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1. LCD MODULE NUMBERING SYSTEM

PART NUMBER: PL-AB...BC-DEFGHI-JK

PL POWER LIGHT TECHNOLOGY
A DISPLAY CONTENTS S---SEGMENT TYPE
 C---CHARACTER TYPE
 G---GRAPHIC TYPE

B...B SERIALS NUMBER FOR SM
 CHARACTERS Vs. LINES FOR CM

POWER LIGHT

C COLUMNS Vs. ROWS FOR GM
D VERSION OF PCB
 LCD TYPE
 P---POS. TN, N---NEG. TN, Y---YELLOW STN, G---GRAY STN
 B---BLUE STN, F---FSTN
E POLARIZER TYPE
 R---REFLECTIVE, F---TRANSFLECTIVE, T---TRANSMISSIVE
F VIEWING ANGLE S---6 O'CLOCK, T---12 O'CLOCK
G OPERATING TEMPRETURE N---NORMAL, E---EXTENDED
H BACKLIGHT TYPE N---NO BACKLIGHT, D---BOTTOM LED, S---SIDE LED,
 E---EL, C---CCFL
I COLOR OF BACKLIGHT Y---YELLOW/GREEN, G---GREEN
 W---WHITE, B---BLUE, A---AMBER
JK FOR CM, CONTROLLER/DRIVER DESIGNATOR
 J: IC A---KS0066U B---SPLC780
 K: DENOTE DIFFERENT CHARACTER TABLE
 FOR GM. J: BACKLIGHT DRIVER Y---WITH, N---WITHOUT
 K: DC-DC CONVERTER Y---WITH, N---WITHOUT

