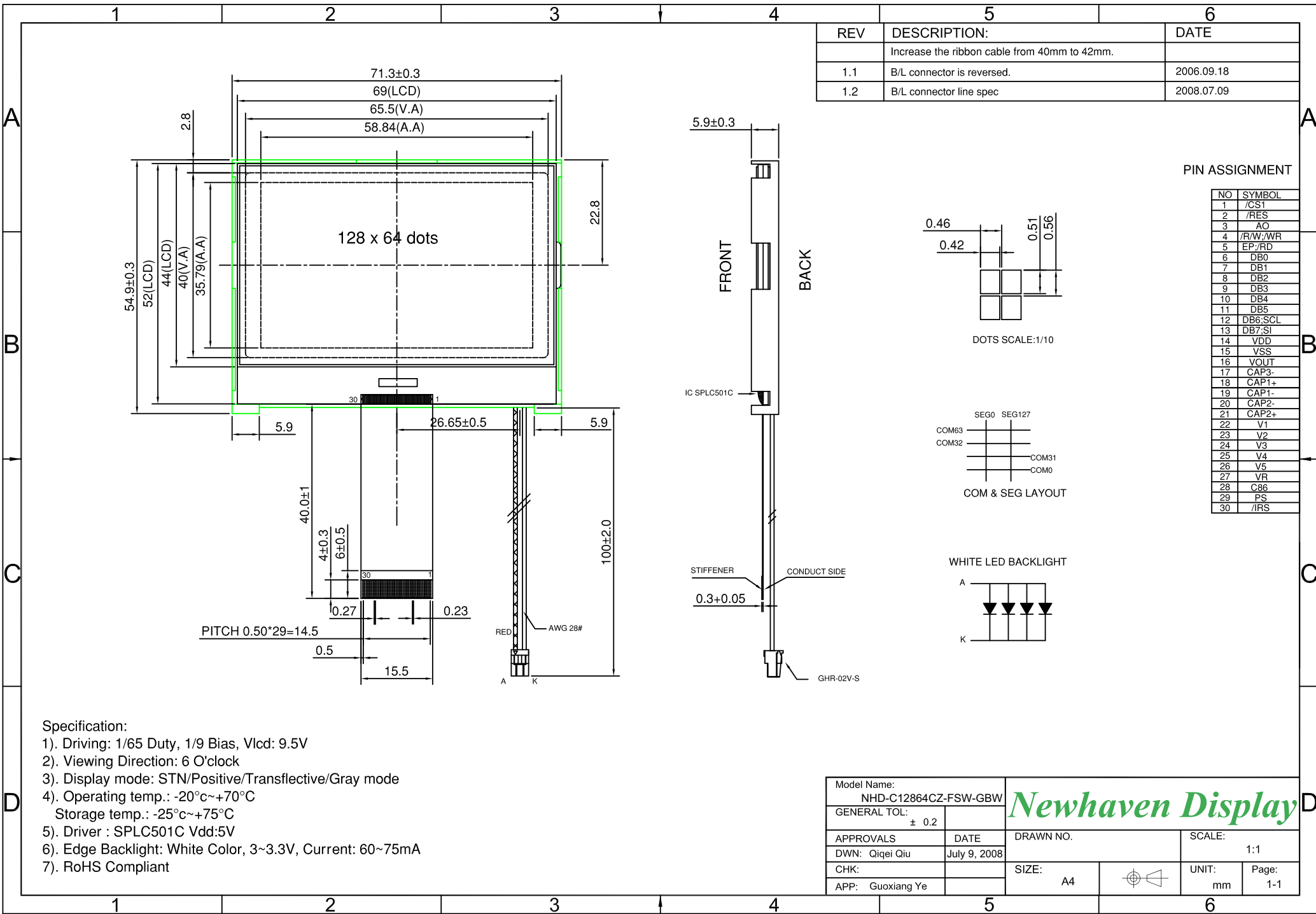
REV	DESCRIPTION:	DATE
	Increase the ribbon cable from 40mm to 42mm.	
1.1	B/L connector is reversed.	2006.09.18
1.2	B/L connector line spec	2008.07.09

71.3±0.3
69(LCD)
65.5(V.A)
58.84(A.A)
2.8

128 x 64 dots

22.8

54.9±0.3
52(LCD)
44(LCD)
40(V.A)
35.79(A.A)

