



User's Guide

NHD-2.4-240320ZF-CTXI#-1 **TFT**

(Liquid Crystal Display Graphic Module)

2.4" Diagonal16-bit digital interface240x320 Resolution (portrait mode)White LED Backlight

Please review the controller spec HX8347-A .

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March 10, 2009

		RECORDS OF REVIS	ION		
DATE	REVISED NO.	REVISED DESCRIPTIONS	PREPARED	CHECKED	APPROVED
2007-12-26	01	FIRST ISSUE			
2008-2-20	00	MODIFY LUMINOUS INTENSITY OF BACKLIGHT	F		
2008-7-21	03	MODIFY THE MODULE			

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.		PAGE	2
			CONTENTS		
1.	GENERAL SPEC	CIFICATION	S	3	,
2.	FEATURES			3	;
3.	MACHANICAL	SPECIFICAT	TIONS	3	
4.	OUTLINE DIM	ESIONS		4	ļ
5.	INTERFACE AS	SSIGNMENT		5	;
6.	APPLICATION	CIRCUIT -		6	
7.	BLOCK DIAGR	AM		6	
8.	TIMING CHAR	ACTERISTIC	CS	7	,
9.	RESET TIMINO	G CHARACTI	ERISTICS	8	3
10	DDRAM ARRA	NGMENT -		9)
11	ABSOLUTE MA	XIMUM RA	ΓINGS	1	0
12	ELECTRICAL (CHARACTER	RISTICS	1	0
13.	LED BACKLIG	HT CHARAC	CTERISTICS	1	1
14.	OPTICAL CHA	RACTERIST	ICS	1:	2
15.	ENVIRONMEN	TAL ABSOLU	UTE MAXIMUM RATINGS	1:	5
16.	RELIABILI TY			1:	5
17.	THE STANDAR	D OF INSPEC	CTION	1	6
18.	USING LCD MO	DDULES		1	9
ı					

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.	PAGE	3
200.	00.		1	

1. GENERAL SPECIFICATIONS

1-1 SCOPE:

This specification covers the delivery requirements for the liquid crystal display delivered by Newhaven to Customer

1-2 PRODUCTS:

Liquid Crystal Display Module (LCM)

1-3 MODULE NAME:

NHD-2.4-240320ZF-CTXI#-1

2. FEATURES

2-1 MAIN LCD (LARGE)

