

User's Guide

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

(Liquid Crystal Display Graphic Module)

2.4" Diagonal
16-bit digital interface
240x320 Resolution (portrait mode)
White LED Backlight
With Touch Panel

Please review the controller spec HX8347-A .

Tel: (847) 844-8795 Fax: (847) 844-8796

Newhaven Display International
2511 Technology Drive, #101
Elgin, IL 60124

February 17, 2009

RECORDS OF REVISION

DATE	REVISED NO.	REVISED DESCRIPTIONS	PREPARED	CHECKED	APPROVED
2007-12-26	01	FIRST ISSUE			
2008-2-20	02	MODIFY LUMINOUS INTENSITY OF BACKLIGHT			
2008-7-21	03	MODIFY THE MODULE			

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.		PAGE	2
------------------	------------------	---------------	--	------	---

CONTENTS

1.	GENERAL SPECIFICATIONS	-----		3
2.	FEATURES	-----		3
3.	MACHANICAL SPECIFICATIONS	-----		3
4.	OUTLINE DIMESIONS	-----		4
5.	INTERFACE ASSIGNMENT	-----		5
6.	APPLICATION CIRCUIT	-----		6
7.	BLOCK DIAGRAM	-----		6
8.	TIMING CHARACTERISTICS	-----		7
9.	RESET TIMING CHARACTERISTICS	-----		8
10	DDRAM ARRANGMENT	-----		9
11	ABSOLUTE MAXIMUM RATINGS	-----		10
12	ELECTRICAL CHARACTERISTICS	-----		10
13.	LED BACKLIGHT CHARACTERISTICS	-----		11
14.	OPTICAL CHARACTERISTICS	-----		12
15.	ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS	-----		15
16.	RELIABILI TY	-----		15
17.	THE STANDARD OF INSPECTION	-----		16
18.	USING LCD MODULES	-----		19

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.		PAGE	3
--------------------------	--------------------------	-----------------------	--	-------------	----------

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

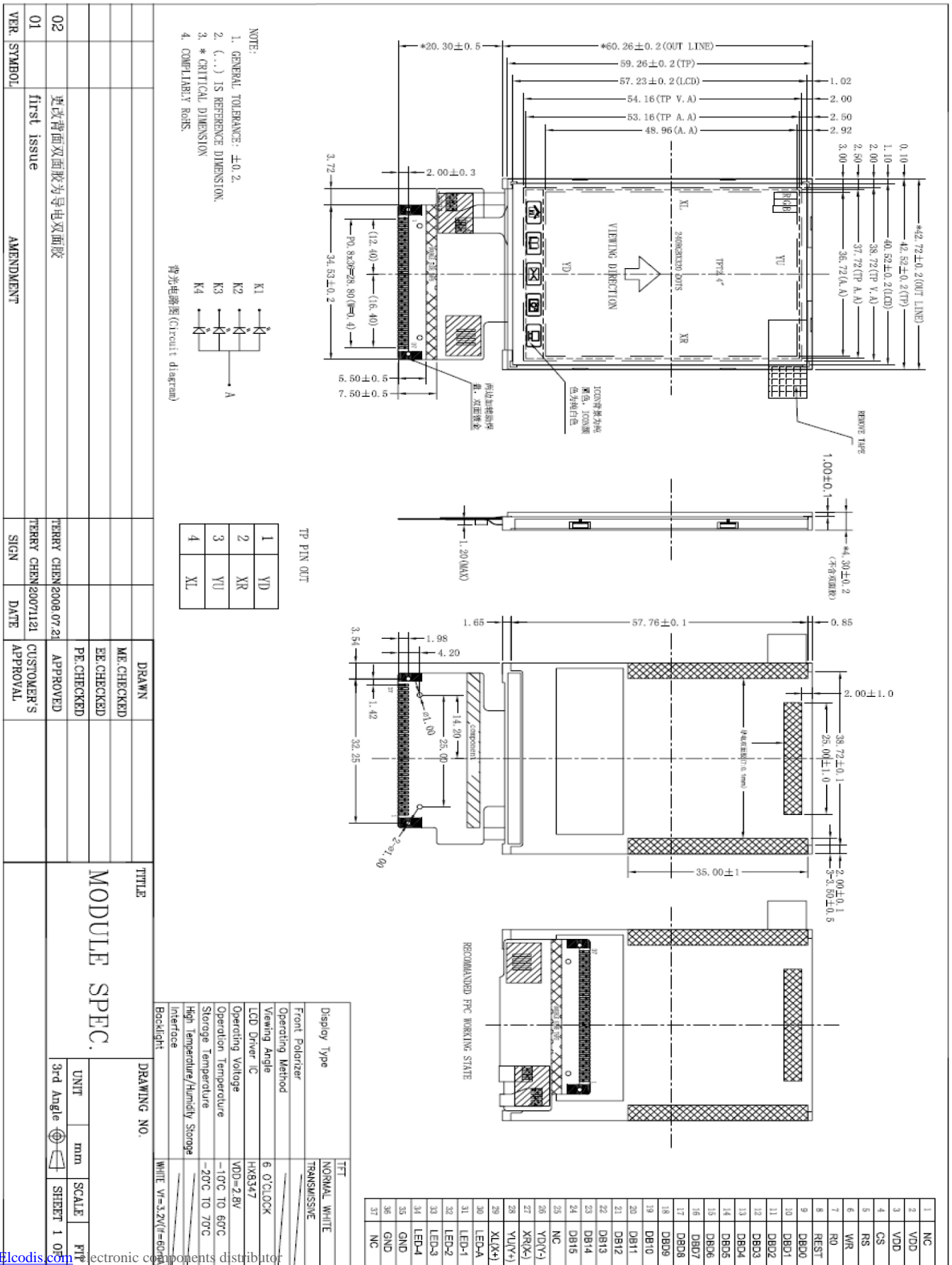
2-1 MAIN LCD (LARGE)

- (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

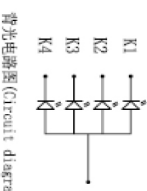
3. MECHANICAL SPECIFICATIONS

ITEM	SPECIFICATIONS	UNIT
OUTLINE DIMENSIONS	42.72(L) x 60.26 (W) x 4.3(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		-

4.OUTLINE DIMENSIONS



NOTE:
 1. GENERAL TOLERANCE: ±0.2
 2. (...) IS REFERENCE DIMENSION.
 3. * CRITICAL DIMENSION
 4. COMPLIARY ROHS.



