



LCD MODULE  
(DEPARTMENT)

---

## **SPECIFICATION**

### **G240320W04NBN11 – REV. A**

CUSTOMER APPROVAL
***STAMP AND SIGNATURE***
DATE: _____

IMPORTANT NOTE: This document must be approved by customer and send back to CCT by mail, email or fax.

If the approved document is not returned, CCT will assume it has been approved if any Mass Production Order is issued subsequently.

	<b>Designation</b>	<b>Name</b>	<b>Signature/Date</b>
<b>Originator</b>	<b>Electronic Engineer</b>	<b>Zaifulnahr Bin Mat Jailaini</b>	<b>31/10/2003</b>
<b>Checked by</b>	<b>Assistant Manager</b>	<b>Zainul Azhan B. Ahmad Bashir</b>	<b>31/10/2003</b>
<b>Approved by</b>	<b>Project Manager</b>	<b>Vuthy Taing</b>	<b>31/10/2003</b>



## LCD Module Specification

### 1.0 Table of Contents

	Page
1. Cover & Contents	1
2. Record of revision	2
3. General specification	3
4. Absolute maximum ratings	4
5. Electrical characteristics	4
6. Environmental requirement	4
7. LCD specification	5 ~ 6
8. Interfacing	7 ~ 8
9. Timing characteristics	8 ~ 9
10. Command set	10
11. On-chip character code	11
12. Power supply	12
13. Block diagram	12
14. Quality assurance	13 ~ 15
15. Precautions in use LCM	16 ~ 17
16. Outline drawing	18



2.0 Record of revision

Rev	Date	Item	Page	Comment
A	31/10/03			Intial Release



### 3.0 General specification

Display format: 240 (H) x 320 (W) dots

View area: 80.0mm x 105.0mm

General dimensions: 96.8mm x 143.0mm

LCD type:       STN Gray     STN Yellow     FSTN

Polarizer mode:     Reflective       Transflective  
                          Transmissive     Negative

View angle:       6 O'clock     12 O'clock     Others \_\_\_\_\_

Backlight:       LED             EL             CCFL

Backlight colour:  Yellow green     Amber       Blue green  
                          White             Others

Controller: SED1335F0B

Driver:    NT7701 and NT7702

DC – DC on board

Temperature range:     Normal temperature       Wide temperature  
   Operating 0 to 50 C            Operating –20 to 70 C  
   Storage –20 to 70 C            Storage –30 to 80 C

**4.0 Absolute maximum rating** $V_{SS} = 0V, T_a = 25^{\circ}C$ 

NO	ITEM	SIMBOL	MIN	MAX	UNIT
1.	Power Supply voltage (Logic)	$V_{DD} - V_{SS}$	0	7.0	V
2.	Power Supply voltage (LCD Driver)	$V_{DD} - V_{EE}$	-	25	V
3.	Operating Temperature	$T_{op}$	Refer page 3		$^{\circ}C$
4.	Storage Temperature	$T_{st}$	Refer page 3		$^{\circ}C$

**5.0 Electrical characteristics**

NO	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
1.	Power Supply voltage (Logic)	$V_{DD} - V_{SS}$	-	4.5	5.0	5.5	V
2.	Power Supply voltage ( $V_{LCD}$ )	$V_{DD} - V_{EE}$	$25^{\circ}C$		22.5		V
3.	Input Voltage (except OSC1)	$V_{IH}$	-	$0.8 V_{DD}$	-	-	V
		$V_{IL}$	-	-	-	$0.3 V_{DD}$	V
4.	Current Supply	$I_{DD}$	$V_{DD} - V_{SS} = 5V$	-	5.0	-	mA
		$I_{EE}$	$V_{DD} - V_{EE} = 22.5V$	-	50	-	mA
5.	Backlight Current	$I_{LED}$	$V_{LED} = 5V$ $R_{BL} = 10\Omega$	-	120	-	mA

**6.0 Environmental requirements**

NO	ITEM	CONDITION
1.	Operating Temperature	Refer to page 3
2.	Storage Temperature	Refer to page 3
3.	Operating Humidity	5% to 95%RH
4.	Cycle Test	0 C @ 30 min to 50 C @ 30min for 1 cycle run for 10 cycles

