



DOCUMENT NUMBER AND REVISION  
**VL-PS-BC240160-01 REV. A**  
**(BC240160 Bistable Cholesteric Displays)**

DOCUMENT TITLE:  
**PRELIMINARY SPECIFICATION**  
**OF**  
**LCD MODULE TYPE**  
**ITEM NO.: BC240160-01**

DEPARTMENT	NAME	SIGNATURE	DATE
PREPARED BY	PHILIP CHENG		2002/3/28
CHECKED BY	DANIEL POON		2002/3/28
APPROVED BY	CYRUS CHEUNG		2002/3/28

DISTRIBUTION LIST: MARKETING



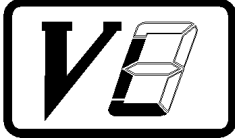
**DOCUMENT REVISION HISTORY 1:**

DOCUMENT REVISION FROM TO	DATE	DESCRIPTION	CHANGED BY	CHECKED BY
A	2002.03.28	First Release.	PHILIP CHENG	DANIEL POON



## CONTENTS

	<u>Page No.</u>
1. GENERAL DESCRIPTION	4
2. MECHANICAL SPECIFICATIONS	4
3. ABSOLUTE MAXIMUM RATINGS	7
3.1 ELECTRICAL MAXIMUM RATINGS (Ta=25°C)	7
3.2 ENVIRONMENTAL CONDITION	7
4. ELECTRICAL SPECIFICATIONS	8
4.1 INTERFACE SIGNALS	8
4.2 TYPICAL ELECTRICAL CHARACTERISTICS	9
5 OPTICAL CHARACTERISTICS AT 25 °C	10
6 OPTICAL CHARACTERISTICS DEFINITION	10
7 DEFECT CRITERIA	11
8. HANDLING LCD AND LCD MODULES	15
8.1 LIQUID CRYSTAL DISPLAY (LCD)	15
8.2 LIQUID CRYSTAL DISPLAY MODULE(MDL)	15
8.2.1 STATIC ELECTRICITY	15
8.3 OPERATION	15
8.4 STORAGE	15
8.5 SAFETY	15
9 LIMITED WARRANTY	16
10 IMPORTANT NOTICE	16



---

## VARITRONIX LIMITED

---

### **Preliminary Specification of LCD Module Type Item No.: BC240160-01**

#### **1. General Description**

- 240 X 160 dots.
- Bistable reflective LCD Graphic Module.
- Greenish yellow(Other colours also available).
- Very Wide Viewing Angle from all directions.
- Special driving scheme.
- High contrast.
- 'SHARP' LH1560F3 (Tab form) LCD Driver.
- 'SHARP' LH1562F4 (Tab form) LCD Driver.
- No need to use backlight.
- No need to use polarizer.

#### **2. Mechanical Specifications**

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1

Parameter	Specifications	Unit
Outline dimensions	69.1 MAX.(W) x 50.4(H) x 1.7 MAX.(D) (LCD)	mm
Viewing area	61.6(W) x 42.4(H)	mm
Active area	57.58(W) x 38.38(H)	mm
Display format	240 (H) dots x 160 (V) dots	-
Dot size	0.22(W) x 0.22(H)	mm
Dot spacing	0.02(W) x 0.02(H)	mm
Dot pitch	0.24(W) x 0.24(H)	mm
Weight	TBD	grams