TP PIN OUT

1	YD
2	XR
3	YU
4	XL

DRAWN	
ME CHECKED	
EE CHECKED	
PE CHECKED	
APPROVED	
CUSTOMER'S APPROVAL	

TITLE: MODULE SPEC.

UNIT	mm	SCALE	FIG
3rd Angle			

DRAWING NO. WHITE VI=3.2V(I=60mA)

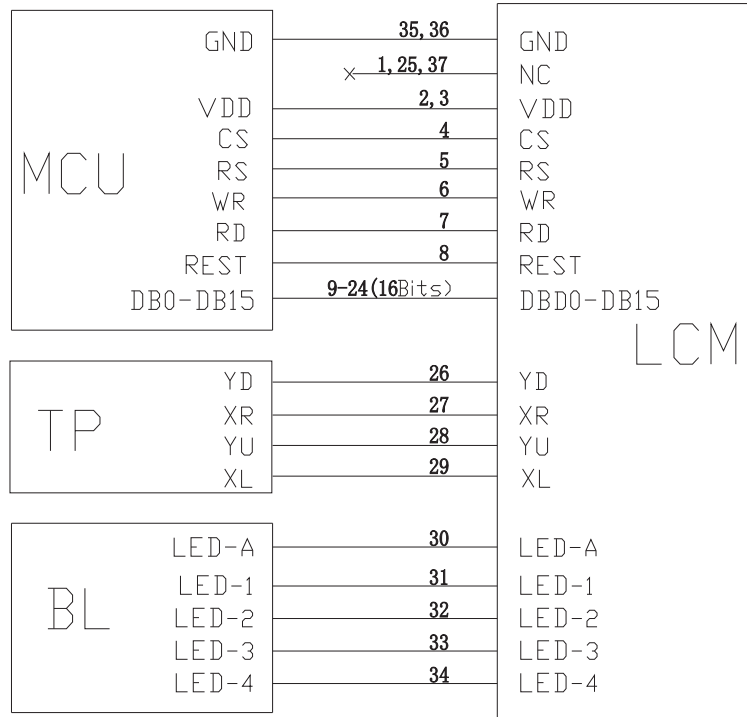
Display Type	TTT
Normal White Transmissive	
Front Polarizer	
Operating Method	
Viewing Angle	6.0°CLOCK
LCD Driver IC	HX8347
Operating Voltage	VDD=2.8V
Operation Temperature	-10°C TO 60°C
Storage Temperature	-20°C TO 70°C
High Temperature/Humidity Storage	
Interface	
Backlight	WHITE VI=3.2V(I=60mA)

VER.	SYMBOL	AMENDMENT	SIGN	DATE	APPROVAL
02		更改背面双面胶为导电双面胶	TERRY CHEN	2008.07.21	APPROVED
01	first issue		TERRY CHEN	2007.11.21	CUSTOMER'S APPROVAL

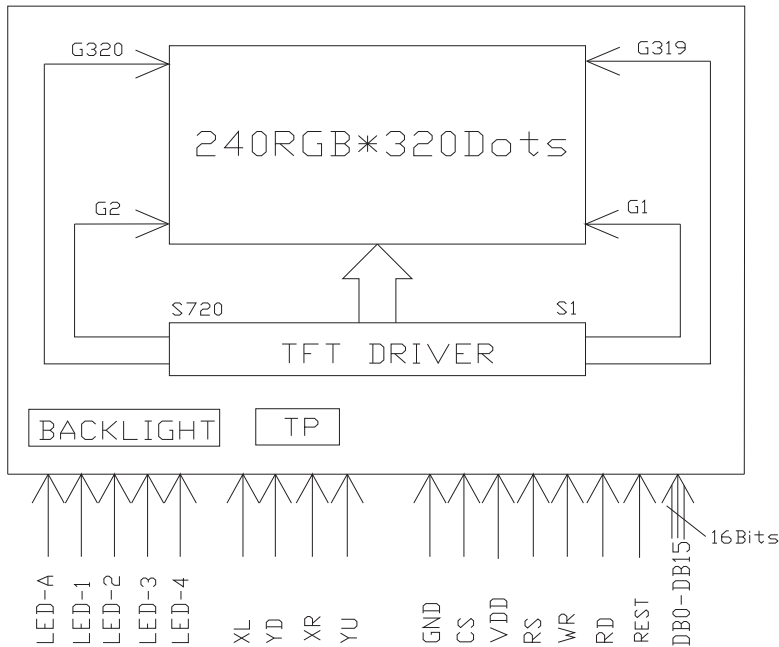
5. INTERFACE ASSIGNMENT

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	Data bus.	DBD0
10		DBD1
11		DBD2
12		DBD3
13		DBD4
14		DBD5
15		DBD6
16		DBD7
17		DBD8
18		DBD9
19		DB10
20		DB11
21		DB12
22		DB13
23		DB14
24		DB15
25	NO CONNECT	NC
26	TOUCH PANEL YD	YD
27	TOUCH PANEL XR	XR
28	TOUCH PANEL YU	YU
29	TOUCH PANEL XL	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