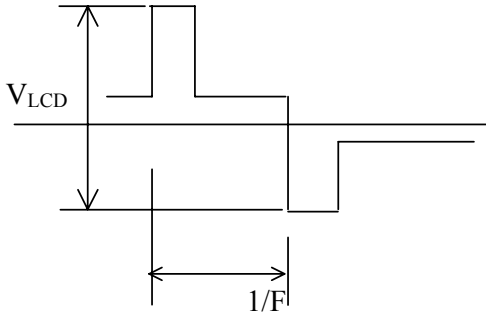
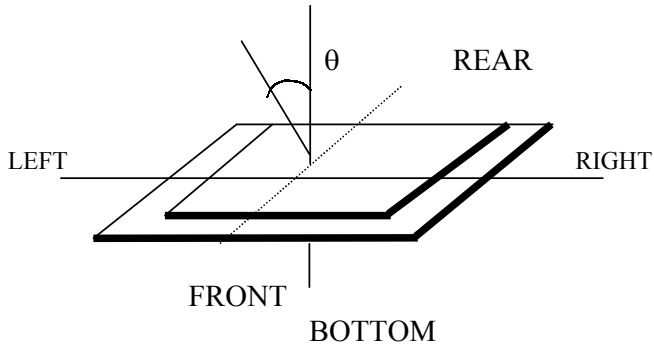
Note: The background on LCD has the possibility to be changed in different temperature range.



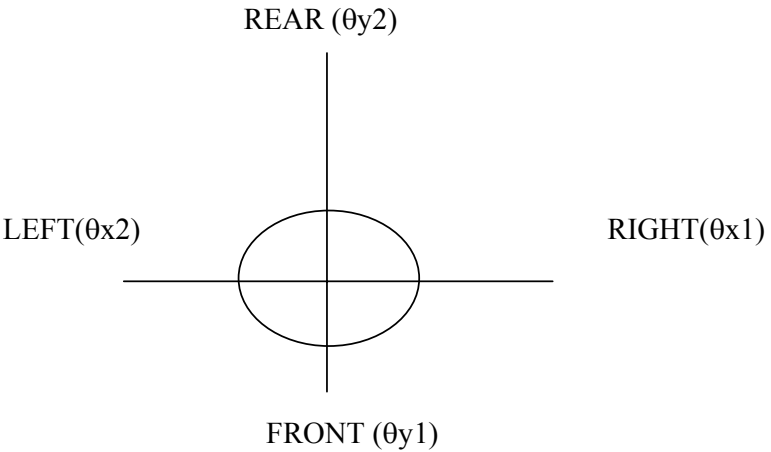
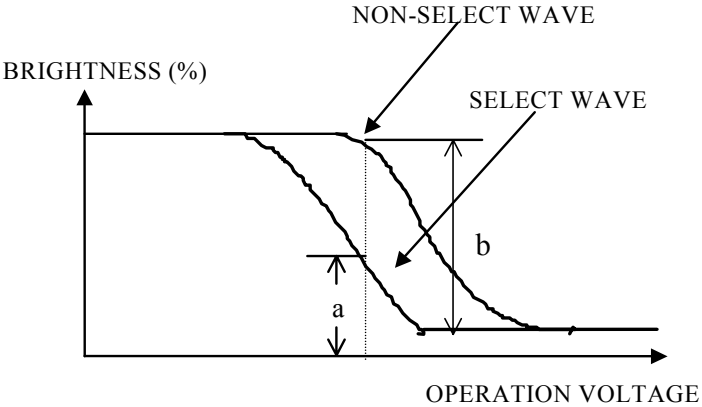
7.0 LCD specification

7.1 Electro-optical characteristics

NO	ITEM	SYMBOL	TEMP. °C	CONDITION	COMMERCIAL			UNIT	REF.
					MIN	TYP	MAX		
1	Operating Voltage	$V_{LCD}$	25	$\theta = 0$ $Cr = \max$	-	22.5	-	Volt	7.1.1
2	Viewing Angle	$\theta_{x1}$	25	$CR \geq 2$ $V_{LCD} = 22.5V$	-	43	-	Deg	7.1.2
		$\theta_{x2}$			-	-35	-		
		$\theta_{y1}$			-	21	-		
		$\theta_{y2}$			-	-31	-		
3	Contrast Ratio	Cr	25	$\theta = 0^\circ, V_{LCD} = 22.5V$	-	23	-		7.1.3

NO	CHARACTERISTICS	DEFINITIONS
7.1.1	<b>Definition of Operating Voltage (<math>V_{LCD}</math>)</b>	 <p><math>V_{LCD}</math> : Operating Voltage F : Frame Frequency</p>
7.1.2	<b>Definition of Viewing Angle</b>	