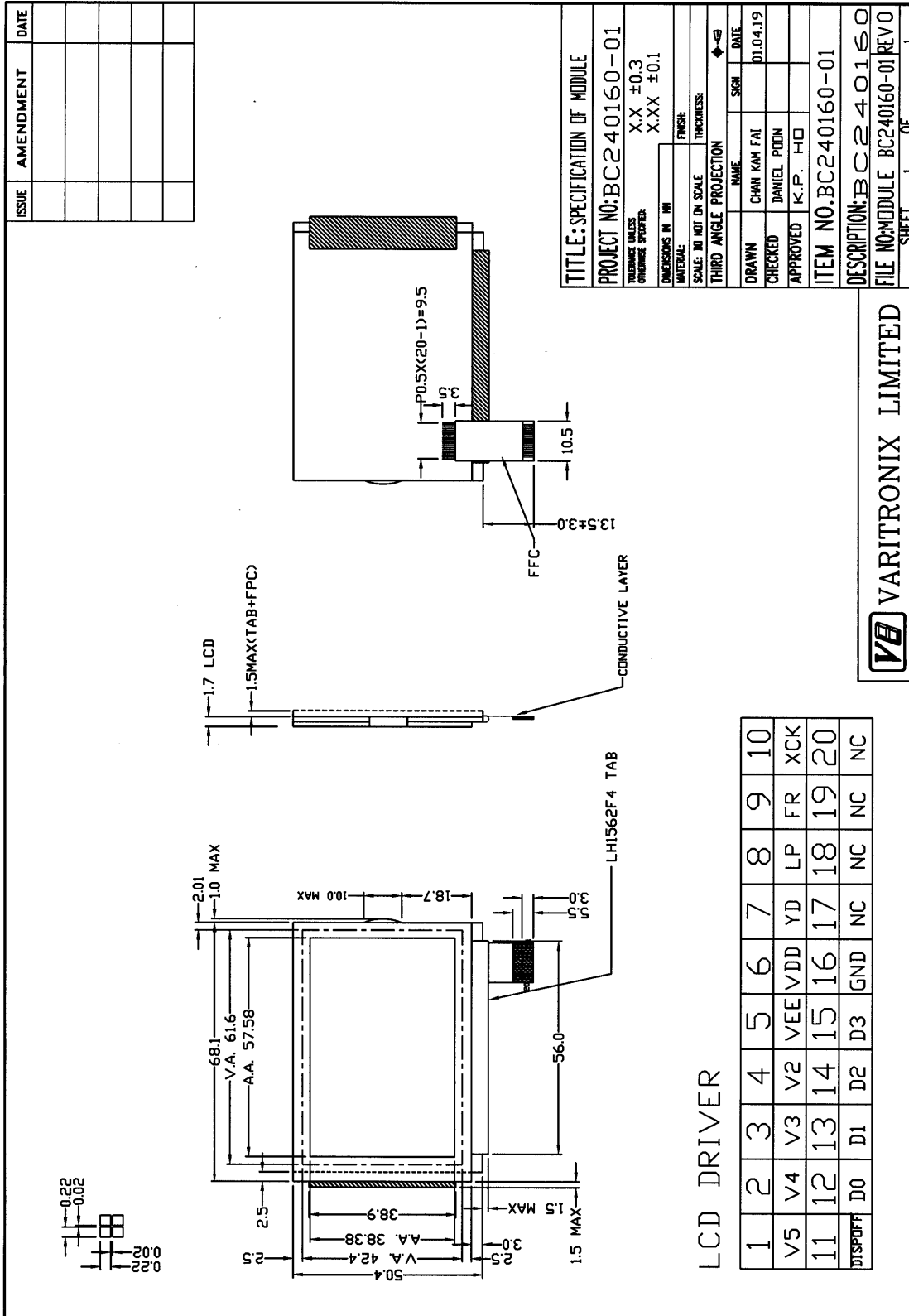


Figure 1: Specification of the BC240160 Bistable Cholesteric Displays module.