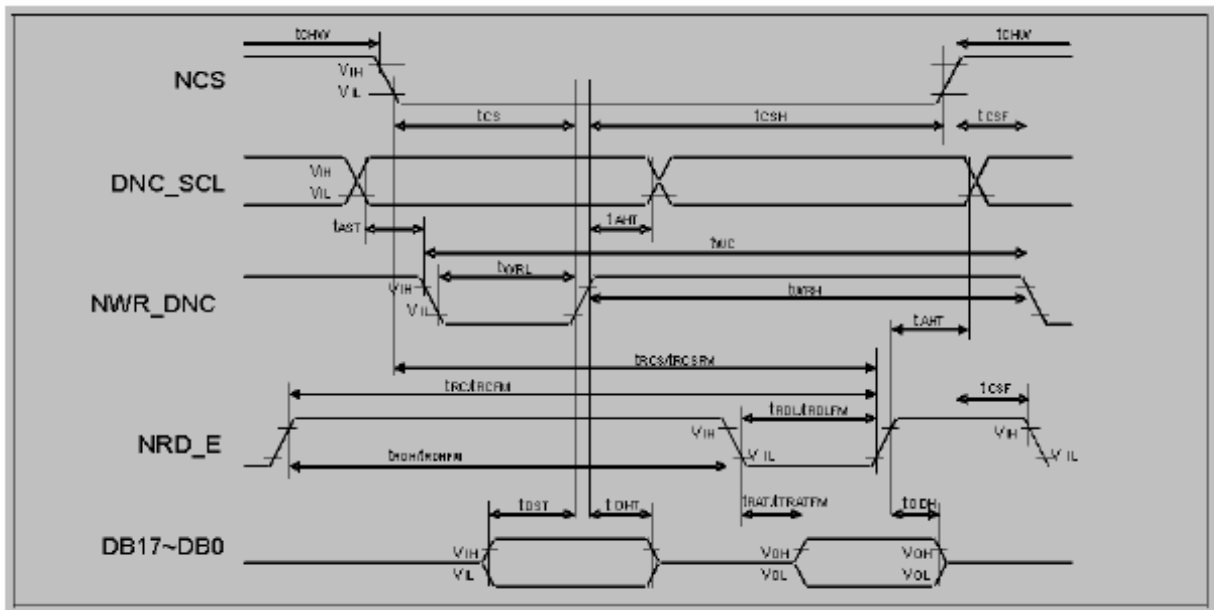
6.APPLICATION CIRCUIT



7. BLOCK DIAGRAM



8.TIMING CHARACTERISTICS



(VSSA=0V, IOVCC=1.65V to 2.50V, VCI=2.3V to 2.9V, Ta = -30 to 70 ° C)

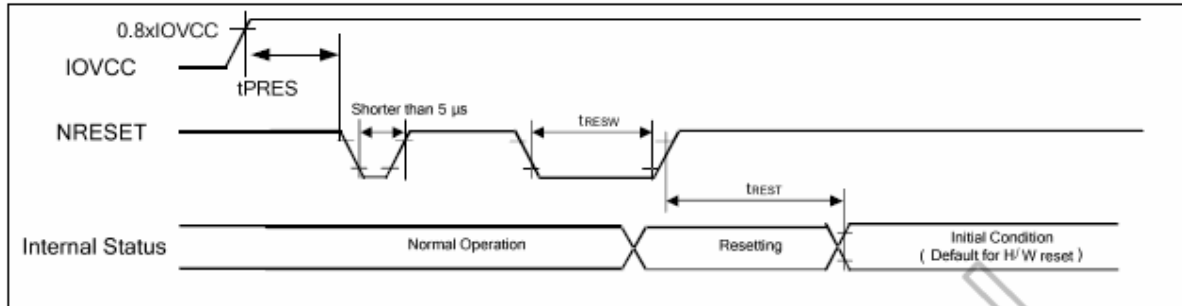
Signal	Symbol	Parameter	Min.	Max.	Unit	Description
DNC_SCL	tAST	Address setup time	10	-	ns	-
	tAHT	Address hold time (Write/Read)	10	-		
NCS	tCHW	Chip select "H" pulse width	0	-	ns	-
	tCS	Chip select setup time (Write)	35	-		
	tRCSFM	Chip select setup time	355	-		
	tCSF	Chip select wait time (Write/Read)	10	-		
	tCSH	Chip select hold time	10	-		
NWR_RNW	tWC	Write cycle	100	-	ns	-
	tWRH	Control pulse "H" duration	35	-		
	tWRL	Control pulse "L" duration	35	-		
NRD_E	tRCFM	Read cycle	450	-	ns	When read from GRAM
	tRDHEM	Control pulse "H" duration	90	-		
	tRDLFM	Control pulse "L" duration	355	-		
D17 to D0	tDST	Data setup time	15	-	ns	For maximum CL=30pF For minimum CL=8pF
	tDHT	Data hold time	10	-		
	tRATFM	Read access time	-	340		
	tODH	Output disable time	20	80		

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.

9. RESET TIMING CHARACTERISTICS

Reset Input Timing

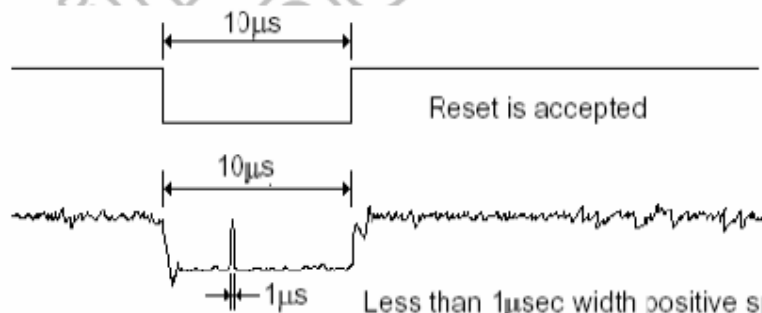


Symbol	Parameter	Related Pins	Min.	Typ.	Max.	Note	Unit
tRESW	Reset low pulse width ⁽¹⁾	NRESET	10	-	-	-	μs
tREST	Reset complete time ⁽²⁾	-	-	-	5	When reset applied during STB mode	ms
		-	-	-	120	When reset applied during STB mode	ms
tPRES	Reset goes high level after Power on time	NRESET & IOVCC	1	-	-	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 μs	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 VGOMOF 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.