		
<p>7.1.3</p>	<p><b>Definition of Contrast Ratio</b></p>	 <p>Contrast Ratio = <math>\frac{\text{Brightness of non-selected state (b)}}{\text{Brightness of selected state (a)}}</math></p> <p><b>Conditions</b></p> <ul style="list-style-type: none"><li>(a) Operating Voltage: <math>V_{LCD}</math></li><li>(b) Temperature: <math>25^{\circ}C</math></li><li>(c) Viewing Angle, <math>\theta = 0^{\circ}</math></li></ul>

**8.0 Interface**

<b>8.1</b>	<b>Controller</b>	SED1335F0B	
<b>8.2</b>	<b>Display Driver</b>	NT7701 & NT7702	
<b>8.3</b>	<b>Duty Cycle</b>	1/240	
<b>8.4</b>	<b>Pin-out Assignments</b>		
	<b>Pin No</b>	<b>Symbol</b>	<b>Description</b>
	1	A0	Data type selection
	2	CS	Chip select (active low)
	3 and 10	D0 to D7	Bi-directional Data Bus. Data Transfer is performed once, thru DB0 to DB7, in the case of interface data length is 8-bits.
	11	RD	Active low 8080 family: Read signal 6800 family: Enable clock
	12	WR	Active low 8080 family: Write signal 6800 family: R/W signal
	13	RES	Reset (active low)
	14	K	Backlight ground
	15	A	Backlight power supply
	16	VSS	Ground terminal of module
	17	VEE	Negative supply for Liquid Crystal Drive
	18	VDD	Supply terminal of module (+5V)
	19	Vo	Liquid Crystal Display contrast adjust
	20	SEL1	8080 or 6800 family interface select





8.5 Pin information/description

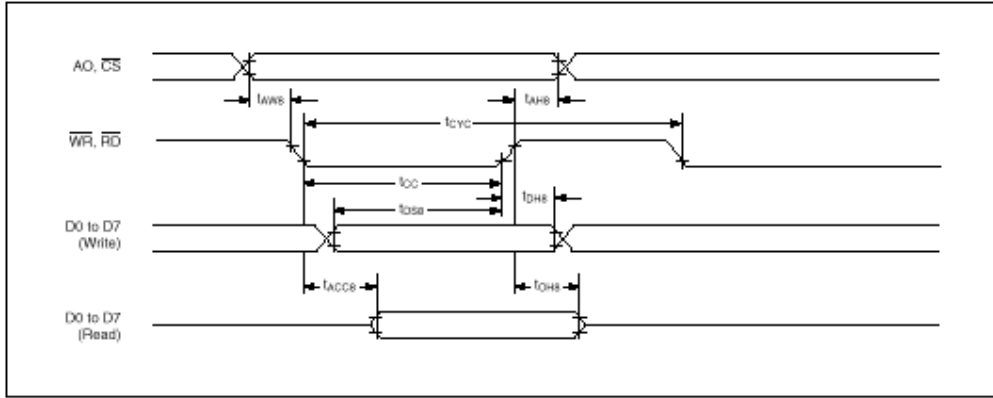
Pin Name	Function																				
A0	A0, in conjunction with the $\overline{RD}$ and $\overline{WR}$ or $R/\overline{W}$ and E signals, controls the type of access to the SED1336F, as shown below. <b>8080 family interface</b>																				
	<table border="1"> <thead> <tr> <th>A0</th> <th><math>\overline{RD}</math></th> <th><math>\overline{WR}</math></th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Status flag read</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Display data and cursor address read</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>Display data and parameter write</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>Command write</td> </tr> </tbody> </table>	A0	$\overline{RD}$	$\overline{WR}$	Function	0	0	1	Status flag read	1	0	1	Display data and cursor address read	0	1	0	Display data and parameter write	1	1	0	Command write
	A0	$\overline{RD}$	$\overline{WR}$	Function																	
	0	0	1	Status flag read																	
	1	0	1	Display data and cursor address read																	
	0	1	0	Display data and parameter write																	
	1	1	0	Command write																	
	<b>6800 family interface</b>																				
	<table border="1"> <thead> <tr> <th>A0</th> <th><math>R/\overline{W}</math></th> <th>E</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>1</td> <td>Status flag read</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>Display data and cursor address read</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Display data and parameter write</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Command write</td> </tr> </tbody> </table>	A0	$R/\overline{W}$	E	Function	0	1	1	Status flag read	1	1	1	Display data and cursor address read	0	0	1	Display data and parameter write	1	0	1	Command write
	A0	$R/\overline{W}$	E	Function																	
0	1	1	Status flag read																		
1	1	1	Display data and cursor address read																		
0	0	1	Display data and parameter write																		
1	0	1	Command write																		
$\overline{RD}$ or E	When the 8080 family interface is selected, this signal acts as the active-LOW read strobe. The SED1330F/1335F/1336F's output buffers are enabled when this signal is active. When the 6800 family interface is selected, this signal acts as the active-HIGH enable clock. Data is read from or written to the SED1330F/1335F/1336F when this clock goes HIGH.																				
$\overline{WR}$ or $R/\overline{W}$	When the 8080 family interface is selected, this signal acts as the active-LOW write strobe. The bus data is latched on the rising edge of this signal. When the 6800 family interface is selected, this signal acts as the read/write control signal. Data is read from the SED1330F/1335F/1336F if this signal is HIGH, and written to the SED1330F/1335F/1336F if it is LOW.																				
$\overline{CS}$	Chip select. This active-LOW input enables the SED1330F/1335F/1336F. It is usually connected to the output of an address decoder device that maps the SED1330F/1335F/1336F into the memory space of the controlling microprocessor.																				
$\overline{RES}$	This active-LOW input performs a hardware reset on the SED1330F/1335F/1336F. It is a Schmitt-trigger input for enhanced noise immunity; however, care should be taken to ensure that it is not triggered if the supply voltage is lowered.																				