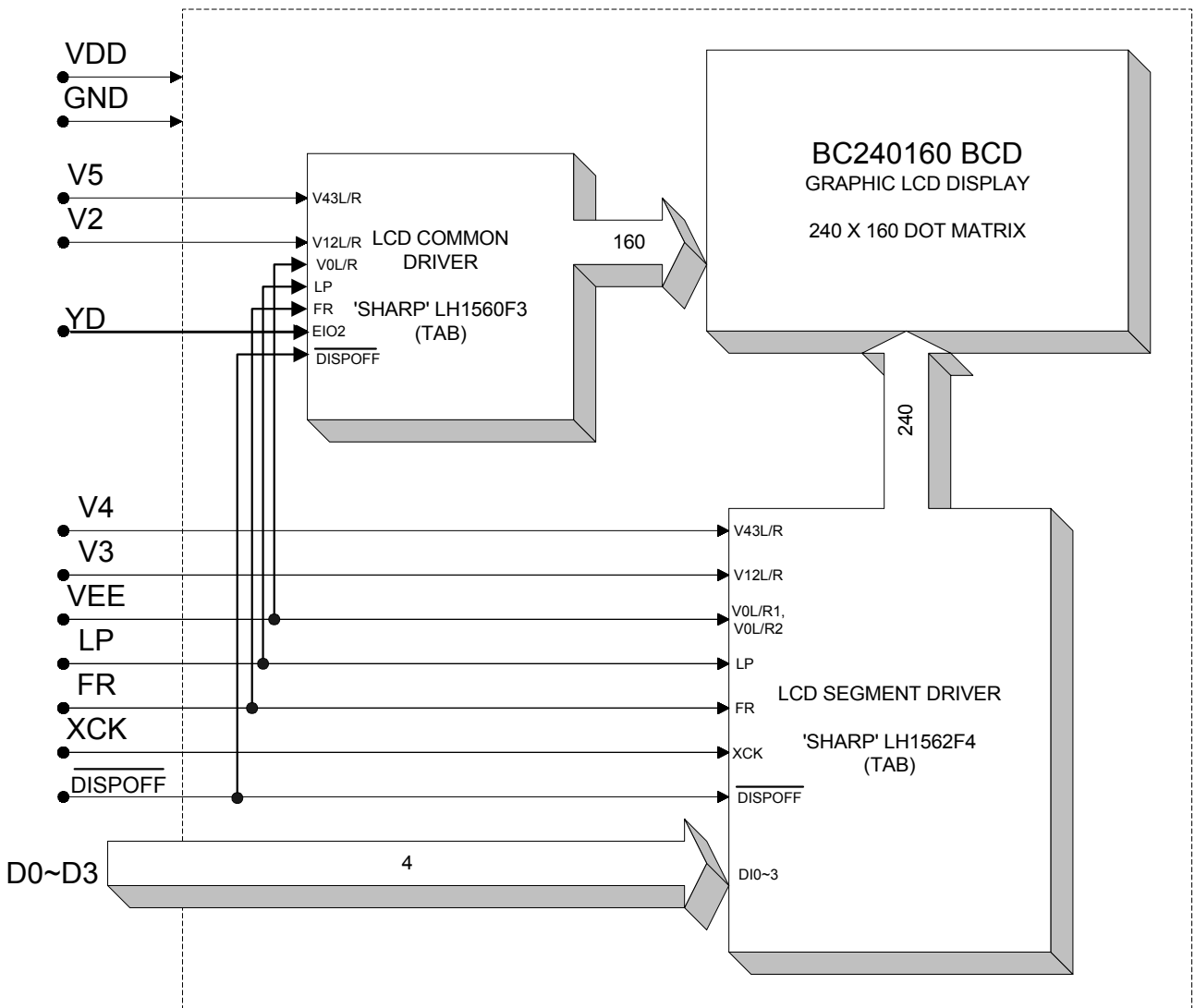


Figure 2: Block Diagram of the module.



### 3. Absolute Maximum Ratings

#### 3.1 Electrical Maximum Ratings(Ta = 25 °C)

Table 2

Parameter	Symbol	Min.	Max.	Unit
Power Supply voltage 1 (Logic)	VDD - GND	-0.3	+7.0	V
Power Supply voltage 2	VEE	-0.3	+40.0	V
	V2	-0.3	VEE+0.3	V
	V3	-0.3	VEE+0.3	V
	V4	-0.3	VEE+0.3	V
	V5	-0.3	VEE+0.3	V
Input voltage	Vin	-0.3	VDD+0.3	V

Note:

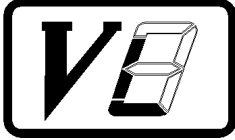
The modules may be destroyed if they are used beyond the absolute maximum ratings.

All voltage values are referenced to GND = 0V.

#### 3.2 Environmental Condition

Table 3

Item	Operating Temperature (Topr)		Storage Temperature (Tstg)		Remark
	Min.	Max.	Min.	Max.	
Ambient Temperature	0°C	+50°C	-30°C	+80°C	Dry
Humidity	TBD				
Vibration	TBD				
cells must be mounted on a suitable connector					
Shock	TBD				
Half-sine pulse shape					