10.DDRAMARRANGMENT

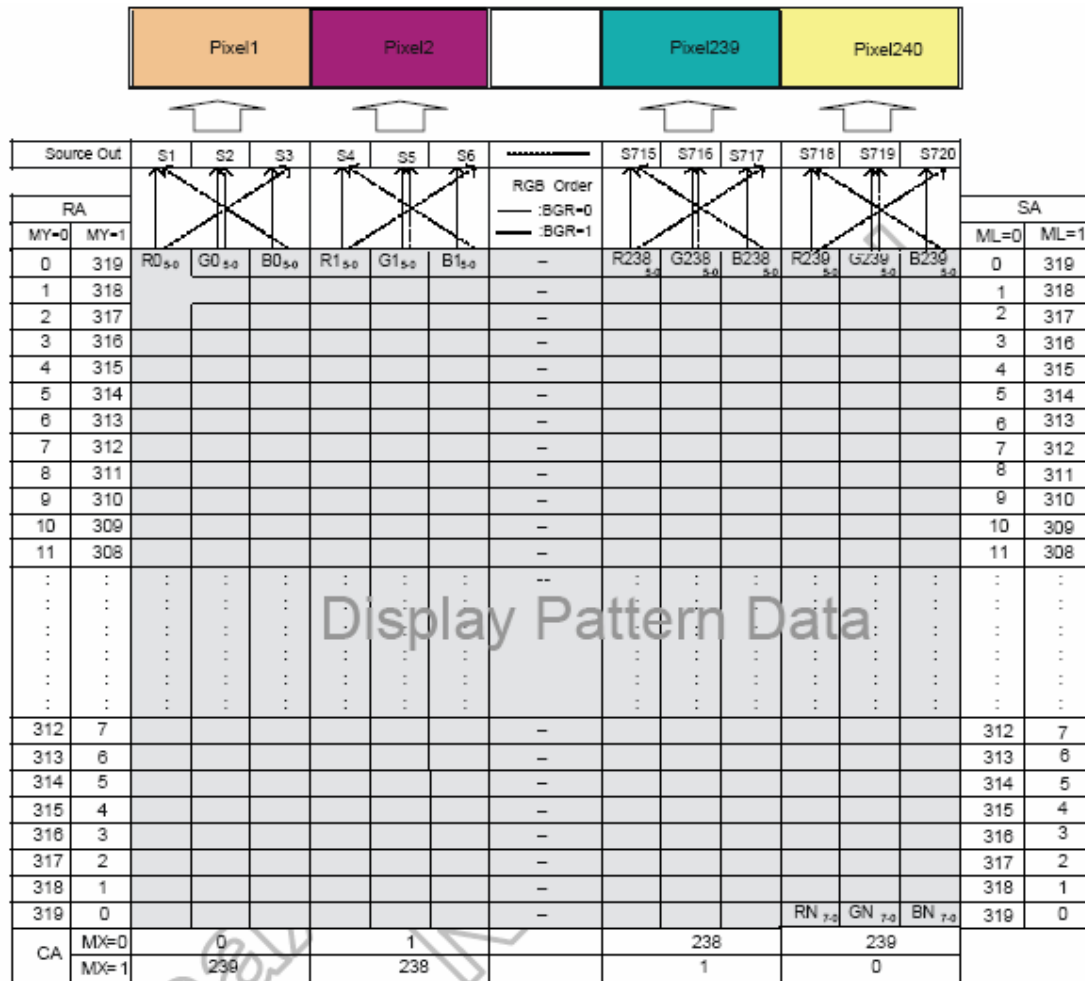


Figure 5. 23 Memory Map (240RGBx320)

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

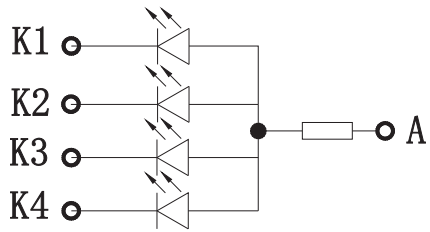
ITEM	SYMBOL	CONDITION	STANDARD VALUE			UNIT
			MIN	TYP	MAX	
POWER SUPPLY FOR LOGIC	IOVCC	Ta=25℃	-0.3	---	+3.3	V
POWER SUPPLY FOR LCD DRIVING	VIN	Ta=25℃	-0.3	---	VCI+0.3	V
OPERATION TEMPERATURE	TOPR	---	-10	---	+60	℃
STORAGE TEMPERATURE	TSTG	---	-20	---	+70	℃

12. ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITIONS	STANDARD VALUE			UNIT
			MIN	TYP	MAX	
POWER SUPPLY FOR LOGIC	IOVCC	Ta= +25℃	---	2.8	---	V
INPUT VOLTAGE "H" LEVEL	VIH	IOVCC=1.65~3.0V	0.8IOVCC	---	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	0.8IOVCC	---	---	V
OUTPUT VOLTAGE "L" LEVEL	VOL	IOVCC=1.65~2.4V IOL=0.1mA	---	---	0.2IOVCC	V

13. LED BACKLIGHT CHARACTERISTICS

13-1 POWER SUPPLY FOR LED BACKLIGHT



13-2 ABSOLUTE MAXIMUM 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	LIGHT SOURCE	CONDITIONS	STANDARD VALUE			UNIT
				MIN	TYP	MAX	
PARAMETER	V	WHITE	If =60mA	3.0	3.2	3.4	V
LUMINOUS INTENSITY	lv	WHITE		100	120	160	cd/m ²
CHROMATICITY COORD	X	WHITE	If =60mA	0.25	0.29	0.29	0.29
	Y						