5.9

26.65±0.5

5.9

30   1

40.0±1
4±0.3
6±0.5

100±2.0

30   1

0.27   0.23

PITCH 0.50*29=14.5

0.5

15.5

RED   AWG 28#

A   K

FRONT   BACK

5.9±0.3

IC SPLC501C

STIFFENER   CONDUCT SIDE

0.3+0.05

RED

GHR-02V-S

0.46
0.42
0.51
0.56

DOTS SCALE:1/10

SEG0   SEG127
COM63
COM32
COM31
COM0

COM & SEG LAYOUT

WHITE LED BACKLIGHT

A

K

PIN ASSIGNMENT

NO	SYMBOL
1	/CS1
2	/RES
3	AO
4	/R/W;/WR
5	EP;/RD
6	DB0
7	DB1
8	DB2
9	DB3
10	DB4
11	DB5
12	DB6;SCL
13	DB7;SI
14	VDD
15	VSS
16	VOUT
17	CAP3-
18	CAP1+
19	CAP1-
20	CAP2-
21	CAP2+
22	V1
23	V2
24	V3
25	V4
26	V5
27	VR
28	C86
29	PS
30	/IRS
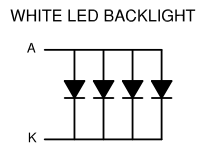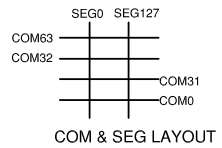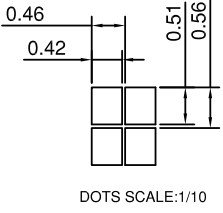
Specification:
1). Driving: 1/65 Duty, 1/9 Bias, Vlcd: 9.5V
2). Viewing Direction: 6 O'clock
3). Display mode: STN/Positive/Transflective/Gray mode
4). Operating temp.: -20°c~+70°C
   Storage temp.: -25°c~+75°C
5). Driver : SPLC501C Vdd:5V
6). Edge Backlight: White Color, 3~3.3V, Current: 60~75mA
7). RoHS Compliant

Newhaven Display

Model Name: NHD-C12864CZ-FSW-GBW	
GENERAL TOL: ± 0.2	
APPROVALS	DATE
DWN: Qiqei Qiu	July 9, 2008
CHK:	
APP: Guoxiang Ye	

DRAWN NO.

SCALE: 1:1

SIZE: A4

UNIT: mm

Page: 1-1

4.Absolute maximum ratings

Item	Symbol	Standard			Unit
Power voltage	V_{DD}-V_{SS}	0	-	7.0	V
Input voltage	V_{IN}	VSS	-	VDD	
Operating temperature range	V_{OP}	-20	-	+70	℃
Storage temperature range	V_{ST}	-25	-	+75	

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	A0	MPU	Register select signal
4	R/W	MPU	Read/write select signal
5	E	MPU	Operation (data read/write) enable signal
6~10	DB0~DB3	MPU	Four low order bi-directional three-state data bus lines. Used for data transfer between the MPU and the LCM. These four are not used during 4-bit operation.
11~13	DB4~DB7	MPU	Four high order bi-directional three-state data bus lines. Used for data transfer between the MPU
14	V_{DD}	Power supply	Power supply for logic (+5V) for LCM
15	V_{SS}		Signal ground for LCM (GND)
16	VOUT		DC/DC voltage converter.
17	CAP3-		
18	CAP1+		
19	CAP1-		
20	CAP2-		
21	CAP+		
22	V1	Power for LCD	A multi-level power supply for the liquid crystal drive.
23	V2		
24	V3		
25	V4		
26	V5		
27	VR		Output voltage regulator terminal.
28	C86	MPU	This is the MPU interface switch terminal.
29	PS	MPU	This is the parallel input/serial data input switch terminal.
30	/IRS	MPU	This terminal selects the resistors for the V5 voltage level adjustment.