## 4. Electrical Specifications

### 4.1 Interface signals

Table 4: Pin Assignment of a 20-pin connector for LCD Driver

Pin No.	Symbol	I/O	Description
1	V5	-	Power supply pin for LC driver voltage bias.
2	V4	-	-Normally, the bias voltage used is set by a resistor divider. -Ensure that voltages are set such as GND<V5<V4<V3<V2<VEE.
3	V3	-	
4	V2	-	
5	VEE	-	
6	VDD	-	Power supply for logic.
7	YD	I	Shift register shift data input pin. It is pull-down.
8	LP	I	Latch pulse input pin for display data.. -Data is latched on the falling edge of the clock pulse.
9	FR	I	AC signal input for LC driving waveform.
10	XCK	I	Clock input pin for taking display data. -Data is read on the falling edge of the clock pulse.
11	$\overline{\text{DISPOFF}}$	I	Control input pin for output deselect level.
12	D0	I	Input pin for display data.
13	D1	I	
14	D2	I	
15	D3	I	
16	GND	-	
17	NC	-	No connection
18	NC	-	No connection
19	NC	-	No connection
20	NC	-	No connection





## 4.2 Typical Electrical Characteristics

At  $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{DD} = 5V \pm 10\%$ ,  $GND = 0V$ .

Table 5

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (Logic)	$V_{DD-GND}$		2.5	5.0	5.5	V
Supply voltage (LCD)	$V_{LCD} = V_{EE-GND}$	$V_{DD} = 5V$ (Note 1)	-	TBD	-	V
Input signal voltage	$V_{IN}$	“High” level	$0.8V_{DD}$	-	$V_{DD}$	V
		“Low” level	0	-	$0.2V_{DD}$	V
Supply Current (Logic & LCD)	$I_{DD}$	$V_{DD} = 5V$	-	TBD	-	mA
Supply Current (VLCD)	$I_{LCD} = I_{EE}$	$V_{LCD} = 35V$ , (Note 1) At Reset.	-	TBD	-	mA
		$V_{LCD} = 35V$ , (Note 1) At Scan.	-	TBD	-	mA

Note 1:

There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.



## 5. Optical Characteristics at 25°C

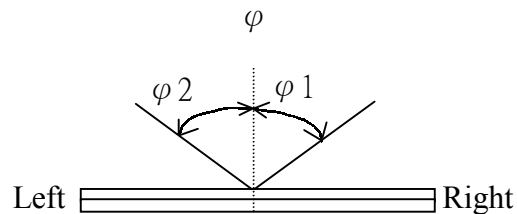
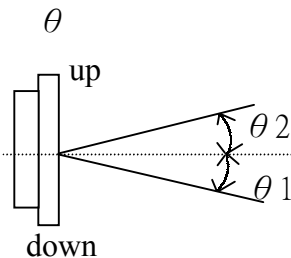
Table 6

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
Scanning Time		-	2	-	sec	Vop = Optimum voltage
Optimum Viewing Area Cr ≥ 2.0	$\theta 1$	60	65	70	degree	Vop = Optimum voltage
	$\theta 2$	60	65	70		
	$\phi 1$	60	65	70		
	$\phi 2$	60	65	70		
Contrast Ratio	Cr	6.0	6.6	7.2	-	Vop = Optimum voltage $\theta = 0^\circ$ . $\phi = 0^\circ$ .

Remark 1: Due to hardware limitation, the maximum measurable angle is  $70^\circ$ .

## 6. Optical Characteristics Definition

### a.) Viewing Angle



### b.) Contrast Ratio

B1 = segments luminance at OFF stable state

B2 = segments luminance at ON stable state

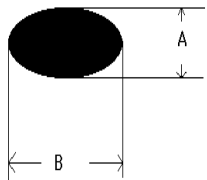
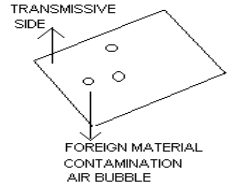
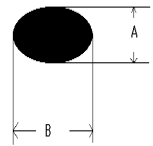
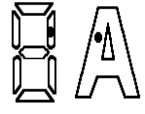
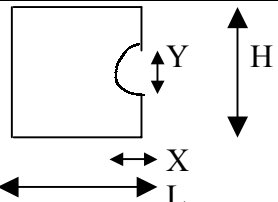
Contrast ratio = B2/B1.

### c.) Scanning Time

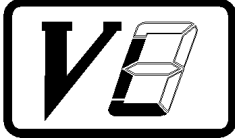
The total time needed to refresh a screen image.