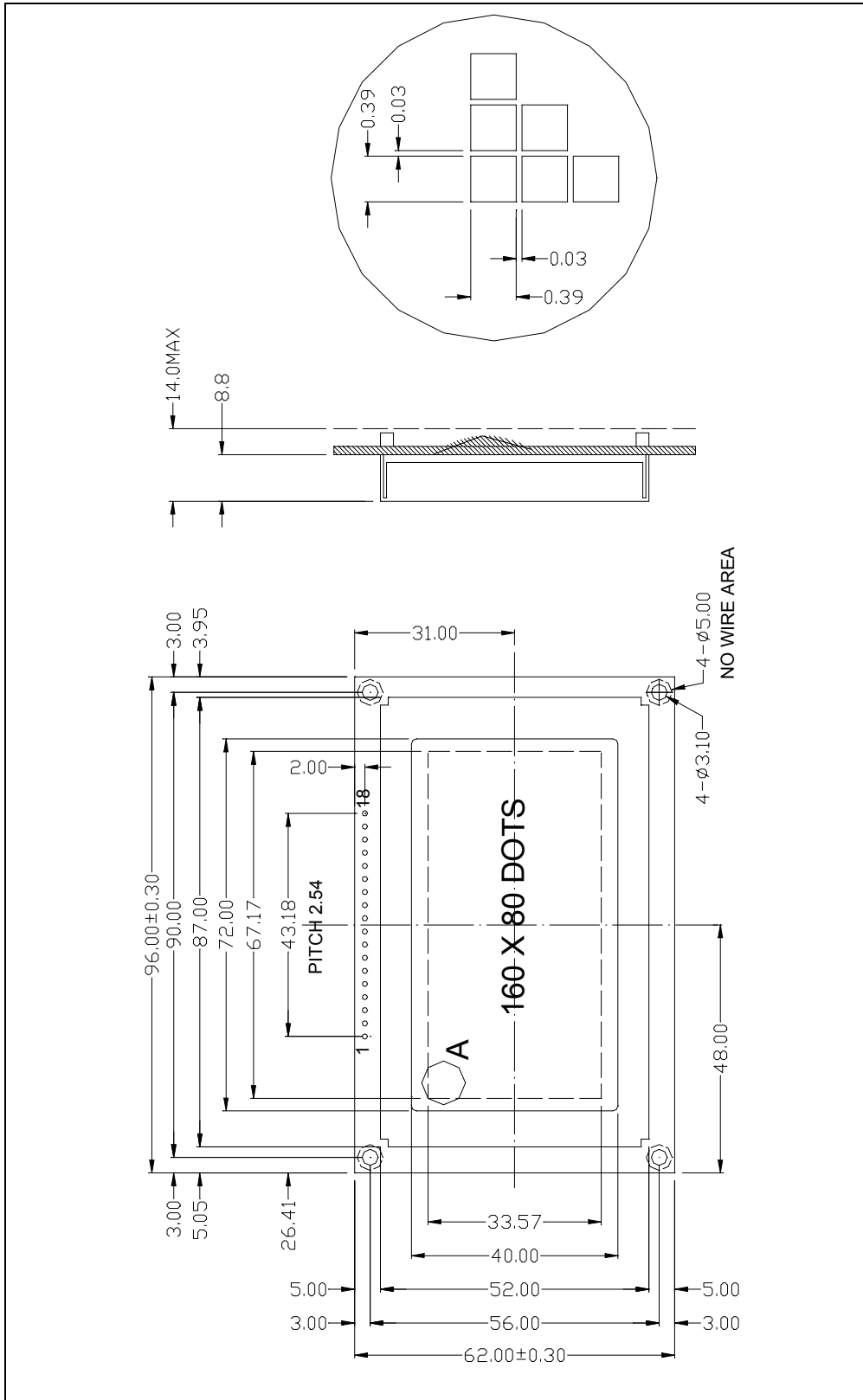
2. MECHANICAL CHARACTERISTICS

2.1 MECHANICAL DATA

ITEM	STANDARD VALUE	UNIT
NUMBER OF DOTS	160 X 80	DOTS
OUTLINE DIMENSIONS	96.0(W) X 62.0(H) X 14.0(T)	mm
EFFECTTVE VIEWING AREA	72.0(W) X 40.0(H)	mm
DOT SIZE	0.39(W) X 0.39(H)	mm
DOT PITCH	0.42(W) X 0.42(H)	mm
APPROX WEIGHT	50	g