(1) Display Type: 2.4"TFT; Transmissive; Normally white; 6 o'clock

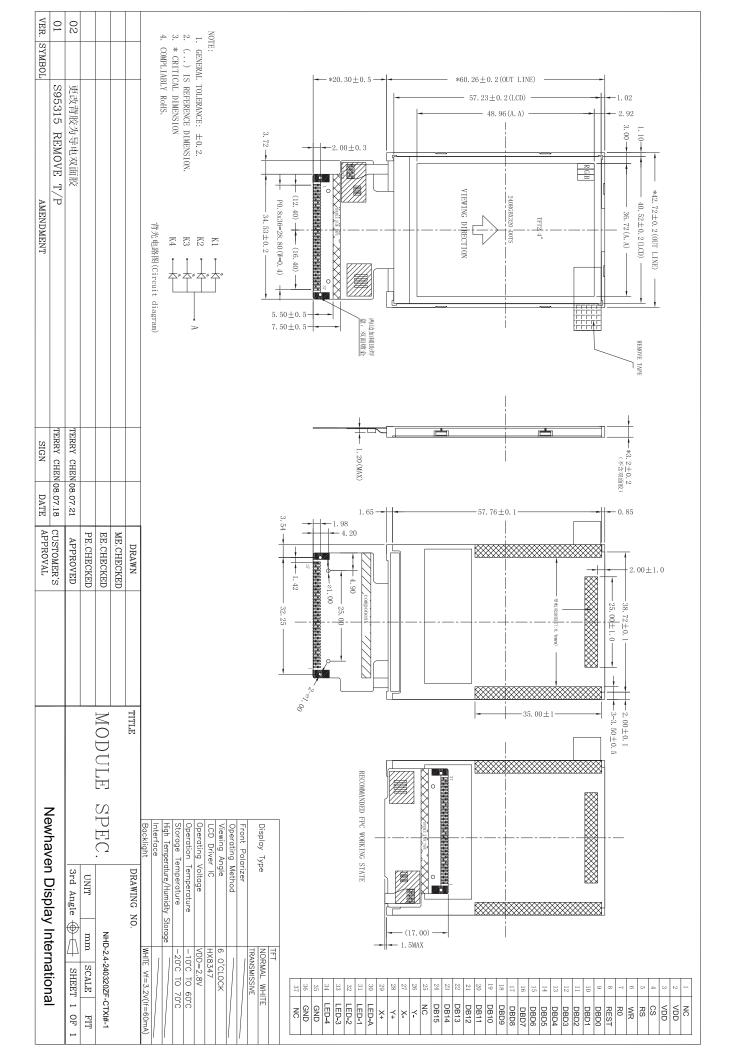
(2) Driving Method: TFT

(3) Built-in controller: HX8347-A

(4) Backlight: WHITE LED

3. MACHANICAL SPECIFICATIONS

ITEM	SPECIFICATIONS	UNIT
OUTLINE DIMEMSIONS	42.72(L) x 60.26 (W) x4.3(T)	mm
ACTIVE AREA	36.72(L) x 48.96(W)	mm
DISP.CONSTRUCTION	240RGB x 320 Dots	
NUMBER OF DOTS	240 x 3 x 320	Dots
PIXEL PITCH	51(L) x 153 (W)	um
ASSY.TYPE	COG+FPC+BL+TP	
BACKLIGHT	WHITE LED	
WEIGHT		-



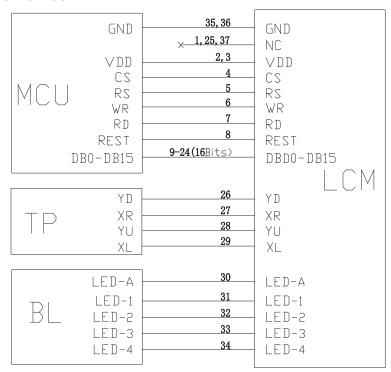
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5. INTERFACE ASSIGNMENT

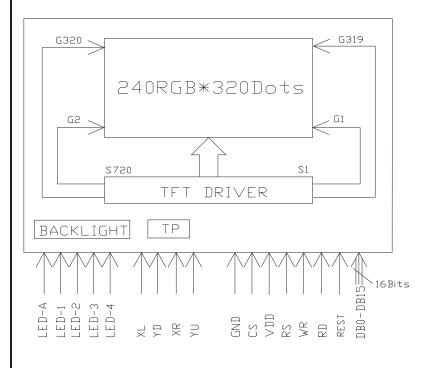
PIN NO.	FUNCTION DESCRIPTIONS	SYMBOL
1	NO CONNECT	NC
2	POWER SUPPLY	VDD
3	POWER SUPPLY	VDD
4	CHIP SELECT PIN	CS
5	COMMAND AND DATA REGISTER SELECT PIN	RS
6	WRITE SIGNAL	WR
7	READ SIGNAL	RD
8	RESET PIN	REST
9		DBD0
10		DBD1
11		DBD2
12		DBD3
13		DBD4
14		DBD5
15		DBD6
16		DBD7
17	Data bus.	DBD8
18		DBD9
19		DB10
20		DB11
21		DB12
22		DB13
23		DB14
24		DB15
25	NO CONNECT	NC
26	NO CONNECT	YD
27	NO CONNECT	ΧR
28	NO CONNECT	YU
29	NO CONNECT	XL
30	POWER SUPPLY+ FOR BACKLIGHT ANODE	LED-A
31	POWER SUPPLY- FOR BACKLIGHT CATHODE	LED-1
32	POWER SUPPLY- FOR BACKLIGHT CATHODE	LED-2
33	POWER SUPPLY- FOR BACKLIGHT CATHODE	LED-3
34	POWER SUPPLY- FOR BACKLIGHT CATHODE	LED-4
35	GROUND	GND
36	GROUND	GND
37	NO CONNECT	NC