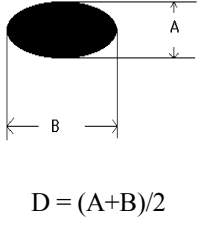
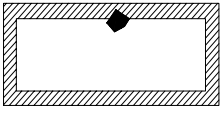
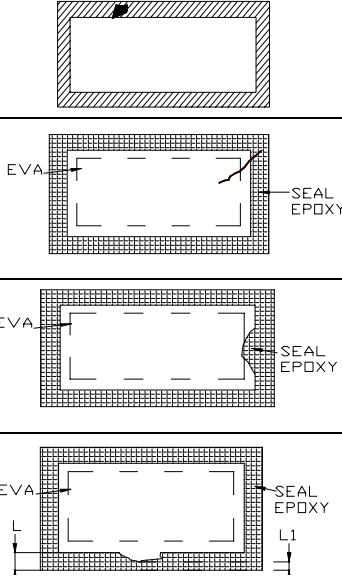
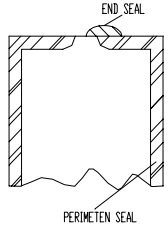


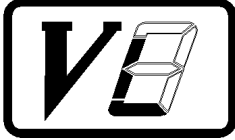
### 7. Defect Criteria :

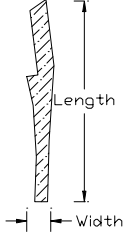
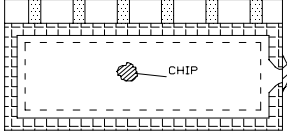
Defect Category	Defect Description(Non-Activated State)		Drawing Specification	
A. 0.3 Black spot/ Foreign Materials :	size	Criterion	 $D=(A+B)/2$ 	
	L	<u>Diameter(mm)</u> $D \leq 0.15$ $0.15 < D \leq 0.3$ $0.30 < D \leq 0.4$ $0.4 < D$		<u>Acc No.</u> Any 5 2 0
	B. 0 Black spot	<u>Diameter(mm)</u> $D \leq 0.15$ $0.15 < D \leq 0.25$ $0.25 < D \leq 0.35$ $0.35 < D$		<u>Acc No.</u> Any 2 1 0
Pin Hole	L	<u>Diameter(mm)</u> $D \leq 0.15$ $0.15 < D \leq 0.3$ $0.30 < D \leq 0.4$ $0.4 < D$	 $D= (A+B)/ 2$ 	
	M	<u>Diameter(mm)</u> $D \leq 0.15$ $0.15 < D \leq 0.25$ $0.25 < D \leq 0.35$ $0.35 < D$		<u>Acc No</u> Any 2 1 0
	S	<u>Diameter(mm)</u> $D \leq 0.15$ $0.15 < D \leq 0.3$ $D > 0.3$		<u>Acc No.</u> Any 1 0
<b>Dot Matrix:</b>	Dot matrix pin hole size must first meet with $X \leq 0.3L$ , $Y \leq 0.3H$ , $XY \leq 10\%LH$ , then refer pin hole criterion.			

- Remark: 1. All above defects min space shall be  $\geq 20$ mm.
2. All above defects total allowed quantity: (Inside EVA and outside EVA respectively)  
 Large size:  $\leq 5$ /pcs, Middle size:  $\leq 2$ /pcs, Small size:  $\leq 1$ /pcs.
3. Maximum diameter size of all accepted foreign materials out of EVA is 1.5 times of the acceptable largest diameter (length) size of foreign materials inside EVA according to the size of glass (L/M/S).