2.2 MECHANICAL DRAWINGS

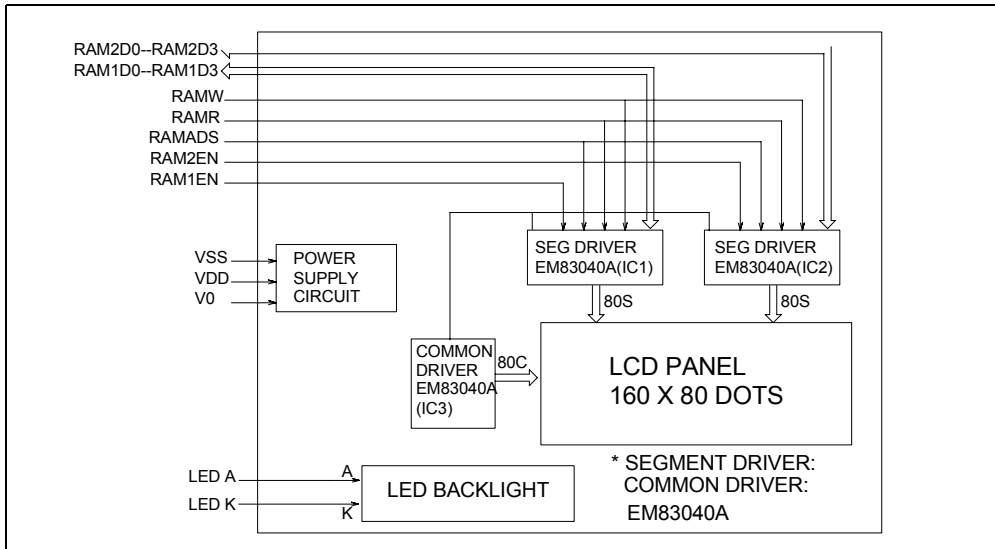
POWER LIGHT



3. CIRCUIT BLOCK DIAGRAM

3.1 Electrical Block Diagram

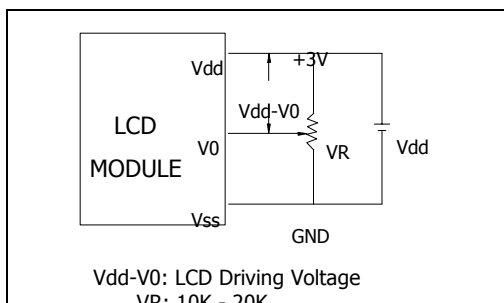
POWER LIGHT



3.2 Pins Definition

PIN	SYMBOL	FUNCTION
1	Vss	Power Supply(GND)
2	Vdd	Power Supply(+3V)
3	Vo	Contrast Adjust
4	RAMADS	Data/Address Select for IC1 and IC2
5	RAMW	RAM Write Signal For IC1 and IC2
6	RAMR	RAM Read Signal For IC1 and IC2
7	RAM1EN	IC1 RAM R/W Enable
8	RAM2EN	IC2 RAM R/W Enable
9-12	RAM1D0-D3	IC1 RAM Data/Address Bus
13-16	RAM2D0-D3	IC2 RAM Data/Address Bus
17	A	Power Supply for LED Backlight(+)
18	K	Power Supply for LED Backlight(-)

3.3 Power Supply For LCM Driving



3.4 Relationship Between LCD Dot Position and Display RAM

POWER LIGHT

NT-G160801A DISPLAY RAM ADDRESS TABLE

LINE	FTR. ADDR.	COLUMN	COLUMN	COLUMN	COLUMN
1	0000	1 2 3 4 5 6 7 8	7374757677787980	8182838485868788	153 155 157 159 154 156 158 160
2	0032	1 2 3 4 5 6 7 8	7374757677787980	8182838485868788	153 155 157 159 154 156 158 160
79	2496	1 2 3 4 5 6 7 8	7374757677787980	8182838485868788	153 155 157 159 154 156 158 160
80	2528	1 2 3 4 5 6 7 8	7374757677787980	8182838485868788	153 155 157 159 154 156 158 160

<p>80 X 80 DOTS</p> <p>IC1</p> <table border="1" style="margin: auto;"> <tr><td>RAM1EN</td></tr> <tr><td>RAM1D0</td></tr> <tr><td>RAM1D1</td></tr> <tr><td>RAM1D2</td></tr> <tr><td>RAM1D3</td></tr> <tr><td>RAM1ADS</td></tr> <tr><td>RAM1M</td></tr> <tr><td>RAM1R</td></tr> </table>	RAM1EN	RAM1D0	RAM1D1	RAM1D2	RAM1D3	RAM1ADS	RAM1M	RAM1R	<p>80 X 80 DOTS</p> <p>IC2</p> <table border="1" style="margin: auto;"> <tr><td>RAM2EN</td></tr> <tr><td>RAM2D0</td></tr> <tr><td>RAM2D1</td></tr> <tr><td>RAM2D2</td></tr> <tr><td>RAM2D3</td></tr> <tr><td>RAM2ADS</td></tr> <tr><td>RAM2M</td></tr> <tr><td>RAM2R</td></tr> </table>	RAM2EN	RAM2D0	RAM2D1	RAM2D2	RAM2D3	RAM2ADS	RAM2M	RAM2R
RAM1EN																	
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RAM2M																	
RAM2R																	

*NOTE: ALL OF THE NUMBERS ARE IN DECIMAL FORMAT

4. ABSOLUTE MAXIMUM RATINGS

4.1 Electrical Absolute Maximum Ratings

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT
------	--------	-----------	-----	-----	------

POWER LIGHT

Supply Voltage (Logic)	Vdd – Vss	-	0	6.0	V
Supply Voltage (LCD Drive)	VLCD	-	0	18.0	V
Input Voltage	Vi	-	-0.3	Vdd +0.3	V