6.Optical characteristics

STN type display module (Ta=25℃, VDD=5.0V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing angle	θ	C_r≥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	Ta =25℃	-	9.5	-	V
Input voltage	V_{DD}		4.7	5.0	5.5	
Supply current	I_{DD}	Ta=25℃, V_{DD}=5.0V	-	1.5	2.5	mA
Input leakage current	I_{LKG}		-	-	1.0	uA
"H" level input voltage	V_{IH}		2.2	-	V_{DD}	
"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	-	-	V
"L" level output voltage	V_{OL}	LOH=1.6mA	-	-	0.4	
Backlight supply voltage	V_F		-	3.0	-	
Backlight supply current	I_{LED}	V_F=3.2V	-	60	-	mA

8. Absolute Maximum Ratings

(Unless otherwise noted, VSS=0V)

Parameter		Symbol	Conditions	Unit
Power Supply Voltage		VDD	-0.3 to +7.0	V
Power supply voltage (2) (VDD Standard)		VSS2	-7.0 to +0.3	V
	With Triple step-up		-4.0 to +0.3	
	With Quad step-up		-3.0 to +0.3	
Power supply voltage (3) (VDD standard)		V5, Vout	-12.0 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 85	C
Storage Temp.	Bare chip	Tstr	-55 to +125	C

VDD ——————   ·················   VDD ——————   —————— VDD

GND   VSS   VSS2, V1 to V4

                                                                             V5, Vout

System MPU) side   SPLC501C chip side
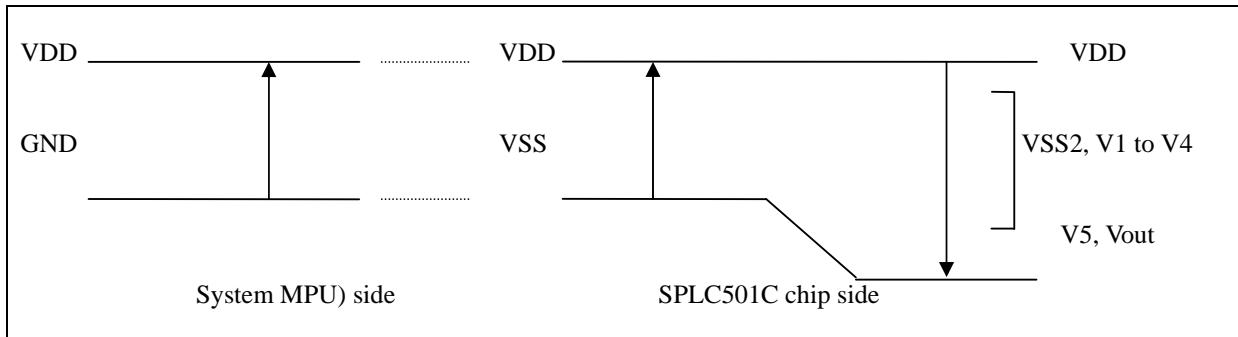
9. Timing Characteristics

9.1 System bus read/write characteristics 1 (for the 8080 series MPU)
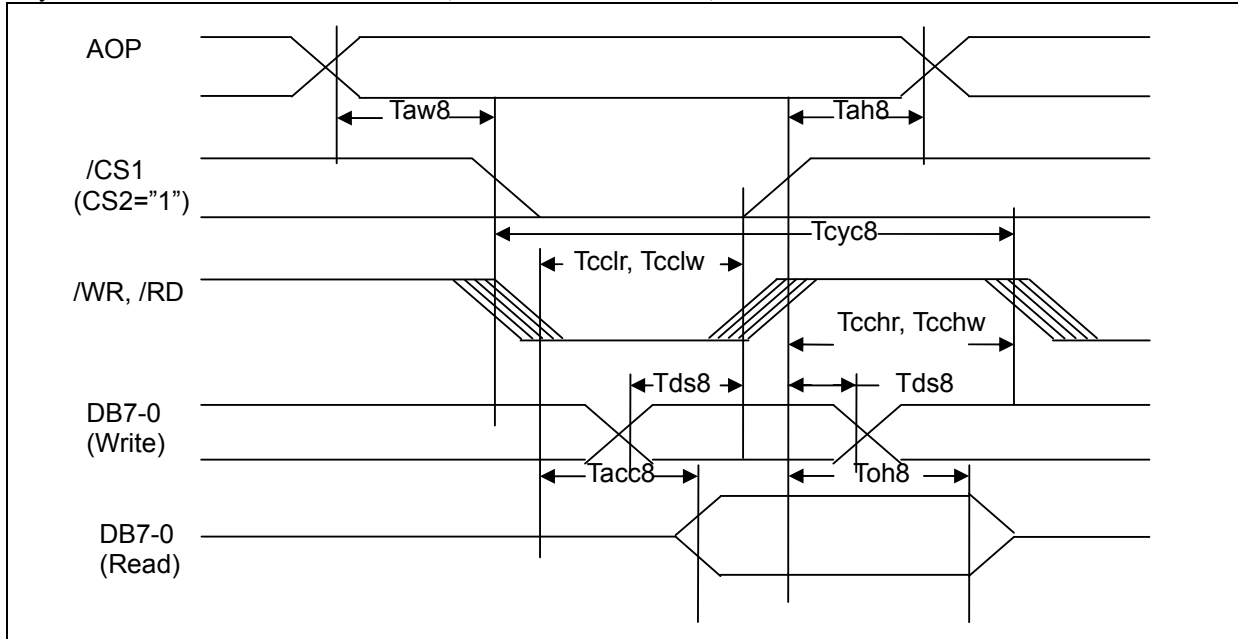
(VDD=4.5V to 5.5V, Ta=25C)