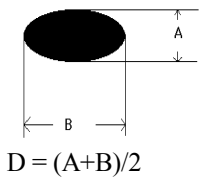


Defect Category	Defect Description (Non-Activated State)	Drawing Specification
0.0 Bubbles	Trapped bubbles : a. One or more bubble with size exceeds 0.3mm in diameter within EVA. b. Two or more bubbles with diameter 0.15mm to 0.3mm within the EVA.	
	Leakage : a. LCD is rejectable if any bubble observed due to leakage of perimeter seal or end seal	
0.1 Sealing Defect	Perimeter seal : a. White or colour marks along the perimeter seal. b. Distinct hairs going into the EVA through the perimeter seal. c. Seal epoxy bleeds into the EVA. d. Seal width narrowed to less than 2/3 of the normal width at any point of the display. $L1 < 2/3 L$ : reject.	
	End seal : a. Colour or hazy appearance neighbouring to the end seal. b. End seal epoxy does not cover entire LC filling port. c. End seal depth : $0.2\text{mm} \leq \text{depth} \leq \text{bar location}$ $0.2\text{mm} \leq \text{depth} \leq 1.5\text{mm}(\text{if no bar})$ * No matter how, end seal is not allowed to enter EVA	
0.2 Alignment Defect	a. Outlines of pattern visibly distinguish from the background. b. Any variation in contrast inside EVA.	

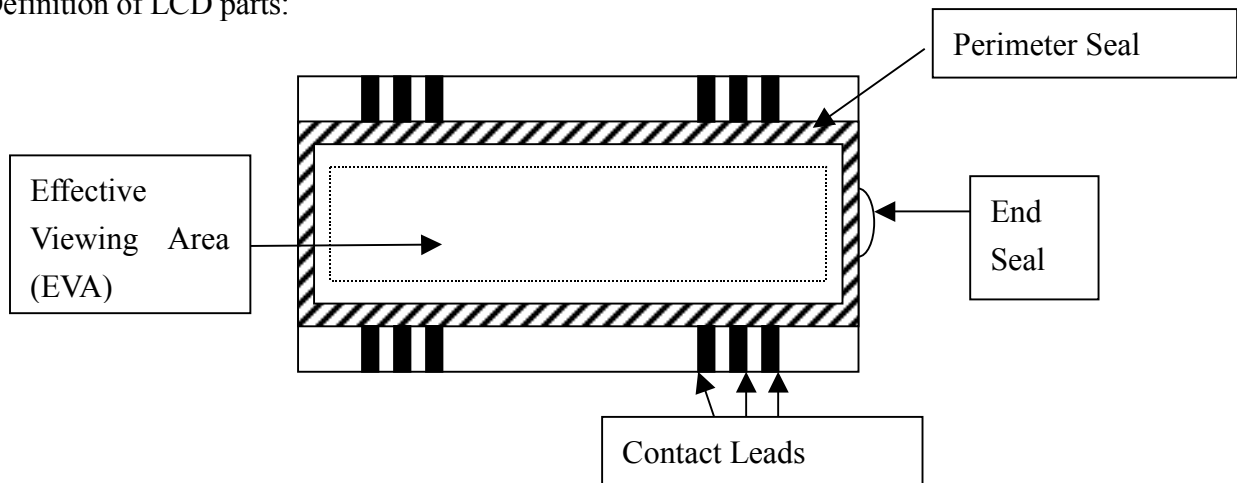


Defect Category	Defect Description (Non-Activated State)	Drawing Specification															
0.3 Dark line Scratches	Dark line / Scratch <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Length(mm)</th> <th style="text-align: center;">Width(mm)</th> <th style="text-align: center;">Acc No.</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">-----</td> <td style="text-align: center;">&lt; 0.02</td> <td style="text-align: center;">Any</td> </tr> <tr> <td style="text-align: center;">&lt;3.0</td> <td style="text-align: center;">&lt; 0.03</td> <td style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">&lt;5.0</td> <td style="text-align: center;">&lt; 0.05</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">-----</td> <td style="text-align: center;">&gt; 0.05</td> <td style="text-align: center;">0</td> </tr> </tbody> </table>	Length(mm)	Width(mm)	Acc No.	-----	< 0.02	Any	<3.0	< 0.03	2	<5.0	< 0.05	1	-----	> 0.05	0	
Length(mm)	Width(mm)	Acc No.															
-----	< 0.02	Any															
<3.0	< 0.03	2															
<5.0	< 0.05	1															
-----	> 0.05	0															
0.4 Surface Dislocation	Foggy spots on the EVA that lower the contrast of the display.																
Rainbow	Arches, circular or parallel colourful spread observed. (Newton ring, corrugation)  (A uniform blue shall be observed on good cells)																
Mechanical Damages	Glass crack : Reject crack of any size.  Glass chip : a. Any chips that will affect the function reliability of the display. b. Chips that lower the cosmetic appearance of the display to the end user.																