6.APPLICATION CIRCUIT

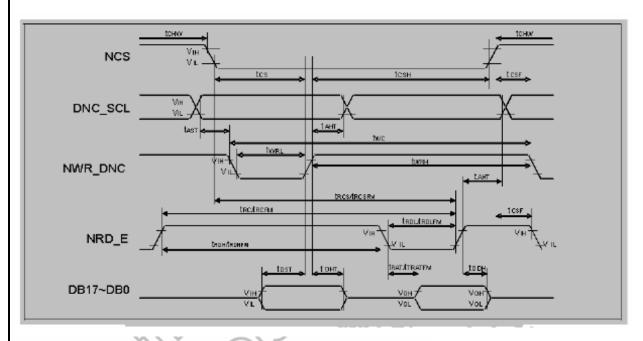


7. BLOCK DIAGRAM



STANDARD DOC.	PRODUCT SPEC.	MODULE NO.		PAGE	7
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8.TIMING CHARACTERISTICS



(VSSA=0V, IOVCC=1.65V to 2.50V, VCI=2,3V to 2.9V, Ta = -30 to 70° C)

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
DNC_SCL	tast taht	Address setup time Address hold time (Write/Read)	10 10		ns	-
NCS	tchw tcs trcsfm tcsf tcsh	Chip select "H" pulse width Chip select setup time (Write) Chip select setup time Chip select wait time (Write/Read) Chip select hold time	0 35 355 10 10)	ns	-
NWR_RNW	twc twr.h twr.L	Write cycle Control pulse "H" duration Control pulse "L" duration	100 35 35	-	ns	-
NRD_E	trofm trdhem trdlem	Read cycle Control pulse "H" duration Control pulse "L" duration	450 90 355		ns	When read from GRAM
D17 to D0	tost toht tratem todh	Data setup time Data hold time Read access time Output disable time	15 10 - 20	- 340 80	ns	For maximum C _L =30pF For minimum C _L =8pF

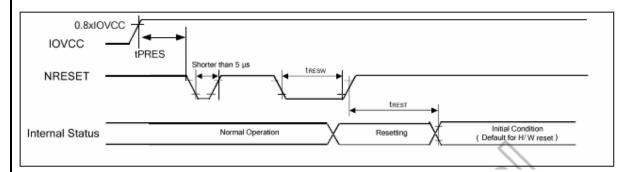
Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.

Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.	PAGE	8
1 200.	O. LO.	110.		

9.RESET TIMING CHARACTERISTICS

Reset Input Timing Reset Input Timing

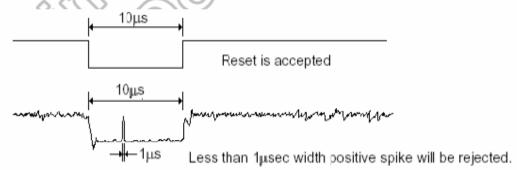


Symbol	Parameter	Related Pins	Min.	Тур.	Max.	Note	Unit
tRESW	Reset low pulse width ⁽¹⁾	NRESET	10	-	-		μs
tREST	Reset complete time ⁽²⁾	-	-	-	5	When reset applied during STB mode	ms
tivesi	Neset complete time	-		-	120	When reset applied during STB mode	ms
tPRES	Reset goes high level after Power on time	NRESET & IOVCC	1	<i>₹</i>	(Θ)	Reset goes high level after Power on	ms