9.0 TIMING CHARACTERISTICS/TIMING DIAGRAMS

Timing Characteristics for SED1335F0B

8080 family interface timing:



Ta = -20 to 75°C

Signal	Symbol	Parameter	VDD = 4.5 to 5.5V		VDD = 2.7 to 4.5V		Unit	Condition
			min	max	min	max		
A0, CS	tAHs	Address hold time	10	—	10	—	ns	CL = 100 pF
	tAWs	Address setup time	0	—	0	—	ns	
WR, RD	tCYC	System cycle time	See note	—	See note	—	ns	
	tCC	Strobe pulsewidth	120	—	150	—	ns	
D0 to D7	tDSs	Data setup time	120	—	120	—	ns	
	tDHS	Data hold time	5	—	5	—	ns	
	tACCs	RD access time	—	50	—	80	ns	
	tOHS	Output disable time	10	50	10	55	ns	

Note: For memory control and system control commands:

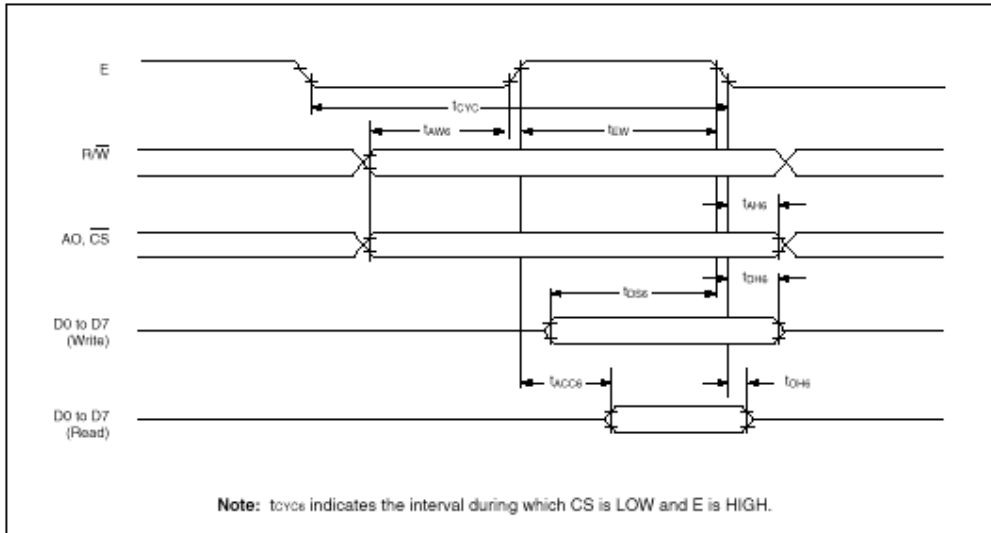
$$t_{CYC8} = 2t_C + t_{CC} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

$$t_{CYC8} = 4t_C + t_{CC} + 30$$



6800 family interface timing:



$T_a = -20$  to  $75^\circ\text{C}$

Signal	Symbol	Parameter	VDD = 4.5 to 5.5V		VDD = 2.7 to 4.5V		Unit	Condition
			min	max	min	max		
AO, CS, R/W	$t_{CYC6}$	System cycle time	See note	—	See note	—	ns	CL = 100 pF
	$t_{AW6}$	Address setup time	0	—	10	—	ns	
	$t_{AH6}$	Address hold time	0	—	0	—	ns	
D0 to D7	$t_{DS6}$	Data setup time	100	—	120	—	ns	
	$t_{DH6}$	Data hold time	0	—	0	—	ns	
	$t_{OH6}$	Output disable time	10	50	10	75	ns	
	$t_{ACC6}$	Access time	—	85	—	130	ns	
E	$t_{EW}$	Enable pulsewidth	120	—	150	—	ns	

**Note:** For memory control and system control commands:

$$t_{CYC6} = 2t_C + t_{EW} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

$$t_{CYC6} = 4t_C + t_{EW} + 30$$



## 10. Command set

Class	Command	Code												Hex	Command Description	Command Read Parameters	
		RD	WR	A0	D7	D6	D5	D4	D3	D2	D1	D0	No. of Bytes			Section	
System control	SYSTEM SET	1	0	1	0	1	0	0	0	0	0	0	0	40	Initialize device and display	8	3.2.1
	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter standby mode	0	3.2.2	
Display control	DISP ON/OFF	1	0	1	0	1	0	1	1	0	0	D	58, 59	Enable and disable display and display flashing	1	3.3.1	
	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	Set display start address and display regions	10	3.3.2	
	CSRFORM	1	0	1	0	1	0	1	1	1	0	1	5D	Set cursor type	2	3.3.3	
	CGRAM ADR	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character generator RAM	2	3.3.6	
	CSRDIR	1	0	1	0	1	0	0	1	1	CD 1	CD 0	4C to 4F	Set direction of cursor movement	0	3.3.4	
	HDOT SCR	1	0	1	0	1	0	1	1	0	1	0	5A	Set horizontal scroll position	1	3.3.7	
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	5B	Set display overlay format	1	3.3.5	
Drawing control	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	Set cursor address	2	3.4.1	
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	Read cursor address	2	3.4.2	
Memory control	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	Write to display memory	—	3.5.1	
	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	Read from display memory	—	3.5.2	

**Notes:**

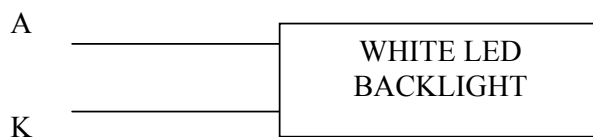
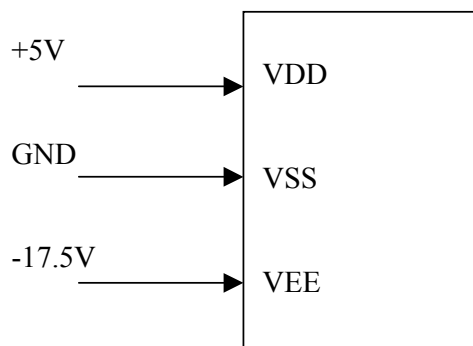
- In general, the internal registers of the SED1330F/1335F/1336F are modified as each command parameter is input. However, the microprocessor does not have to set all the parameters of a command and may send a new command before all parameters have been input. The internal registers for the parameters that have been input will have been changed but the remaining parameter registers are unchanged.
  - 2-byte parameters (where two bytes are treated as one data item) are handled as follows:
    - CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.
    - SYSTEM SET, SCROLL, CGRAM ADR: Both parameter bytes are processed together. If the command is changed after half of the parameter has been input, the single byte is ignored.
- APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.