4.2 Enviromental Absolute Maximum Ratings

ITEM	SYMBOL	CONDITIONS	MIN	MAX	UNIT
Operating Temp	Topr	Extended temp. version	-20	70	deg C
Storage Temp	Ttsg		-30	80	deg C
Humidity Endurance	RH	no ondensation Ta<=40 deg	-	95	%
Vibration	-	100-300Hz, X/Y/Z directions, 1 hour	-	4.9m/ss 0.5g	-
Shock	-	10 mS X/Y/Z direction 1 time each	-	29.4m/ss 3.0g	-

5. ELECTRICAL CHARACTERISTICS

5.1 DC Characteristics

Electrical Characteristics at Ta=25 deg C, Vdd = 3V + / - 5%

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply Voltage (logic)	Vdd-Vss	-	2.6	3.0	5.0	V
Supply Voltage (LCD)	V0	Vdd = 3V	0	0.5	3.0	V
Input signal Voltage (for E, DB0-7,R/W,RS)	V-ih	"H" level	2.0	-	Vdd	V
	V-il	"L" level	0	-	0.8	V
Supply Current	Icc	-	-	100	120	mA

5.2 AC Characteristics

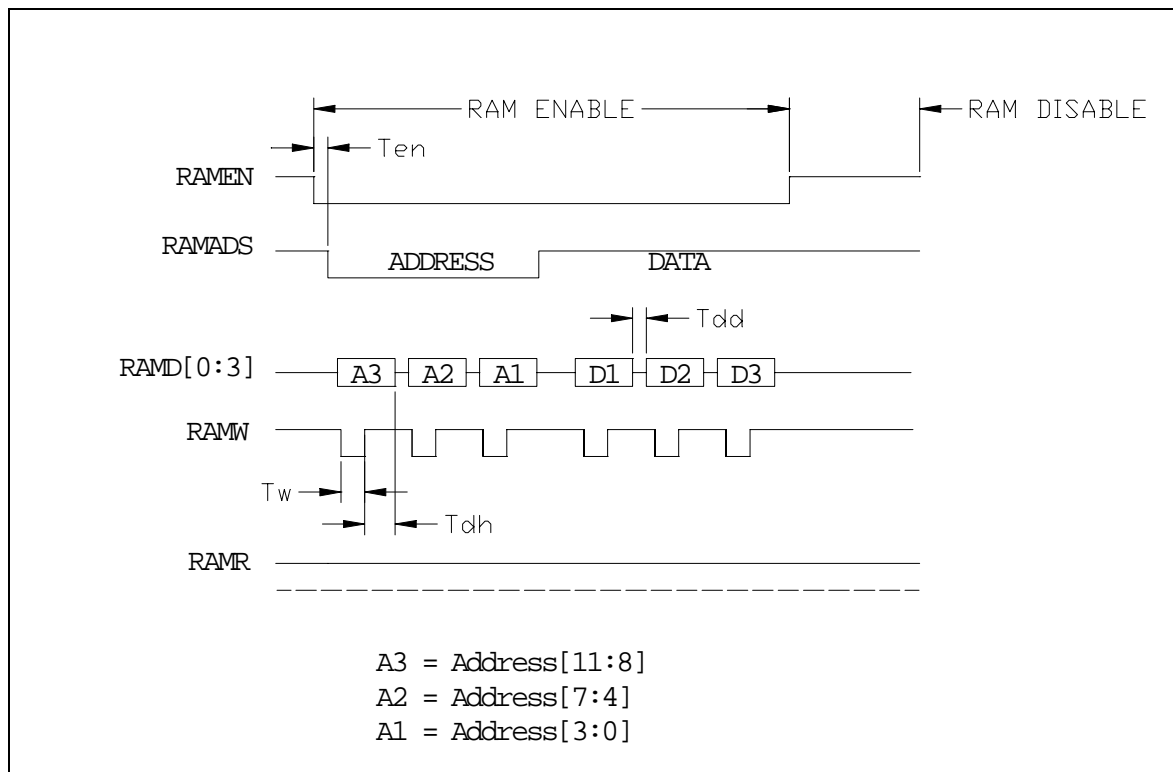
TIMING SPECIFICATIONS at Ta = 25 deg C, Vdd = 3V+/-5%, Vss =0V