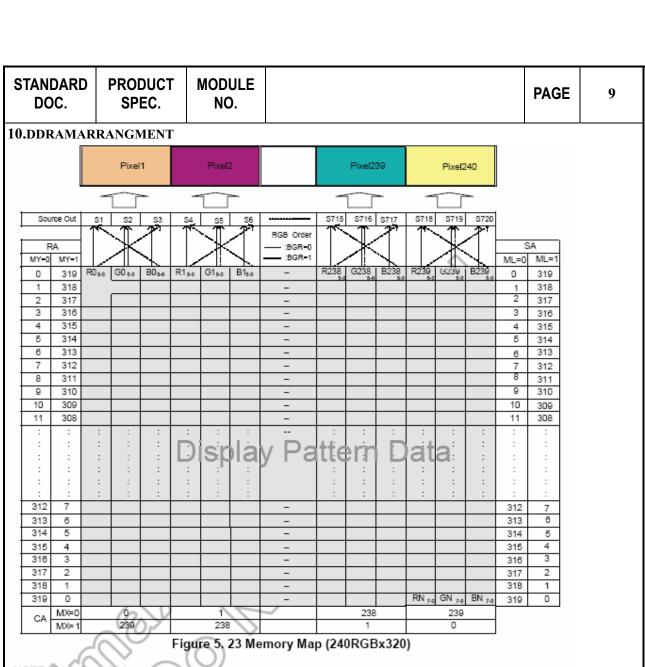
Note: (1) Spike due to an electrostatic discharge on NRESET line does not cause irregular system reset according to the table below.

NRESET Pulse	Action
Shorter than 5 µ	Reset Rejected
Longer than 10 µs	Reset
Between 5 μs and 10 μs	Reset Start

- (2) During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in STB Out –mode. The display remains the blank state in STB –mode) and then return to Default condition for H/W reset.
- (3) During Reset Complete Time, ID2 and VCOMOF value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of NRESET.
- (4) Spike Rejection also applies during a valid reset pulse as shown below:



(5) It is necessary to wait 5msec after releasing !RES before sending commands. Also STB Out command cannot be sent for 120msec.



NOTE: RA = Row Address,

CA = Column Address,

SA = Scan Address,

MX = Mirror X-axis (Column address direction parameter), D6 parameter of Memory Access Control command

MY = Mirror Y-axis (Row address direction parameter), D7 parameter of Memory Access Control command

ML = Scan direction parameter, D4 parameter of Memory Access Control command

RGB= Red, Green and Blue pixel position change, D3 parameter of Memory Access Control command

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.	PAGE	10

11. ABSOLUTE MAXIMUM RATING

ITEM	SYMBOL	CONDITION	STA	UNIT			
I Livi	STWIDOL	CONDITION	MIN	TYP	MAX	OIVII	
POWER SUPPLY FOR LOGIC	IOVCC	Ta=25⊠	-0.3		+3.3	٧	
POWER SUPPLY FOR LCD DRIVING	VIN	Ta=25⊠	-0.3		VCI+0.3	٧	
OPERATION TEMPERATURE	TOPR		-10		+60		
STORAGE TEMPERATURE	TSTG		-20		+70		

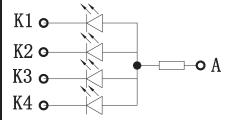
12. ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITIONS	STA	UNIT		
TILIVI	STWIDOL	CONDITIONS	MIN	TYP	MAX	OIVII
POWER SUPPLY FOR LOGIC	IOVCC	Ta= +25⊠		2.8		V
INPUT VOLTAGE "H" LEVEL	VIH	IOVCC=1.65~3.0V	0.8IOV CC		IOVCC	V
INPUT VOLTAGE "L" LEVEL	VIL	IOVCC=1.65~3.0V	-0.3		0.2IOVCC	V
OUTPUT VOLTAGE "H" LEVEL	VOH	IOH=-0.1mA	0.8IOV CC			V
OUTPUT VOLTAGE "L" LEVEL	VOL	IOVCC=1.65~2.4V IOL=0.1mA			0.2IOVCC	V

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.	F	PAGE	11
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13. LED BACKLIGHT CHARACTERISTICS