14. OPTICAL CHARACTERISTICS

Item	Symbol	Conditions	Specifications			Unit	Note	
			Min.	Typ.	Max.			
Transmittance	T%	Viewing normal angle $\theta_x = \theta_y = 0^\circ$		4.7		%	All left side data are based on CMO's following condition – Type 767 NTSC: 60% LC:5066 Light : C light (Machine:BM5A) Normal Polarizer Without DBEF	
Contrast Ratio	CR		150	250	-	-		
Response Time	T_R		NA	10	20	ms		
	T_F		NA	20	30	ms		
Chromaticity	Red		X_R	0.603	0.633	0.663		
			Y_R	0.299	0.329	0.359		
	Green		X_G	0.264	0.294	0.324		
			Y_G	0.546	0.576	0.606		
	Blue		X_B	0.103	0.133	0.163		
			Y_B	0.092	0.122	0.152		
White	X_W	0.278	0.308	0.338				
	Y_W	0.316	0.346	0.376				
Viewing Angle	Hor.	θ_{x+}		45	-	deg.		
		θ_{x-}		45	-			
	Ver.	θ_{y+}		35	-			
		θ_{y-}		15	-			

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

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

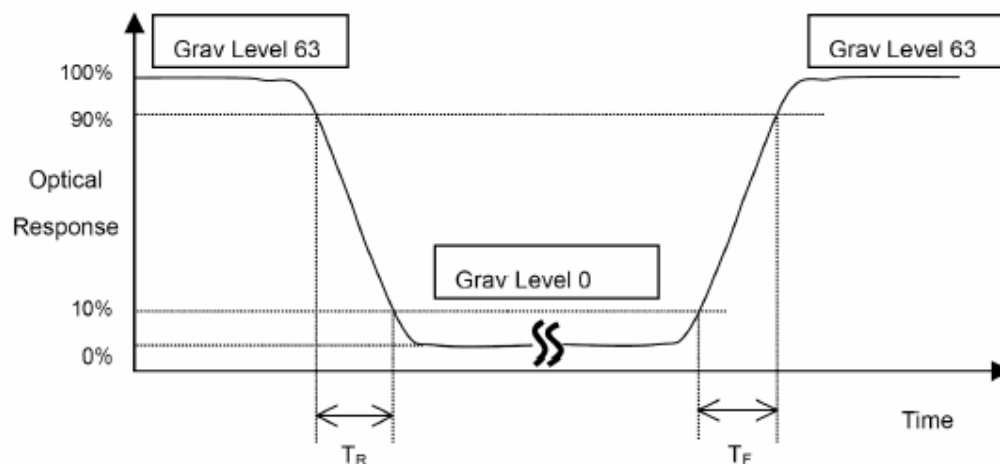
L63: Luminance of gray level 63

L0: Luminance of gray level 0

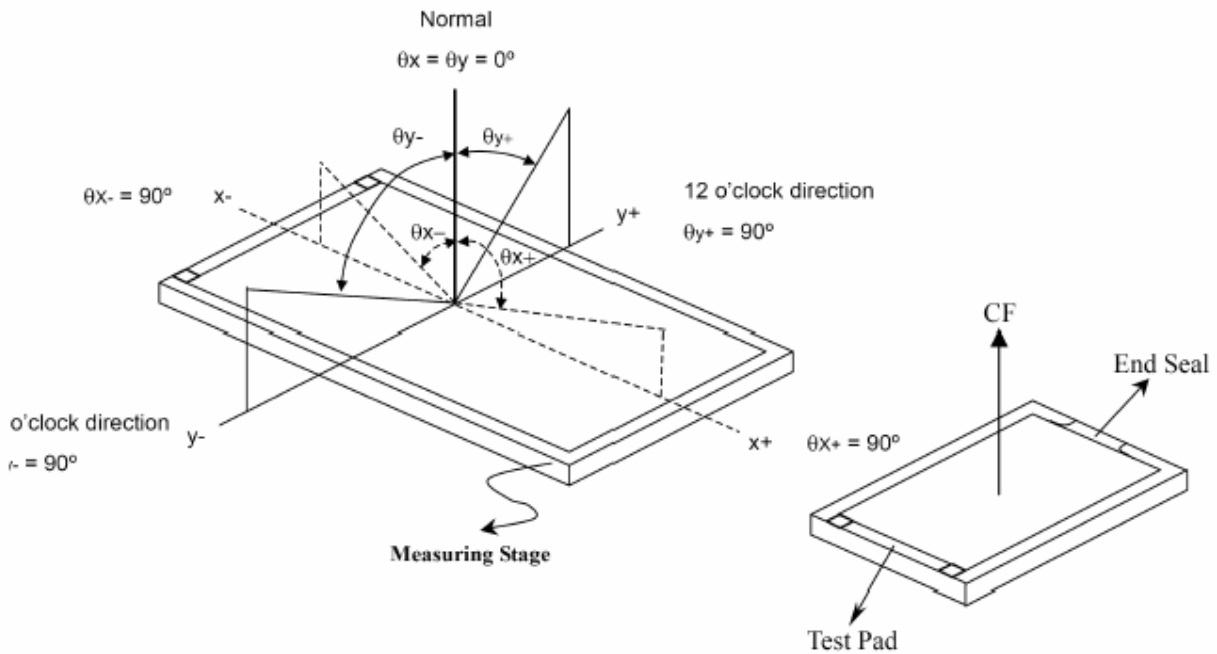
$$CR = CR(10)$$

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

*Note (2) Definition of Response Time (T_R , T_F):