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Unit
Address hold time	AOP	Tah8		0	-	ns
Address setup time		Taw8		0	-	ns
System cycle time	AOP	Tcyc8		166	-	ns
Control L pulse with (/WR)	/WR	Tcclw		30	-	ns
Control L pulse with (/RD)	/RD	Tcclr		70	-	ns
Control H pulse with (/WR)	/WR	Tcchw		30	-	ns
Control H pulse with (/RD)	/RD	Tcchr		30	-	ns
Data setup time	DB7-0	Tds8		30	-	ns
Address hold time		Tdh8		10	-	ns
/RD access time		Tacc8	Cl=100pF	-	70	ns
Output disable time		Toh8		5.0	50	ns

(VDD=2.7V to 4.5V, Ta=25C)

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Unit
Address hold time	AOP	Tah8		0	-	ns
Address setup time		Taw8		0	-	ns
System cycle time	AOP	Tcyc8		300	-	ns
Control L pulse with (/WR)	/WR	Tcclw		60	-	ns
Control L pulse with (/RD)	/RD	Tcclr		120	-	ns
Control H pulse with (/WR)	/WR	Tcchw		60	-	ns
Control H pulse with (/RD)	/RD	Tcchr		60	-	ns
Data setup time		Tds8		40	-	ns
Address hold time	DB7-0	Tdh8		15	-	ns
/RD access time		Tacc8	Cl=100pF	-	140	ns
Output disable time		Toh8		10	100	ns

(VDD=2.4V to 2.7V, Ta=25C)

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Unit
Address hold time	AOP	Tah8		0	-	ns
Address setup time		Taw8		0	-	ns
System cycle time	AOP	Tcyc8		1000	-	ns
Control L pulse with (/WR)	/WR	Tcclw		120	-	ns
Control L pulse with (/RD)	/RD	Tcclr		240	-	ns
Control H pulse with (/WR)	/WR	Tcchw		120	-	ns
Control H pulse with (/RD)	/RD	Tcchr		120	-	ns
Data setup time		Tds8		80	-	ns
Address hold time	DB7-0	Tdh8		30	-	ns
/RD access time		Tacc8	Cl=100pF	-	280	ns
Output disable time		Toh8		10	200	ns

Note1: The input signal rise time and fall time(Tr, Tf) is specified at 15 ns or less. When the system cycle time is extremely fast, (Tr-Tf) < or = (Tcyc8-Tcclw-Tcchw) for (Tr+Tf) < or = (Tcyc8-Tcclr-Tcchr) are specified.
Note2: All timing is specified using 20% and 80% of VDD as the reference.
Note3: Tcclw and Tcclr are specified as the overlap between /CS1 being "L" (/CS2 = "H") and /WR and /RD being at the "L' level.