13-1 POWER SUPPLY FOR LED BACKLIGHT



13-2 ABSOLUTE MAXIMUN RATING

PARAMETER	SYMBOL	SPECIFICATIONS	UNIT
POWER DISSIPATION	PD	360	mW
FORWARD CURRENT	IFm	80	mA
REVERSE VOLTAGE	VR	5(每粒灯)	V
OPERATION TEMPERATURE	TOPR	-10⊠ ~ +60⊠	×
STORAGE TEMPERATURE	TSTG	-20⊠ ~ +70⊠	

13-3 ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	IBOL LIGHT CONDITIONS		STANDARD VALUE			UNIT
PARAMETER	STWIDOL	SOURCE	DURCE		TYP	MAX	OINIT
PARAMETER	V	WHITE	If =60mA	3.0	3.2	3.4	V
LUMINOUS INTENSITY	lv	WHITE	II =60MA	100	120	160	cd/m ²
CHROMATICCITY COORD	X Y	WHITE	If =60mA	0.25	3 0	29	3

14. OPTICAL CHARACTERISTICS

Item Symbo		Symbol	Conditions	Spe	ecificati	ons	Unit	Note			
		Syllibol	Conditions	Min.	Тур.	Max.	Offic	Note			
Transmittance	9	T%			4.7		%				
Contrast Ratio	0	CR	·	150	250	-	-				
Dospones Tip	20	T _R		NA	10	20	ms	All left side data			
Response Tin	ie	T _F		NA	20	30	ms	are based on			
	Dod	XR		0.603	0.633	0.663		CMO's following			
	Red	Y _R	Vienning manned and	0.299	0.329	0.359		condition -			
	Green	X_G	Viewing normal angle	0.264	0.294	0.324		Type 767			
Chromoticity		Y _G	$\theta^{X} = \theta^{A} = 0_{\circ}$	0.546	0.576	0.606		NTSC: 60%			
Chromaticity	Divo	X _B		0.103	0.133	0.163		LC:5066 Light : C light			
	Blue	Y _B		0.092	0.122	0.152		(Machine:BM5A)			
	\//bito	X _w		0.278	0.308	0.338		Normal Polarizer			
	White	Yw	Ţ	0.316	0.346	0.376		Without DBEF			
	Llor	θ_{X^+}			45	-					
Viewing	Hor.	θ _{X-}	Center		45	-	doa				
Angle	Ver.	θ_{Y^+}	CR≥10		35	-	deg.				
	ver.	θ _{γ-}			15	-					

*Note (1) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

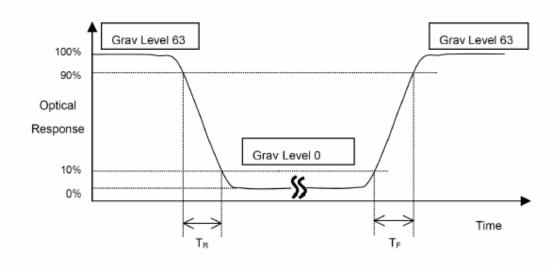
L63: Luminance of gray level 63

L0: Luminance of gray level 0

CR = CR(10)

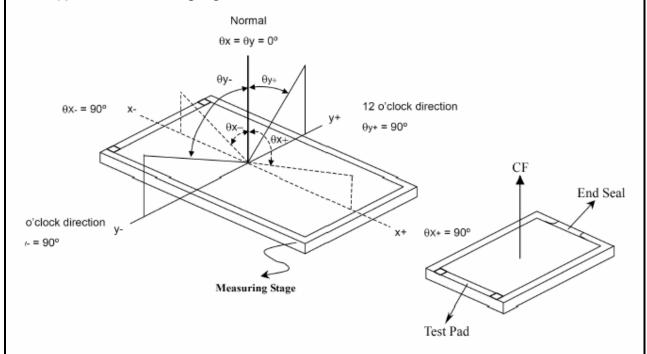
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