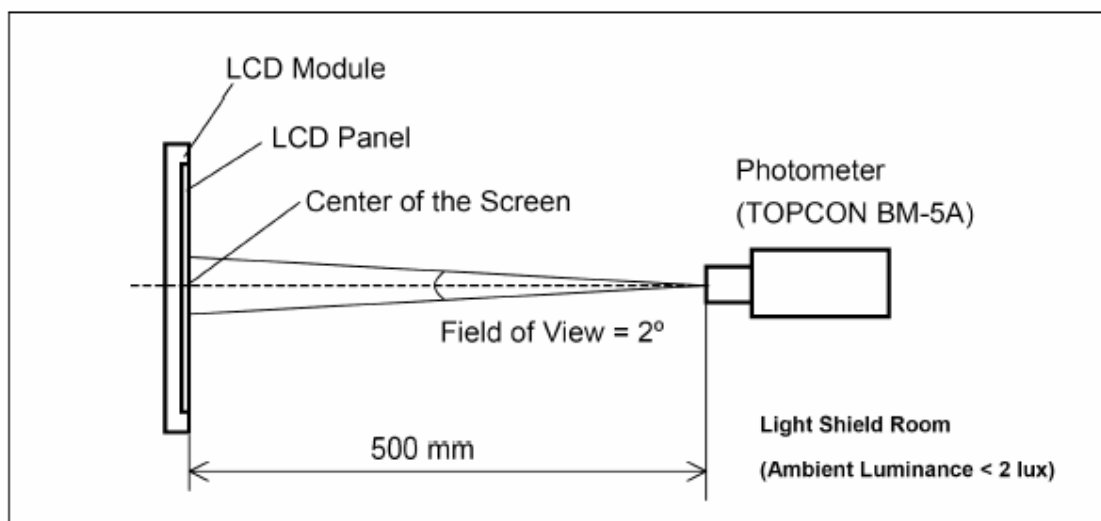
*Note(3) Definition of Viewing Angle



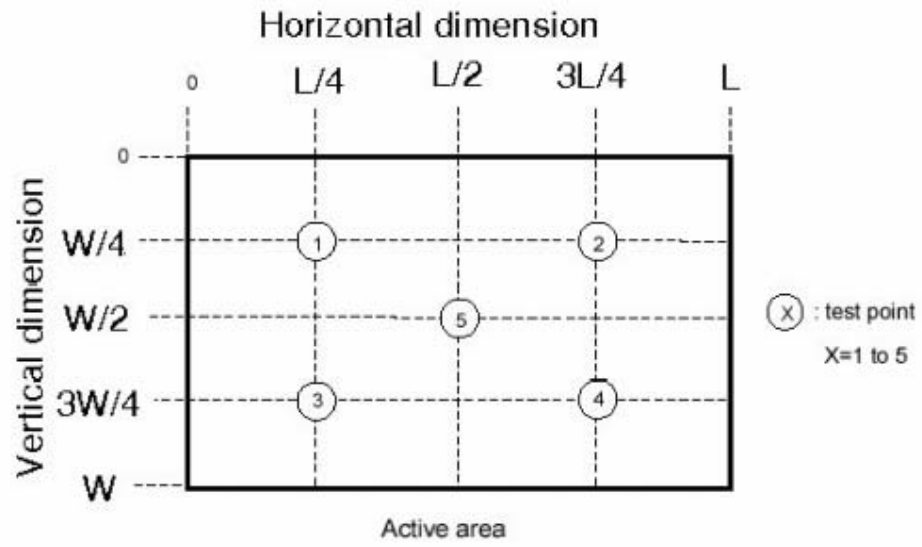
*** The above "Viewing Angle" is the measuring position with Largest Contrast Ratio; not for good image quality. View Direction for good image quality is 6 O'clock. Module maker can increase the "Viewing Angle" by applying Wide View Film.

*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.



*Note (5)



STANDARD DOC.	PRODUCT SPEC.	MODULE NO.		PAGE	15
--------------------------	--------------------------	-----------------------	--	-------------	-----------

15. ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	CONDITIONS	CRITERION
OPERATING TEMPERATURE	TOPR	-10☒ ~ +60☒	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
STORAGE TEMPERATURE	TSTG	-20☒ ~ +70☒	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
HUMIDITY	-		WITHOUT CONDENSATION

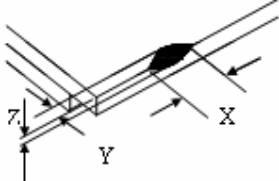
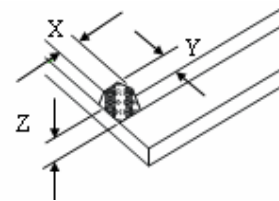
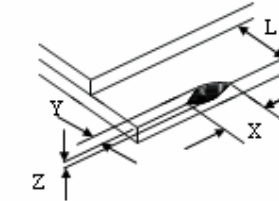
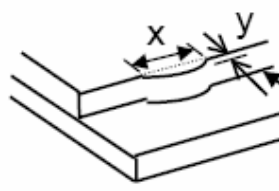
16. RELIABILITY

16- 1 RELIABILITY TEST

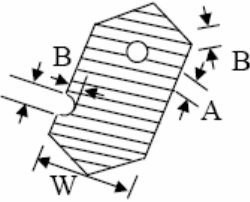
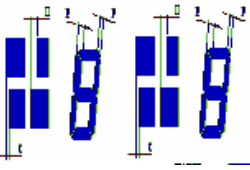
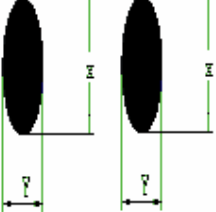
ITEM	CONDITIONS	CRITERION
OPERATING TEMPERATURE	HIGH TEMPERATURE +60☒ 72HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
	LOW TEMPERATURE - 10☒ 72HRS	
STORAGE TEMPERATURE	HIGH TEMPERATURE +70☒ 120HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
	LOW TEMPERATURE - 20☒ 120HRS	
HUMIDITY	40☒ 90%RH 72HRS	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
VIBRATION	☒ Operating Time: thirty minutes exposure for each direction (X,Y,Z) ☒ Sweep Frequency: 10 ~ 55Hz (1 min) ☒ Amplitude: 1.5mm	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION
THERMAL SHOCK	-20☒ (30mins) ←→+70☒ (30mins) 10 cycles	NO DEFECT IN DISPLAYING AND OPERATIONAL FUNCTION