11. On-chip character code

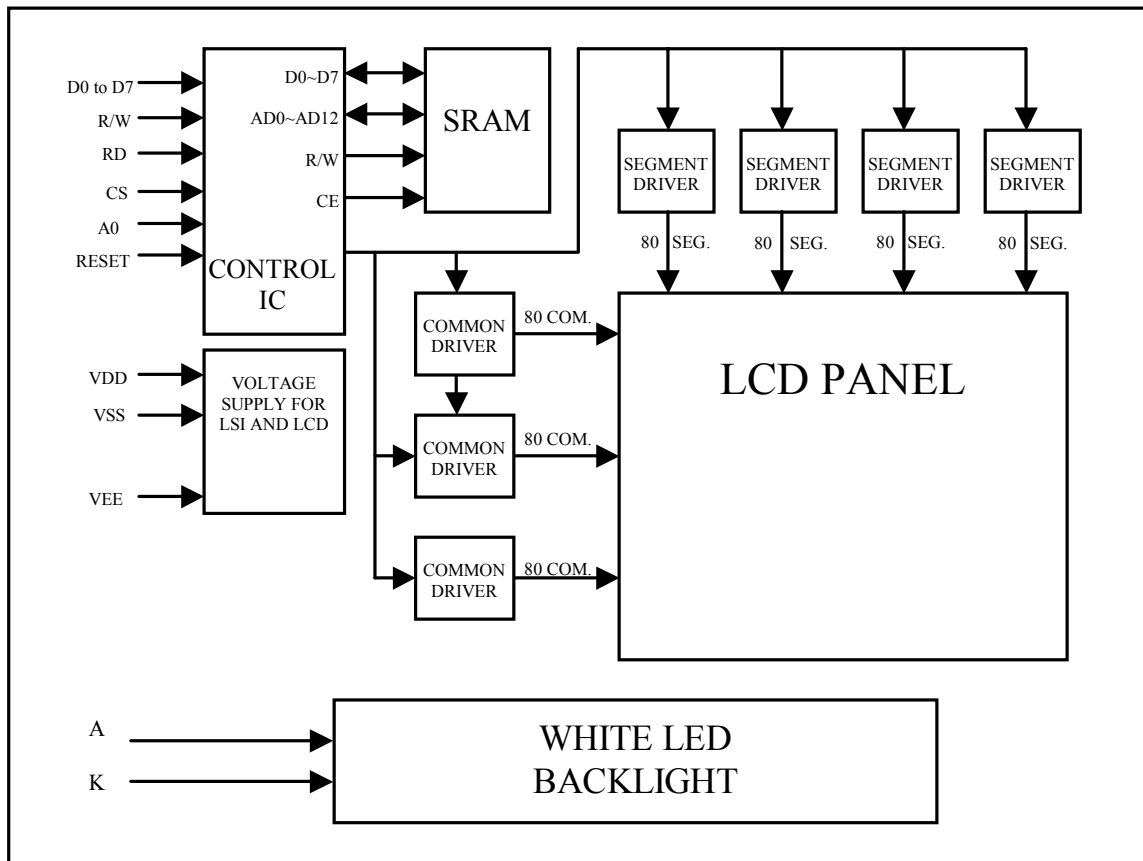
Lower 4 bits	Upper 4 bits															
	0	1	2	3	4	5	6	7	8	8	A	B	C	D	E	F
0			0	@	P	'	p				ー	夕	三			
1			!	1	A	Q	a	q			。	ア	子	亡		
2			"	2	B	R	b	r			「	イ	ツ	メ		
3			#	3	C	S	c	s			」	ウ	〒	E		
4			\$	4	D	T	d	t			、	エ	ト	卜		
5			%	5	E	U	e	u			。	オ	ナ	ユ		
6			&	6	F	V	f	v			ヲ	カ	ニ	ヨ		
7			'	7	G	W	g	w			ヲ	キ	ヌ	ラ		
8			(	8	H	X	h	x			イ	フ	ネ	リ		
9			)	9	I	Y	i	y			ら	ケ	リ	ル		
A			*	:	J	Z	j	z			エ	コ	ハ	レ		
B			+	:	K	[	k	{			オ	サ	ヒ	口		
C			,	<	L	¥	l				ト	シ	フ	ワ		
D			.	+	M	]	m	}			ユ	ス	ハ	フ		
E			-	>	N	^	n	→			ヨ	ヒ	ホ	◇		
F			/	?	O	_	o	←			ウ	リ	マ	□		

12. Power Supply





13. Block Diagram



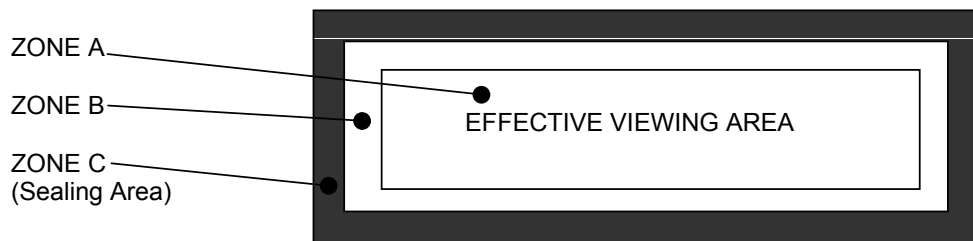


14. Quality Assurance

Inspection condition

The LCD shall be inspected under 40W white fluorescent light. The distance between the eyes and the sample shall be more than 30cm. All directions for inspecting the sample should be 45° against perpendicular line.