9.2 System bus read/write characteristics 1 (for the 6800 series MPU)
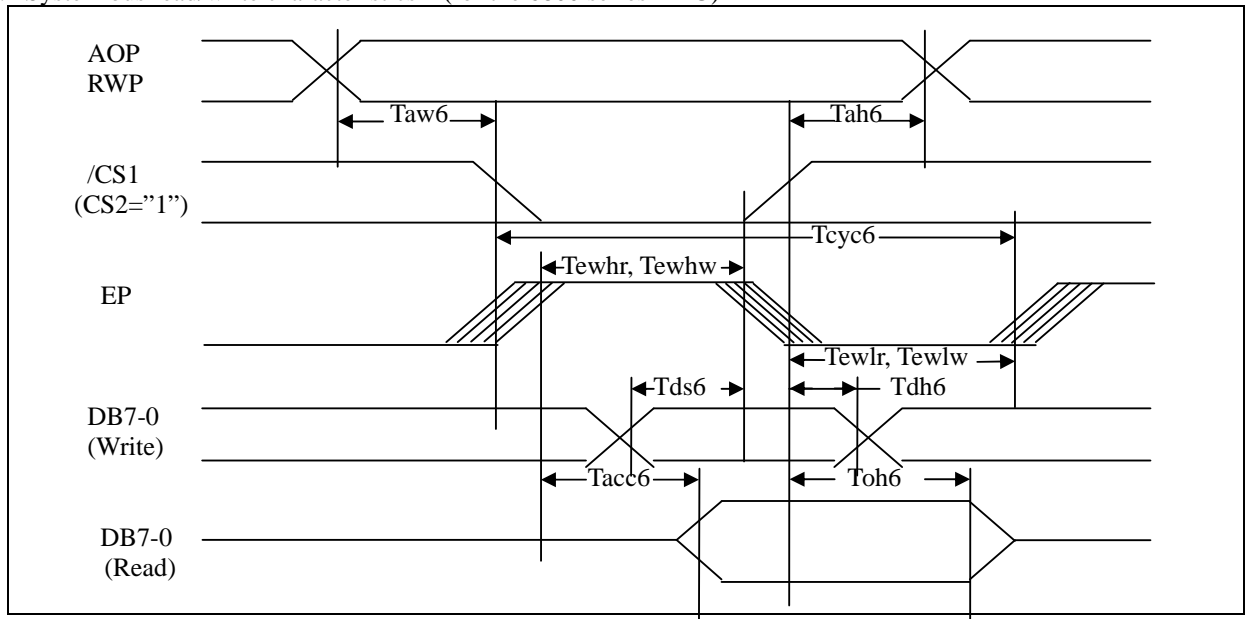
(VDD=4.5V to 5.5V, Ta=25C)

Item		Signal	Symbol	Condition	Rating		Unit
					Min.	Max.	
Address hold time		AOP	Tah6		0	-	ns
Address setup time			Taw6		0	-	ns
System cycle time		AOP	Tcyc6		166	-	ns
Data setup time		DB7-0	Tds6	Cl=100pF	30	-	ns
Data hold time			Tdh6		10	-	ns
Access time			Tacc6		-	70	ns
Output disable time			Toh6		10	50	ns
Enable H pulse time	Read	EP	Tewhr		70	-	ns
	Write		Tewhw		30	-	ns
Enable L pulse time	Read	EP	Tewlr		30	-	ns
	Write		Tewlw		30	-	ns

(VDD=2.7V to 4.5V, Ta=25C)

Item		Signal	Symbol	Condition	Rating		Unit
					Min.	Max.	
Address hold time		AOP	Tah6		0	-	ns
Address setup time			Taw6		0	-	ns
System cycle time		AOP	Tcyc6		300	-	ns
Data setup time		DB7-0	Tds6	Cl=100pF	40	-	ns
Data hold time			Tdh6		15	-	ns
Access time			Tacc6		-	140	ns
Output disable time			Toh6		10	100	ns
Enable H pulse time	Read	EP	Tewhr		120	-	ns
	Write		Tewhw		60	-	ns
Enable L pulse time	Read	EP	Tewlr		60	-	ns
	Write		Tewlw		60	-	ns

(VDD=2.4V to 2.7V, Ta=25C)

Item		Signal	Symbol	Condition	Rating		Unit
					Min.	Max.	
Address hold time		AOP	Tah6		0	-	ns
Address setup time			Taw6		0	-	ns
System cycle time		AOP	Tcyc6		1000	-	ns
Data setup time		DB7-0	Tds6	Cl=100pF	80	-	ns
Data hold time			Tdh6		30	-	ns
Access time			Tacc6		-	280	ns
Output disable time			Toh6		10	120	ns
Enable H pulse time	Read	EP	Tewhr		240	-	ns
	Write		Tewhw		120	-	ns
Enable L pulse time	Read	EP	Tewlr		120	-	ns
	Write		Tewlw		120	-	ns

Note1: The input signal rise time and fall time (Tr, Tf) is specified at ns or less. When the system cycle time is extremely fast, (Tr+Tf) < or = (Tcyc6-Tewlw-Tewhw) for (Tr+Tf) < or = (Tcyc6-Tewlr-Tewhr are specified.
Note2: All timing is specified using 20% and 80% of VDD as the reference.
Note3: Tewlw and Tewlr are specified as the overlap between /CS1 being "L" (CS2="H") and EP.