For Write mode

ITEM	SYMBOL	MIN	MAX	UNIT
------	--------	-----	-----	------

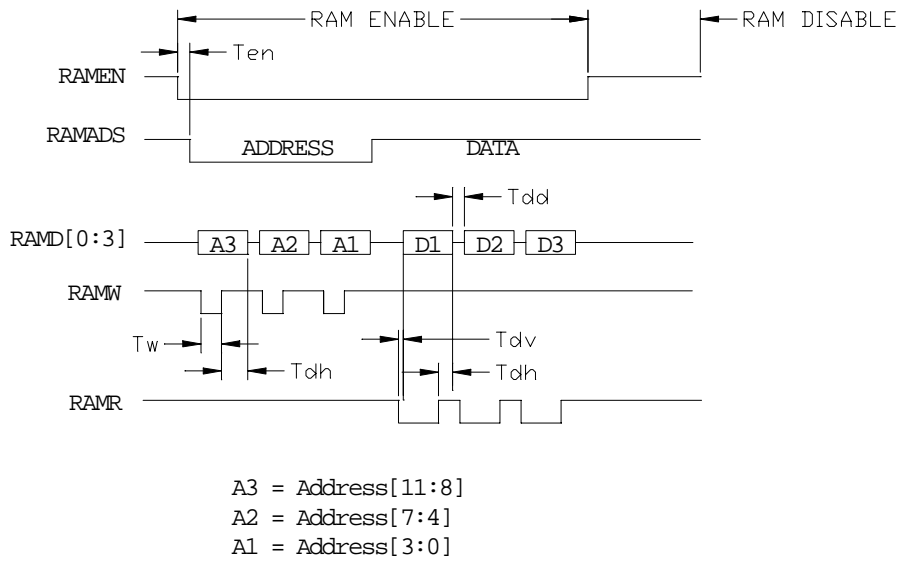
RC Clock Variable	Vrc	-20	20	%
Frame Period	Tframe	-	1/64	s
Load Period	Tload	-	31	us
Enable Time	Ten	30	-	us
Write Low Pulse	Tw	2	-	us
Data Hold Time	Tdh	500	-	ns
Data to Data Time	Tdd	2	-	us
Data Valid Time	Tdv	1500	-	ns

LCD RAM WRITE MODE TIMING DIAGRAM



LCD RAM READ MODE TIMING DIAGRAM

POWER LIGHT



6. BACKLIGHT CHARACTERISTICS

6.1 Absolute Maximum Ratings

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT
Forward Current	Ifm	-	-	350	mA
Reverse Voltage	Vr	-	-	8	V
Power Dissipation	Pd	-	-	1500	mW

6.2 Operating Parameters

ITEM	SYMBOL	CONDITION	MIN	TYP.	MAX	UNIT
Forward Voltage	Vf	If=330mA	4.0	4.2	4.4	V
Peak Wavelength	λ	If=330mA	-	568	-	nm

7. ELECTRO-OPTICAL CHARACTERISTICS

POWER LIGHT

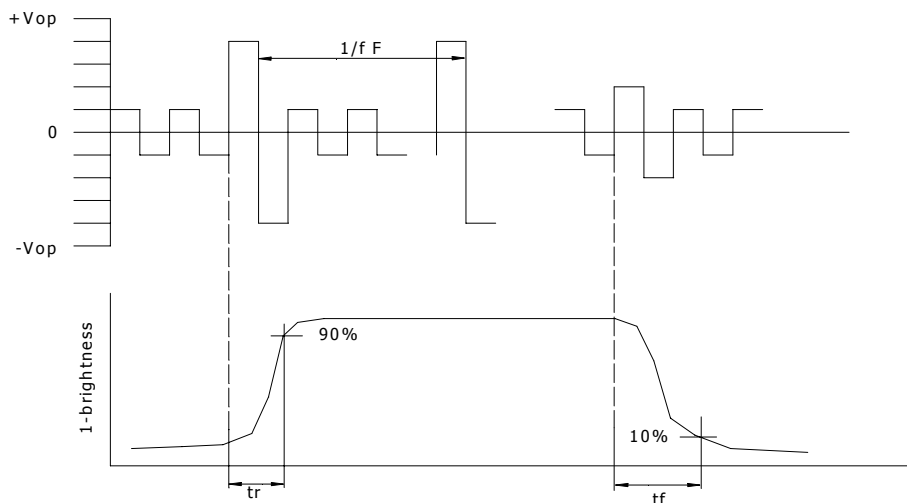
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REF.
Contrast	CR	25°C	--	12	--		Note1
Rise Time	tr	25°C	--	160	240	ms	Note2
Fall Time	tf	25°C	--	100	150	ms	note 2
Viewing Angle	$\theta 1 - \theta 2$	25°C	--	--	60	DEG	Note 3
	$\varnothing 1, \varnothing 2$		-40(S)/-15(T)	--	40		
Frame Frequency	Ff	25°C	--	70	--	Hz	note 2