Definition of applicable zones.



ITEM  
Black Spot, Foreign Materials,  
White Spot, Polarizer Damage

CRITERIA

(1) Round Shape

Dimension * \ Zone	Acceptable No.		
	A	B	C
D < 0.10mm	NC	NC	NC
0.10 < D < 0.203mm	3		NC
0.203 < D < 0.305mm	1	2	NC
D > 0.305mm	0		NC

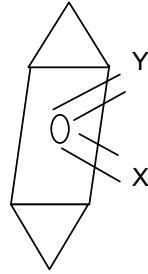
(2) Line Shape

Dimension \ Zone		Acceptable No.		
X	Y	A	B	C
<0.013mm		NC	NC	NC
< 2mm	<0.025mm	1	1	NC
<0.991mm	< 2mm	1	2	NC

Note : Total defects shall not exceed five



<u>NO</u>	<u>ITEM</u>	<u>CRITERIA</u>
1.2	Pin Holes/Voids (on segment)	(X+Y) / 2 = 0.203mm within 1 part/segment



1.3 Polarizer Air Bubbles

Zone Dimension *	Acceptable No.		
	A	B	C
$D \leq 0.152\text{mm}$	NC	NC	NC
$0.152 < D \leq 0.305\text{mm}$	3	5	NC
$0.305 < D \leq 0.508\text{mm}$	2	3	NC
$0.508 < D \leq 0.991\text{mm}$	0	1	NC

NC : No Count  
 \* : Mean Diameter  
 D : Diameter  
 All dimensions in mm.





## 15. Precaution for using LCM

### 1. Liquid Crystal Display (LCD)

LCD is made up of glass, organic sealant, organic fluid and polymer based polarizers. The following precautions should be taken when handling.

- b) Keep the temperature within the range of use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel off or bubble.
- c) Do not contact the exposed polarizer with anything harder than HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzine.
- d) Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or colour fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.
- e) Glass can be easily chipped or cracked from rough handling, especially at corners and edges.
- f) Do not drive LCD with DC voltage.

### 2. Liquid Crystal Display Modules.

#### 2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modification. The following should be noted.

- a) Do not tamper in any way with the tabs on the metal frame.
- b) Do not modify the PCB by drilling extra holes, changing its outline, moving its component or modifying its pattern.
- c) Do not touch the elastomer connector, especially insert a backlight panel (for example, EL)
- d) 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.

- a) Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

#### 2.2 Static Electricity

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

- a) The operator should be grounded whenever he/she 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 parts of the human body.
- b) The modules should be kept in antistatic bags or other containers 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 spark.
- e) The normal static prevention measures should be observed for work clothes and working benches, the latter conductive (rubber) mat is recommended.
- f) Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

#### 2.3 Soldering

- a) Solder only to the I/O terminals.
- b) Use only soldering irons with proper grounding and no leakage.
- c) Soldering temperature: 280°C
- d) Soldering time: 3 to 4 sec
- e) Use eutectic solder with resin flux fill.
- f) If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed afterwards.