10. Table of LCM commands

| Command	AOP	/RD	/WR	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
1) Display ON/OFF	0	1	0	1	0	1	0	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						Set 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 the status RAM
7) Display data read	1	0	1	Read data								Reads from the display RAM
8) ADC select	0	1	0	1	0	1	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	1	0	0	1	1	0/1	Sets the LCD display normal/reverse 0: normal, 1: reverse
10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0/1	Display all points 0: normal display 1: all points ON
11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0/1	Sets the LCD driver voltage bias ratio SPLC501C…..0: 1/9, 1: 1/7
12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
13) End	0	1	0	1	1	1	0	1	1	1	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	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) V5 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio (Rb/Ra) mode
18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set the V5 output voltage electronic volume register
Electronic volume register set	0	1	0	*	*	Electronic volume value						
19) Static indicator ON/OFF				1	0	1	0	1	1	0	0/1	0: OFF, 1: ON
Static indicator Register set				*	*	*	*	*	*	Mode		Set the flashing mode
20) Page Blink	0	1	0	1	1	0	1	0	1	0	1	
Page selection	0	1	0	P7	P6	P5	P4	P3	P2	P1	P0	P7-0: 1 – blinking page 0 – no blinking, normal display
21) Driving Mode set	0	1	0	1	1	0	1	0	0	1	0	Set the driving mode register
Mode selection	0	1	0	D1	D0	0	0	0	0	0	0	Driving capability (D1, D0): (1,1)>(0,0)>(0,1)>(1,0)
22) Power saver												Display OFF and display all points ON compound command
6) Display data write	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
7) Display data read	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command
				1	1	0	1	0	1	0	0	

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.

Fluorescent
Lamps

30cm $_{min}$ 100cm $_{min}$

45°   45°

LCM   LCD
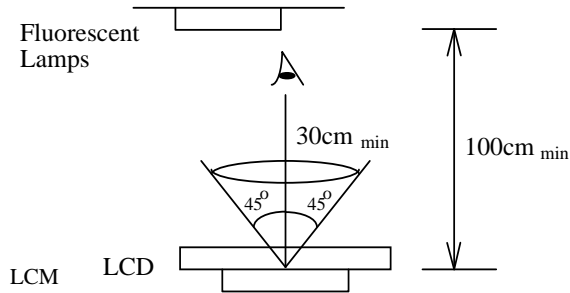
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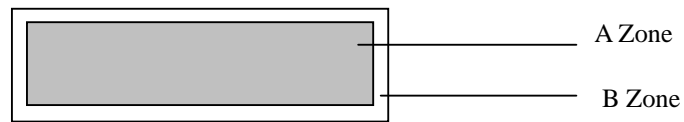
A Zone