*Note (2) Definition of Response Time (TR, TF):



|--|

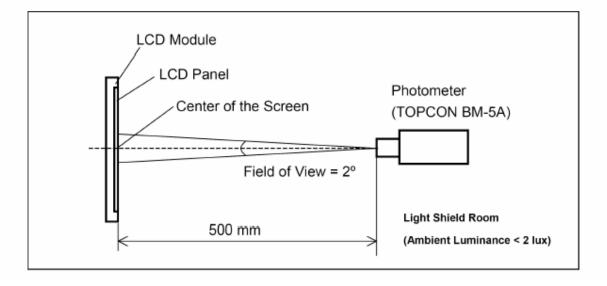
*Note(3) Definition of Viewing Angle



*** The above "Viewing Angle" is the measuring position with Largest Contrast Ratio; not for good image quality. View Direction for good image quality is 6 O'clock. Module maker can increase the "Viewing Angle" by applying Wide View Film.

*Note (4) Measurement Set-Up:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



STANDARD DOC.	PRODUCT SPEC.	MODULE NO.				PAGE	1
*Note (5)		Horizo	ntal dimer	ncion			
		0 L/4	L/2	3L/4	L		
	0						
	Vertical dimension			2			
	∯ W/2		5			t point	
	3W/4	3				1 10 5	
	× w	ļ.	<u> </u>				
			Active area				

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.	PAGE	15
DOC.	or Lo.	110.		

15. ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	CONDITIONS	CRITERION
OPERATING TEMPERATURE	TOPR	-10⊠ ~ +60⊠	NO DEFECT IN DISPLAYING AND
OFERATING TEMPERATURE	TOPK	-102 1002	OPERATIONAL FUNCTION
STORAGE TEMPERATURE	TSTG	-20⊠ ~ +70⊠	NO DEFECT IN DISPLAYING AND
STORAGE TEINIFERATURE	TEMPERATURE 151G		OPERATIONAL FUNCTION
HUMIDITY	-		WITHOUT CONDENSATION

16. RELIABILITY

16-1 RELIABILITY TEST

ITEM	CONDITIONS	CRITERION
OPERATING	HIGH TEMPERTURE +60⊠ 72HRS	NO DEFECT IN DISPLAYING AND
TEMPERATURE	LOW TEMPERTURE - 10⊠ 72HRS	OPERATIONAL FUNCTION
STORAGE	HIGH TEMPERTURE +70⊠ 120HRS	NO DEFECT IN DISPLAYING AND
TEMPERATURE	LOW TEMPERTURE - 201 120HRS	OPERATIONAL FUNCTION
HUMIDITY	40⊠ 90%RH 72HRS	NO DEFECT IN DISPLAYING AND
HUMIDITY	402 90 /01(11 /2111(3	OPERATIONAL FUNCTION
VIBRATION	each direction (X,Y,Z)	NO DEFECT IN DISPLAYING AND
VIDRATION	Sweep Frequency: 10 ~ 55Hz (1 min)	OPERATIONAL FUNCTION
	☑ Amplitude: 1.5mm	
THERMAL	-20⊠ (30mins) ← →+70⊠ (30mins) 10 cycles	NO DEFECT IN DISPLAYING AND
SHOCK	-2012 (30111115) C 7+1012 (30111115) 10 cycles	OPERATIONAL FUNCTION

17.THE STANDARD OF INSPECTION 17-1 Inspection items and specification for appearance (power off) No. Item Criterion AQL 1 Dimension Dimension out of the specification 1, General crack X	No. Ite	pection items a	nd specification for ap	Criterio				107
No. Item Criterion AQL 1 Dimension Dimension out of the specification 1, General crack X Y Z X Not over X area X X Y Z X Z	No. Ite	tem		Criterio				101
1 Dimension Dimension out of the specification 1, General crack $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			Dimension out of the		n			A 0.T
1. General crack $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	1 D	Dimension	Dimension out of the					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				specification				1.0
$\begin{array}{c c} X & Y \\ \geq K/8 & \geq L/3 \end{array}$ Transfer position crack: $\leq L/5$	2	Glass crack	2, corner 2, corner 3, contact pad crack 4, Substrate protube	≥ x ance and internal cr	X No No No No No No No N	Y 2 ch	Z No heck	2.50