Note(1): Contrast ratio is defined under the following condition:

CR= $\frac{\text{brightness of selected condition}}{\text{brightness of non-selected condition}}$

- (a). Temperature-----25C
- (b). Frame Frequency-----64Hz
- (c). Viewing angle----- $\theta = 0, \varnothing = 0$
- (d). Operating Voltage---5.0V

Note(2): definition of response time:

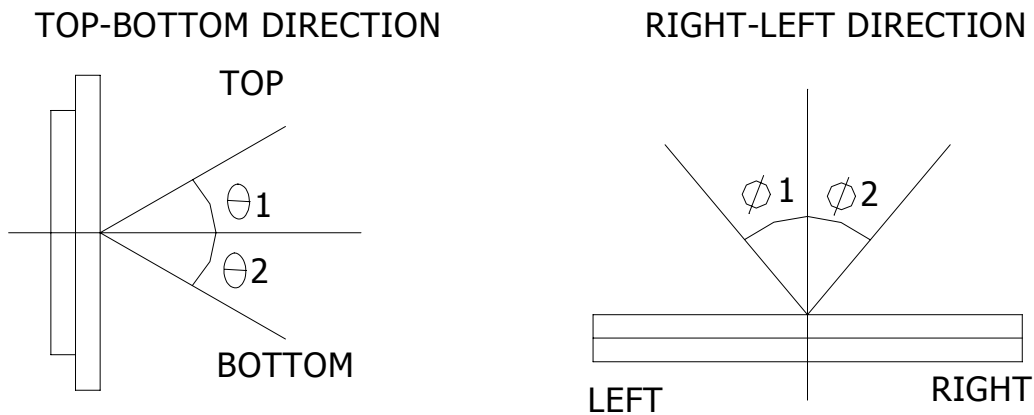


Condition:

- (a). Temperature-----25C
- (b). Frame Frequency-----64Hz
- (c). Viewing angle----- $\theta = 0, \varnothing = 0$
- (d). Operating Voltage---5.0V

POWER LIGHT

Note(3): definition of view angle:



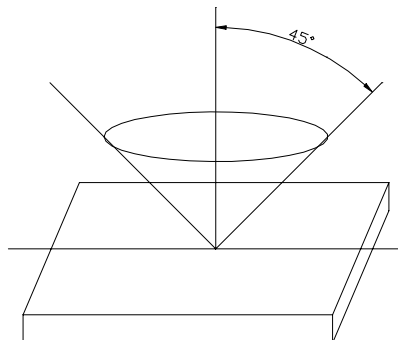
8. INSPECTION STANDARDS

8.1 Inspection Conditions

The LCD shall be inspected under 40W white fluorescent light.

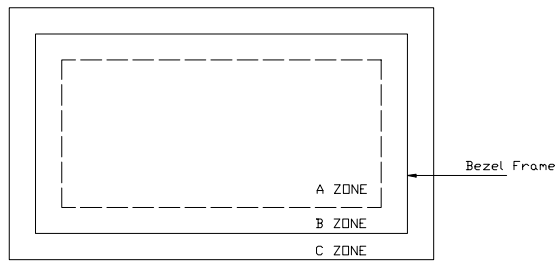
The distance between the eyes and the samples shall be more than 30cm.