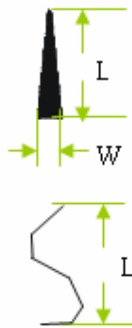
17.THE STANDARD OF INSPECTION

17-1 Inspection items and specification for appearance (power off)

No.	Item	Criterion	AQL																						
1	Dimension	Dimension out of the specification	1.0																						
2	Glass crack	<p>1、 General crack</p>  <table border="1"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td>$\geq K/8$</td> <td>Not over A area</td> <td>$\leq T$</td> </tr> </table> <p>2、 corner</p>  <table border="1"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td>$\geq K/8$</td> <td>Not over A area</td> <td>No check</td> </tr> </table> <p>3、 contact pad crack</p>  <table border="1"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td>$\geq K/8$</td> <td>$\geq L/3$</td> <td>No check</td> </tr> </table> <p>4、 Substrate protuberance and internal crack</p>  <table border="1"> <tr> <td>X</td> <td>Y</td> </tr> <tr> <td>$\geq K/8$</td> <td>$\geq L/3$</td> </tr> </table> <p>Transfer position crack: $\leq L/5$</p>	X	Y	Z	$\geq K/8$	Not over A area	$\leq T$	X	Y	Z	$\geq K/8$	Not over A area	No check	X	Y	Z	$\geq K/8$	$\geq L/3$	No check	X	Y	$\geq K/8$	$\geq L/3$	2.50
X	Y	Z																							
$\geq K/8$	Not over A area	$\leq T$																							
X	Y	Z																							
$\geq K/8$	Not over A area	No check																							
X	Y	Z																							
$\geq K/8$	$\geq L/3$	No check																							
X	Y																								
$\geq K/8$	$\geq L/3$																								

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.		PAGE	17																			
3	Black dot \ White dot	<table border="1"> <thead> <tr> <th rowspan="2">D</th> <th colspan="2">Acceptable of defect</th> </tr> <tr> <th>A/B Area</th> <th>C Area</th> </tr> </thead> <tbody> <tr> <td>D < 0.2</td> <td colspan="2">No check</td> </tr> <tr> <td>0.2 ≤ D < 0.3</td> <td>2</td> <td rowspan="2">No check</td> </tr> <tr> <td>0.3 ≤ D ≤ 0.5</td> <td>1</td> </tr> <tr> <td>D > 0.5</td> <td colspan="2">0</td> </tr> </tbody> </table> <p>X: long diameter Y: shot diameter D: average of diameter $D=(X+Y)/2$</p>	D	Acceptable of defect		A/B Area	C Area	D < 0.2	No check		0.2 ≤ D < 0.3	2	No check	0.3 ≤ D ≤ 0.5	1	D > 0.5	0		2.50					
D	Acceptable of defect																							
	A/B Area	C Area																						
D < 0.2	No check																							
0.2 ≤ D < 0.3	2	No check																						
0.3 ≤ D ≤ 0.5	1																							
D > 0.5	0																							
4	Line defect	<table border="1"> <thead> <tr> <th rowspan="2">Length</th> <th rowspan="2">Whidth</th> <th colspan="2">Acceptable of defect</th> </tr> <tr> <th>A/B Area</th> <th>C Area</th> </tr> </thead> <tbody> <tr> <td>accept</td> <td>$W \leq 0.02$</td> <td>No check</td> <td rowspan="2">No check</td> </tr> <tr> <td>$L \leq 3$</td> <td>$W \leq 0.05$</td> <td>2</td> </tr> <tr> <td rowspan="2">$L \leq 2.5$</td> <td>$W \leq 0.05$</td> <td>2</td> <td rowspan="2">As round type</td> </tr> <tr> <td>$W > 0.05$</td> <td colspan="2"></td> </tr> </tbody> </table> <p>L: Length W: Width Defect of polarizer (Scratches、 Spot) : According to the limit specimen</p>	Length	Whidth	Acceptable of defect		A/B Area	C Area	accept	$W \leq 0.02$	No check	No check	$L \leq 3$	$W \leq 0.05$	2	$L \leq 2.5$	$W \leq 0.05$	2	As round type	$W > 0.05$			2.50	
Length	Whidth	Acceptable of defect																						
		A/B Area	C Area																					
accept	$W \leq 0.02$	No check	No check																					
$L \leq 3$	$W \leq 0.05$	2																						
$L \leq 2.5$	$W \leq 0.05$	2	As round type																					
	$W > 0.05$																							
5	Polarizer Bubble	<table border="1"> <thead> <tr> <th rowspan="2">D</th> <th colspan="2">Acceptable of defect</th> </tr> <tr> <th>A/B Area</th> <th>C Area</th> </tr> </thead> <tbody> <tr> <td>$D \leq 0.2$</td> <td colspan="2">No check</td> </tr> <tr> <td>$0.2 \leq D \leq 0.5$</td> <td>3</td> <td rowspan="2">No check</td> </tr> <tr> <td>$0.5 \leq D \leq 1.0$</td> <td>2</td> </tr> <tr> <td>$D > 1.0$</td> <td colspan="2">0</td> </tr> </tbody> </table>	D	Acceptable of defect		A/B Area	C Area	$D \leq 0.2$	No check		$0.2 \leq D \leq 0.5$	3	No check	$0.5 \leq D \leq 1.0$	2	$D > 1.0$	0		2.50					
D	Acceptable of defect																							
	A/B Area	C Area																						
$D \leq 0.2$	No check																							
$0.2 \leq D \leq 0.5$	3	No check																						
$0.5 \leq D \leq 1.0$	2																							
$D > 1.0$	0																							
6	External print of panel	<ol style="list-style-type: none"> Transfigure、 pin hole : same as segment transfiguer Print width: print width $\geq 1/2$ standard width is acceptable 	2.50																					
7	Silicon glue	The area of painting silicon glue must cover the ITO circuit.	2.50																					
8	Defect of PCB	<ol style="list-style-type: none"> The char 、 wrong edition、 bresking off circuit、 crack and air-logged orifice are unreceivable for PCB. gold finger of PCB can not be oxidative、 smudgy and broken.. 	2.50																					