B 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
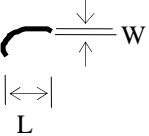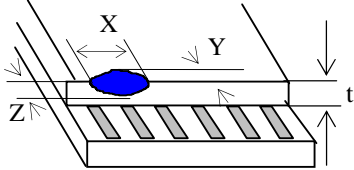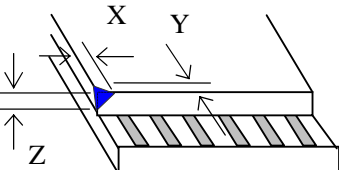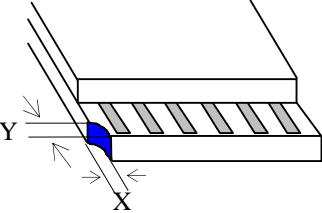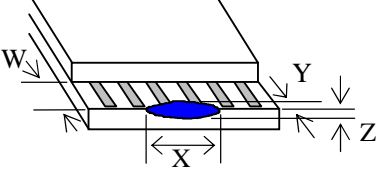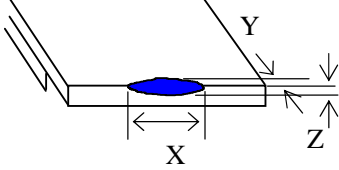
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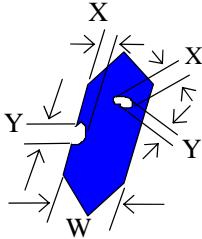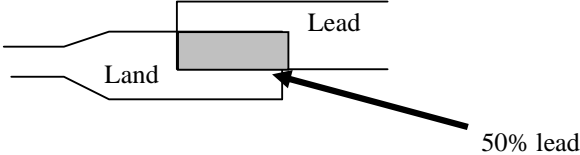
Defect classification   **(Note: * is not including)**
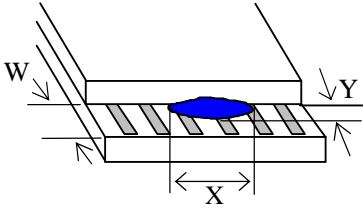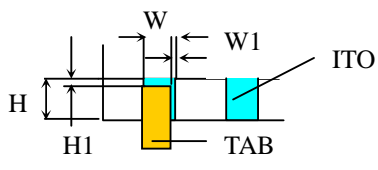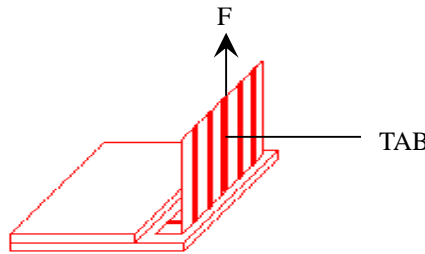
Classify		Item		Note	AQL
Major	Display state	Short or open circuit		1	0.65
		LC leakage			
		Flickering			
		No display			
		Wrong viewing direction			
		Contrast defect (dim, ghost)		2	
		Back-light		1,8	
	Non-display	Flat cable or pin reverse		10	
		Wrong or missing component		11	
Minor	Display state	Background color deviation		2	1.0
		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	Not allow
	LC leakage	
	Flickering	
	No display	
	Wrong viewing direction	
	Wrong Back-light	
2	Contrast defect	Refer to approval sample
	Background color deviation	
3	Point defect, Black spot, dust (including Polarizer) $\phi = (X+Y)/2$	<table below>
4	Line defect, Scratch	<table below>
5	Rainbow	Not more than two color changes across the viewing area.

For item 3:

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
$\phi > 0.30$	0

Unit : mm

For item 4:

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

Unit: mm

No	Item	Criterion

6	Chip Remark: 　X: Length 　　direction 　Y: Short 　　direction 　Z: Thickness 　　direction 　t: Glass 　　thickness 　W: Terminal 　　Width	Acceptable criterion

Acceptable criterion

X	Y	Z
≤2	0.5mm	≤t/2

Acceptable criterion

X	Y	Z
≤2	0.5mm	≤t

Acceptable criterion

X	Y	Z
≤3	≤2	≤t
shall not reach to ITO		

Acceptable criterion

X	Y	Z
Disregard	≤0.2	≤t

Acceptable criterion

X	Y	Z
≤5	≤2	≤t/3

No.	Item	Criterion
7	Segment pattern W = Segment width $\phi = (X+Y)/2$	(1) Pin hole ϕ < 0.10mm is acceptable. <table><tr><td>Point Size</td><td>Acceptable Qty</td></tr><tr><td>$\phi \le 1/4W$</td><td>Disregard</td></tr><tr><td>$1/4W < \phi \le 1/2W$</td><td>1</td></tr><tr><td>$\phi > 1/2W$</td><td>0</td></tr></table>
8	Back-light	(1) The color of backlight should correspond its specification. (2) Not allow flickering
9	Soldering	(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. 50% lead
10	Wire	(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.
11*	PCB	(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.

No	Item	Criterion
12	Protruded W: Terminal Width	 Acceptable criteria: $Y \le 0.4$
13	TAB	1. Position $W1 \le 1/3W$ $H1 \le 1/3H$ 2 TAB bonding strength test P (=F/TAB bonding width) ≥650gf/cm ,(speed rate: 1mm/min) 5pcs per SOA (shipment)
14	Total no. of acceptable Defect	A. Zone 　Maximum 2 minor non-conformities per one unit. 　Defect distance: each point to be separated over 10mm B. Zone 　It is acceptable when it is no trouble for quality and assembly 　in customer's end product.

11.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	No abnormalities
Low temp. Operating	-20°C	48	in functions
Humidity	40°C/ 90%RH	48	and appearance
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+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 isoproply alcohol, ethyl alcohol or trichlorotriflorothane, 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
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.
8. 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$\pm$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 Vo.
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 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.