#### 2.4 Operation

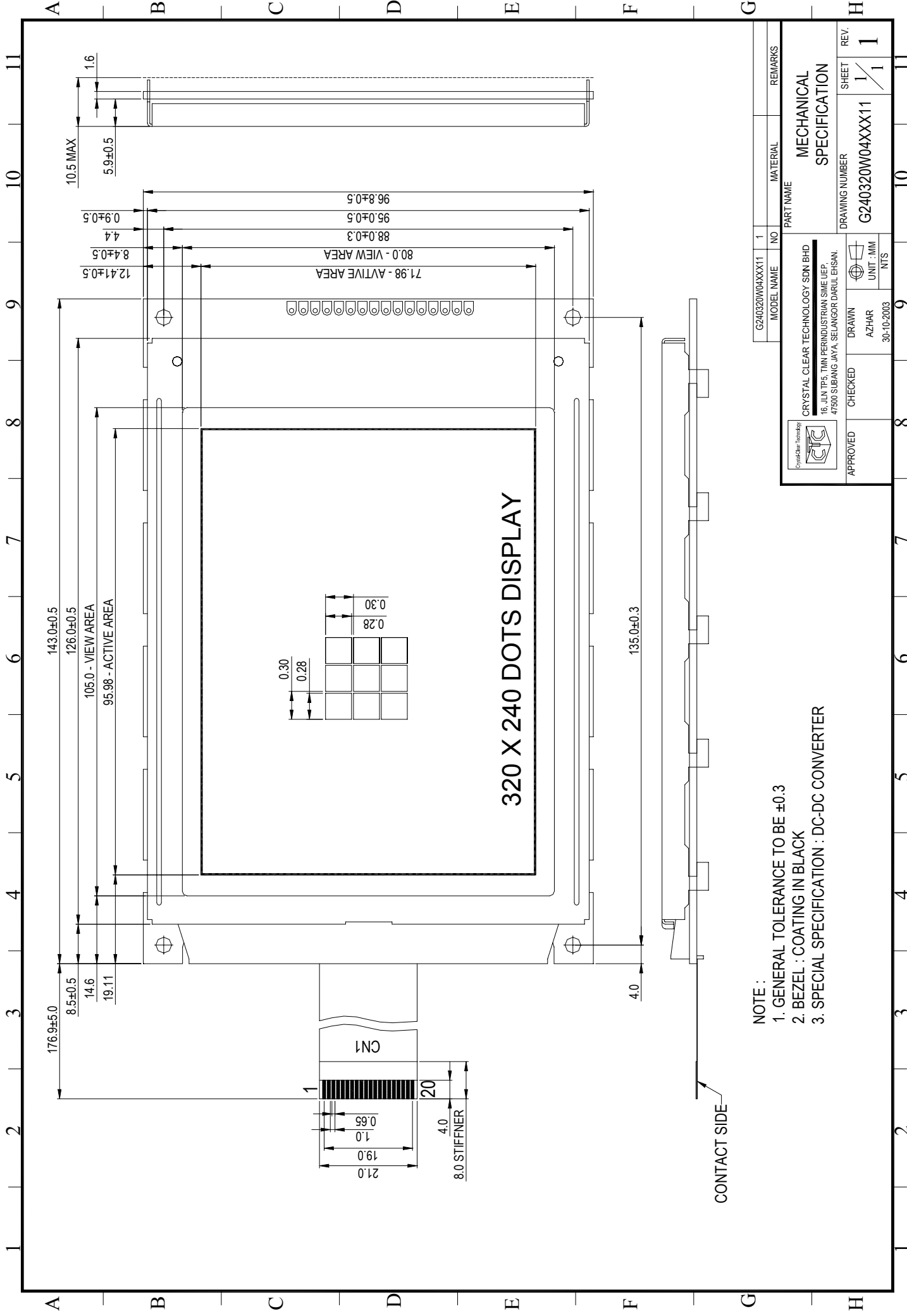
- a) The contrast can be adjusted by varying the LCD driving voltage  $V_0$
- b) Driving voltage should be kept within specified range, excess voltage shortens display life.
- c) Response time increases with decrease in temperature.
- d) Display may turn black or dark blue at temperature above its operational range, this is (however not pressing on the viewing area) may cause the segments to appear “fractured”.
- e) Mechanical disturbance during operation ( such as pressing on the viewing area) may cause the segments to appear “fractured”.

#### 2.5 Storage

If any fluid leaks out of the 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 the time.

#### 2.6 Limited Warranty

Unless otherwise agreed between Crystal Clear Technology and customer, Crystal Clear Technology will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with Crystal Clear Technology acceptance standards, for a period of one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Crystal Clear Technology is limited to repair and/or replacement on the terms set forth above. Crystal Clear Technology will not be responsible for any subsequent or consequential events.



**NOTE :**

1. GENERAL TOLERANCE TO BE  $\pm 0.3$
2. BEZEL : COATING IN BLACK
3. SPECIAL SPECIFICATION : DC-DC CONVERTER

	APPROVED	CHECKED	DRAWN	DRAWING NUMBER	PART NAME	MATERIAL	REMARKS
			AZHAR	G240320W04XXX11	MECHANICAL SPECIFICATION		
CRYSTAL CLEAR TECHNOLOGY SDN BHD 16, JLN TP5, TMN PERINDUSTRIAN SIME UEP, 47500 SUBANG JAYA, SELANGOR DARUL EHSAN.				UNIT : MM	SHEET	REV.	
				30-10-2003	1 / 1	1	