Defect Category	Defect Description (Activated State)	Drawing Specification								
	<p>a. Dust            The glass chips or other foreign material affixed on the Surface of glass can't be wiped off.</p> <p>i). Remove it with blade if appears outside pattern.</p> <p>ii). If appears inside pattern:</p> <table border="0"> <tr> <td><u>Diameter (D)</u></td> <td><u>Acceptable Q'ty</u></td> </tr> <tr> <td><math>D \leq 0.15\text{mm}</math></td> <td>Any</td> </tr> <tr> <td><math>0.15 &lt; D \leq 0.3 \text{ mm}</math></td> <td>1</td> </tr> <tr> <td><math>D &gt; 0.3 \text{ mm}</math></td> <td>0</td> </tr> </table>	<u>Diameter (D)</u>	<u>Acceptable Q'ty</u>	$D \leq 0.15\text{mm}$	Any	$0.15 < D \leq 0.3 \text{ mm}$	1	$D > 0.3 \text{ mm}$	0	 <p style="text-align: center;"><math>D = (A+B)/2</math></p>
<u>Diameter (D)</u>	<u>Acceptable Q'ty</u>									
$D \leq 0.15\text{mm}$	Any									
$0.15 < D \leq 0.3 \text{ mm}$	1									
$D > 0.3 \text{ mm}$	0									

Definition of LCD parts:





## 8. HANDLING LCD AND LCD MODULES

### 8.1 Liquid Crystal Display (LCD)

The following precautions should be taken when handling.

- A) An active LCD with water condensation on its surface will cause corrosion of ITO electrodes.
- B) Glass can be easily chipped or cracked from rough handling, especially at corners and edges.
- C) Do not drive LCD with DC voltage.

### 8.2 Liquid Crystal Display Modules (MDL)

#### 8.2.1 Static Electricity

MDL contains CMOS LSI's and the same precaution for such devices should apply, namely:

- A) The operator should be grounded whenever he comes into contact with the module. Never touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any part of the human body.
- B) The modules should be kept in antistatic bags or other containers resistant to static for storage.
- C) Only properly grounded soldering irons should be used.
- D) If an electric screwdriver is used it should be well grounded and shielded from commutator sparks.
- E) The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.

### 8.3 Operation

- A) The viewing angle can be adjusted by varying the LCD driving voltage  $V_o$ .
- B) Driving voltage should be kept within specified range, excess voltage shortens display life.
- C) Display may not function properly at temperatures above its operational range.
- D) Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured".
- E) Condensation at terminals will cause malfunction and possible electrochemical reaction. Relative humidity of the environment should therefore be kept below 60%.

### 8.4 Storage

- A) LCD's should be kept in sealed polyethylene bags while MDL's should use antistatic ones. If properly sealed, there is no need for desiccant.
- B) Store in dark places and do not expose to sunlight or fluorescent light. Keep the temperature between 0°C and 35°C and the relative humidity low. Please consult VARITRONIX for other storage requirements.



## 8.5 Safety

- A) If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all times.

## 9. LIMITED WARRANTY

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

1. The liability of VARITRONIX is limited to repair or replacement on the terms set forth below. VARITRONIX 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 VARITRONIX and the customer, VARITRONIX will only replace or repair any its LCD which is found defective electrically or visually when inspected in accordance with VARITRONIX LCD Acceptance Standards, for a period of one year from the date of shipment. Confirmation of such date shall be based on freight document.
2. No warranty can be granted if any of the precautions stated in HANDLING LCD and LCD Modules above have been disregarded. Broken glass, scratches on polarizers, mechanical damages as well as defects that are caused by accelerated environmental tests are excluded from warranty.
3. In returning the LCD and Modules, they must be properly packaged and there should be detailed description of the failures or defects.

## 10. IMPORTANT NOTICE

The information presented in this specification has been carefully checked and is believed to be accurate, however, no responsibility is assumed for inaccuracies. VARITRONIX reserves the right to make changes to nay specifications without further notice for performance, reliability, production technique and other considerations. VARITRONIX does not assume any liability arising out of the application or use of products herein. Please see Limited Warranty in the previous section.

“Varitronix Limited reserves the right to change this specification.”

FAX:(852) 2343-9555.

URL:<http://www.varitronix.com>

- END -