DO	DARD C.	PROD SPE		MODULE NO.						PAGE	1
						_	Accep	otable of o	defect		•
					-	D -	A/B	Area	C Are	a	
				1	<u> </u>	0 < 0.2	No c	heck			
				┙ Ψ━	0.2≤	D < 0.3	2		No ob		
3 Black dot \ White dot		dot \	Y	Y	0.3≤	D≤0.5	1		No ch	песк	2.50
		- `- -	- `-		D>0.5	0			2.50		
			Y: sho	g diameter t diameter rrage of diame	eter D=(X-	+Y)/2					
			1	<u> </u>							
				L	Longth	Whidth	Ac	ceptable	of defec	:t	
					Length	whiath	Α	\/B Area	C Area	a	
4 Line d		-	← w	accept	W≤0.02	No	check				
					L≤3	W≤0.05		2	No ch	neck	
		T 1 C .		<u> </u>		W≤0.05		2			
	Line defect		r		L≤2.5 W > 0.05		5	As round	d type		2.50
			1	gth W: Width			1				
			1	t of polarizer(cording	to the limi	t		
			Defect	t of polarizer(ccording 1	to the limi ptable of	t defect		
			Defect	t of polarizer(Scratches	、Spot): Ad	Acce A/B	to the limi ptable of Area	t		
5	Pola	arizer	Defect	t of polarizer((Scratches.	、 Spot) : Ac D ≤0.2	Acce A/B / No che	to the limi ptable of Area	t defect		2 50
5		arizer ıbble	Defect	t of polarizer(D: 0.2≤I	、Spot) : Ad D ≤0.2 D≤0.5	Acce A/B / No che	to the limi ptable of Area	t defect		2.50
5			Defect	t of polarizer(D: 0.2≤[0.5≤[Spot) : Acc D ≤0.2 D≤0.5 D≤1.0	Acce A/B / No che 3	ptable of Area eck	t defect C Area		2.50
5			Defect	t of polarizer(D: 0.2≤[0.5≤[、Spot) : Ad D ≤0.2 D≤0.5	Acce A/B / No che 3	to the limi ptable of Area	t defect C Area		2.50
5	Bu	abble	Defect specin	t of polarizer(D: 0.2≤[0.5≤[D in hole: san	D ≤0.2 D≤0.5 D≤1.0 > 1.0 me as segments	Acce A/B / No che 3 2	ptable of Area eck	t defect C Area No che		2.50
	Exterr of pan	abble	Defect specin	ransfigure, pi	D: 0.2≤I 0.5≤I D in hole: saint width ≥1	D ≤0.2 D≤0.5 D≤1.0 > 1.0 me as segmen/2 standard	Acce A/B / No che 3 2 nt transfir width is a	ptable of Area eck 0 nguer acceptabl	t defect C Area No che		

STAND		PROD SPE		MODULE NO.				F	PAGE	18
9	SMT o	organ	2、Tryir 3、Dam	 2. Trying to keep dot of soldering tin orbicular 3. Damage , break, wrong assembly and unseal are unreceivable for component. 						
10	Steel F	Frame	2、If the		ick which o		ame. cast or hole of	painting,	we	2.50
7-2 In	spection	items ar	nd specifica	ation for disp	olay defect	(power on)				
1		trical fect		Segme	nt missing ent short display	Not al Not al Not allo	low			1.0
2	Pin	hole	1, Pin h	ole A	* B	width W < 0.4 W≥0.4 D=(A+B)/2	D≤0.2 & D D≤0.25 & D D≤0.1 accepta	0≤1/2W e≤1/3W		2.50
3		play tern	W: Desig	n dimension	- C, D:	Width W < 0.4 W≥0.4 discrepant dim	Acceptable C, D, C, D, C	G≤1/2W G≤0.2		1.0
		W. Design of			D D < 0.1	Acceptak A/B Area No check	<u>. </u>			
4		/white ot	X: long d	liamator		D < 0.1 0.1≤D < 0.2 0.2≤D≤0.25 D>0.25	2 1 0	No chec	ck j	2.50
			Y: shot d		D=(X+Y)/	2				