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.		PAGE	18															
9	SMT organ	1、 deflexion of component $\leq 1/3$ width of component 2、 Trying to keep dot of soldering tin orbicular 3、 Damage 、 break、 wrong assembly and unseal are unreceivable for component.			2.50															
10	Steel Frame	1、 Break and distortion are unreceivable for frame. 2、 If there is one nick which can not lead to cast or hole of painting, we allow that following: Length ≤ 5 mm; Width ≤ 0.3 mm			2.50															
17-2 Inspection items and specification for display defect (power on)																				
1	Electrical Defect	Segment missing		Not allow	1.0															
		Segment short		Not allow																
		Non-display		Not allow																
2	Pin hole	1、 Pin hole 		<table border="1"> <thead> <tr> <th>width</th> <th>Acceptable of defect</th> </tr> </thead> <tbody> <tr> <td>$W < 0.4$</td> <td>$D \leq 0.2$ & $D \leq 1/2W$</td> </tr> <tr> <td>$W \geq 0.4$</td> <td>$D \leq 0.25$ & $D \leq 1/3W$</td> </tr> </tbody> </table>	width	Acceptable of defect	$W < 0.4$	$D \leq 0.2$ & $D \leq 1/2W$	$W \geq 0.4$	$D \leq 0.25$ & $D \leq 1/3W$	2.50									
		width	Acceptable of defect																	
$W < 0.4$	$D \leq 0.2$ & $D \leq 1/2W$																			
$W \geq 0.4$	$D \leq 0.25$ & $D \leq 1/3W$																			
* $D = (A+B)/2$ $D \leq 0.1$ acceptable																				
3	Display pattern			<table border="1"> <thead> <tr> <th>Width</th> <th>Acceptable of defect</th> </tr> </thead> <tbody> <tr> <td>$W < 0.4$</td> <td>$C、 D、 G \leq 1/2W$</td> </tr> <tr> <td>$W \geq 0.4$</td> <td>$C、 D、 G \leq 0.2$</td> </tr> </tbody> </table>	Width	Acceptable of defect	$W < 0.4$	$C、 D、 G \leq 1/2W$	$W \geq 0.4$	$C、 D、 G \leq 0.2$	1.0									
		Width	Acceptable of defect																	
		$W < 0.4$	$C、 D、 G \leq 1/2W$																	
$W \geq 0.4$	$C、 D、 G \leq 0.2$																			
W: Design dimension C、 D: discrepant dimension $G = E-F $																				
4	Black/white dot			<table border="1"> <thead> <tr> <th rowspan="2">D</th> <th colspan="2">Acceptable QTY</th> </tr> <tr> <th>A/B Area</th> <th>C Area</th> </tr> </thead> <tbody> <tr> <td>$D < 0.1$</td> <td colspan="2">No check</td> </tr> <tr> <td>$0.1 \leq D < 0.2$</td> <td>2</td> <td rowspan="3">No check</td> </tr> <tr> <td>$0.2 \leq D \leq 0.25$</td> <td>1</td> </tr> <tr> <td>$D > 0.25$</td> <td>0</td> </tr> </tbody> </table>	D	Acceptable QTY		A/B Area	C Area	$D < 0.1$	No check		$0.1 \leq D < 0.2$	2	No check	$0.2 \leq D \leq 0.25$	1	$D > 0.25$	0	2.50
		D	Acceptable QTY																	
			A/B Area	C Area																
		$D < 0.1$	No check																	
		$0.1 \leq D < 0.2$	2	No check																
$0.2 \leq D \leq 0.25$	1																			
$D > 0.25$	0																			
X: long diameter Y: shot diameter D: average diameter $D = (X+Y)/2$																				

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.			PAGE	19	
5	Line defect	 <p>L: length W: width</p>	Length	Width	Acceptable QTY		2.50
			≠	$W \leq 0.02$	No check	C Area	
			$L \leq 3$	$W \leq 0.03$	2	No check	
			$L \leq 2.5$	$0.03 < W \leq 0.05$	2		
				$W > 0.05$	Sa round type		

18.USING LCD MODULES

18-1 LIQUID CRYSTAL DISPLAY MODULES

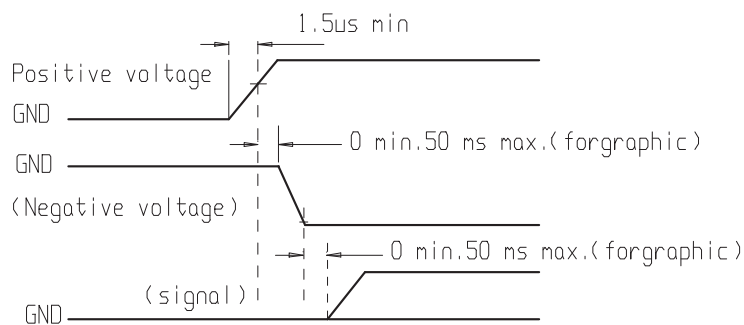
LCD is composed of glass and polarizer. Pay attention to the following items when handling.

- (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 jarring.

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

STANDARD DOC.	PRODUCT SPEC.	MODULE NO.		PAGE	20
<p>module or making any alterations or modifications to it.</p> <ol style="list-style-type: none"> (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. <p>18-3 ELECTRO-STATIC DISCHARGE CONTROL</p> <p>Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.</p> <ol style="list-style-type: none"> (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. <p>18-4 PRECAUTIONS FOR OPERATION</p> <ol style="list-style-type: none"> (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. 					



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 leaks 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.