All directions for inspecting the sample should be within 45 degree against perpendicular line.



8.2 Definition of Applicable Zone

POWER LIGHT

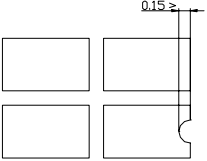
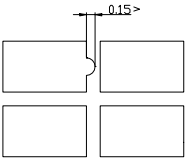
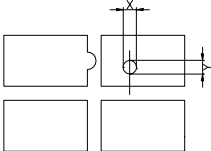


A Zone: Active Display Area
 B Zone: Area from Bezel Frame to A Zone
 C Zone: Rest Area of Bezel
 A Zone + B Zone=Effective Viewing Area

8.3 Standards

NO	PARAMETER	CRITERIA				
1	Black and White Spots, Foreign Substances	Round Shape				
		Zone		Acceptable Number		
		DIMENSION(MM)		A	B	C
		D≤0.1		*	*	*
		0.1<D≤0.2		5	5	*
		0.2<D≤0.3		0	1	*
		0.3<D		0	0	*
		D=(long+short)/2 * Disregard				
		Line Shape				
		X(mm) Y(mm)		Acceptable Number		
-		A	B	C		
0.02≥W		*	*	*		
2.0≥L		3	3	*		
1.0≥L		1	2	*		
1.0≥L		0	2	*		
-		Not acceptable				
X: Length Y: Width * Disregard						
Total defects shall not exceed 5.						
2	Air Bubbles (Between glass and polarizer)	Zone		Acceptable Number		
		Dimension(mm)		A	B	C
		D≤0.1		*	*	*
		0.1<D≤0.2		5	5	*
		0.2<D≤0.3		0	1	*
0.3<D		0	0	*		

POWER LIGHT

		*: Disregard Total defects shall not exceed 3.
3	The Shape of Dot	<p>(1) Dot Shape(with dent)</p>  <p>As per the sketch of left hand.</p> <p>(2) Dot Shape(with Projection)</p>  <p>Should not connect to next dot.</p> <p>(3) Pin Hole</p>  <p>$(X+Y)/2 < 0.2\text{mm}$ (less than 0.1mm is not counted)</p> <p>Total defects shall not exceed 5.</p>
4	Polarizer Scratches	Not to be conspicuous defects.
5	Polarizer Dirts	If the stains are removed easily from LCD surface, the module is not defective.
6	Color Variation	Not to be conspicuous defects.

9. PRECAUTIONS IN 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 handing,

- (1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel off or bubble.
- (2). Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface. Wipe gently with cotton. Chamois or other soft material soaked in petroleum benzin.
- (3). Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.
- (4). Glass can be easily chipped or cracked from rough handing. especially at corners and

edges.

- (5). 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 modifications. The following should be noted.

- (1). Do not tamper in any way with the tabs on the metal frame.
- (2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.
- (3). Do not touch the elastomer connector, especially insert a backlight panel (for example, EL).
- (4). 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.
- (5). 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

- (1). 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.
- (2). The modules should be kept in antistatic bags or other containers resistant to static for storage.
- (3). Only properly grounded soldering irons should be used.
- (4). If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.
- (5). The normal static prevention measures should be observed for work clothes and working benches; for the latter a conductive (rubber) mat is recommended.
- (6). Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

2.3. Soldering

- (1). Solder only to the I/O terminals.
- (2). Use only soldering irons with proper grounding and no leakage.
- (3). Soldering temperature: $280\text{ }^{\circ}\text{C} \pm 10^{\circ}\text{C}$
- (4). Soldering time: 3 to 4 sec.
- (5). Use eutectic solder with resin flux fill.
- (6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed afterwards.

2.4. Operation

- (1). The viewing angle can be adjusted by varying the LCD driving voltage V_0 .
- (2). Driving voltage should be kept within specified range; excess voltage shortens display life.
- (3). Response time increases with decrease in temperature.
- (4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
- (5). 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 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 the time.

END

POWER LIGHT