STAND		PROD SPE		MODULE NO.				PAG		■	19
			1	<u></u>	Length	Width	Accepta	ble QT	Υ		
			1	Ī	Length	wiatri	A/B Area	C Are	a		
	Line defect		→ w		不	W≤0.02	No check	No check			
					L≤3	W≤0.03	2				
					L≤2.5	0.03 < W≤0.05	2				
5					L≤2.5	W > 0.05	Sa round	d type	2.50	2.50	
			L: leng	Jth W: width							

18.USING LCD MODULES

18-1 LIQUID CRYSTAL DISPLAY MODULES

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

- (1) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.
- (2) Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.).
- (3) N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropylalcohol.
- (4) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, wipe gently with absorbent cotton or other soft material like chamois soaked in Isopropyl alcohol or Ethyl alcohol. Do not scrub hard to avoid damaging the display surface.
- (5) Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.
- (6) Avoid contacting oil and fats.
- (7) Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.
- (8) Do not put or attach anything on the display area to avoid leaving marks on.
- (9) Do not touch the display with bare hands. This will stain the display area and degradate insulation between terminals (some cosmetics are determinated to the polarizers).
- (10) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- (11) As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or iarring.

18-2 PRECAUTION FOR HANDING LCD MODULES

Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the

DOC. SPEC. NO. PAGE 20

module or making any alterations or modifications to it.

- (1) Do not alter, modify or change the the shape of the tab on the metal frame.
- (2) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- (3) Do not damage or modify the pattern writing on the printed circuit board.
- (4) Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- (5) Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- (6) Do not drop, bend or twist LCM. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
- (7) In order to avoid the cracking of the FPC, you should to pay attention to the area of FPC where the FPC was bent .the edge of coverlay; the area of surface of Ni-Au plating, the area of soldering land, the area of through hole.

18-3 ELECTRO-STATIC DISCHARGE CONTROL

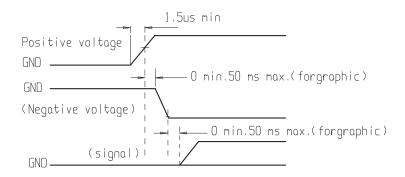
Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

- (1) Make certain that you are grounded when handing LCM. To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules. Exposed area of the printed circuit board. Terminal electrode sections.
- (2) Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.
- (3) When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.
- (4) When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
- (5) As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
- (6) To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.

18-4 PRECAUTIONS FOR OPERATION

- (1) Viewing angle varies with the change of liquid crystal driving voltage (VO). Adjust VO to show the best contrast.
- (2) Driving the LCD in the voltage above the limit shortens its life.
- (3) If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.
- (4) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.
- (5) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
- (6) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used under the relative condition of 40°C . 50% RH.
- (7) When turning the power on, input each signal after the positive/negative voltage becomes stable.

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.	PAGE	21
200.	00.			ı



18-5 STORAGE

When storing LCDs as spares for some years, the following precaution are necessary.

- (1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for dessicant.
- (2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0 □C and 35 □C.
- 3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped.)
- (4) Environmental conditions:
 - Do not leave them for more than 160hrs, at 70 C.
 - Should not be left for more than 48hrs. at -20 C.

18-6 SAFETY

- (1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- (2) If any liquid leakes out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

18-7 LIMITED WARRANTY

Unless agreed between Newhaven and customer, Newhaven will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with Newhaven LCD acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects must be returned to Newhaven within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Newhaven limited to repair and/or replacement on the terms set forth above. Newhaven will not be responsible for any subsequent or consequential events.

18-8 RETURN LCM UNDER WARRANTY

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are:

- Broken LCD glass.
- Circuit modified in any way, including addition of components.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB's eyelet, conductors and terminals.