SPECIFICATIONS

FOR   LCD   MODULE

CUSTOMER	
CUSTOMER PART NO.	
PART NO.	AMC2002GR-B-Y6WFDY
DESCRIPTION	
APPROVED BY	
DATE	

PREPARED BY	CHECKED BY	APPROVED BY

REVISION RECORD

REV.	DATE	PAGE	COMMENT
A	2005-5-12		NEW RELEASE
B	2007-5-8	4	FFC LENGTH

20 CHARACTERS X 2 LINES

OUTLINE DIMENSION: 89.0 X 24.0 X 7.8 MM

VIEWING AREA: 76.0 X 15.0 MM

CHARACTER SIZE: 2.95 X 5.15 MM

CHARACTER PITCH: 3.45 X 5.55 MM

BACKLIGHT: YELLOW/GREEN LED

DISPLAY MODE: Y/G STN, TRANSFLECTIVE

TEMPERATURE RANGE: WIDE

POWER SUPPLY: 5V

CONTENTS

1. Module Classification Information

A M C 1 6 0 2 A R - B - B 6 W T D W - S P
1 2 3 4 5 6 7 8 9 10 11 12 13

1	Brand：Orient Display (N.A.) Ltd.	
2	Display Type：C→ Character Type, G→ Graphic Type, NONE→ Custom-made	
3	Display Font：Characters X Lines / Rows X Columns /Others	
4	Model serials no.	
5	RoHS compliant: R→YES　NONE→ NO	
6	IC Package Type：	M→ SMT Type B→ COB Type T→ TAB Type G→ COG Type F→ COF Type S→ Special
7	LCD Mode：	P→TN Positive N→TN Negative Y→ STN Positive, Yellow Green B→ STN Negative, Blue G→ STN Positive, Gray W→ FSTN Positive T→ FSTN Negative F→ FFSTN Negative S→ Special
8	Viewing direction	6→ 6:00,12→12:00, S→Special
9	Temperature range	N → Normal Temperature W→ Wide Temperature S→ Special
10	LCD Polarizer Type	R→ Reflective T→ Transmissive F→ Transflective S→ Special
11	Backlight Type	N→ None D→ LED E→ EL F→ CCFL S→ Special
12	Backlight Color	Y→ Yellow-green B→ Blue A→ Amber W→ White G→ Green R→ Red S→ Special
13	Internal Code	

2. MECHANICAL CHARACTERISTICS

2.1 Mechanical Data

ITEM	STANDARD VALUE	UNIT
NUMBER OF CHARACTERS	20 CHARACTERS X 2 LINES	
CHARACTER FORMAT	5 X 7 DOTS PLUS CURSOR	
OUTLINE DIMENSIONS	89.0(W)X24.0(H) X 7.8 (T)	mm
EFFECTTVE VIEWING AREA	76.0(W) X 15.0(H)	mm

CHARACTER SIZE	2.95(W) X 5.15(H)	mm
CHARACTER PITCH	3.45(W) X 5.55(H)	mm
DOT SIZE	0.55(W) X 0.60(H)	mm
DOT PITCH	0.60(W) X 0.65(H)	mm
APPROX WEIGHT	40	g

2.2   Mechanical Drawings
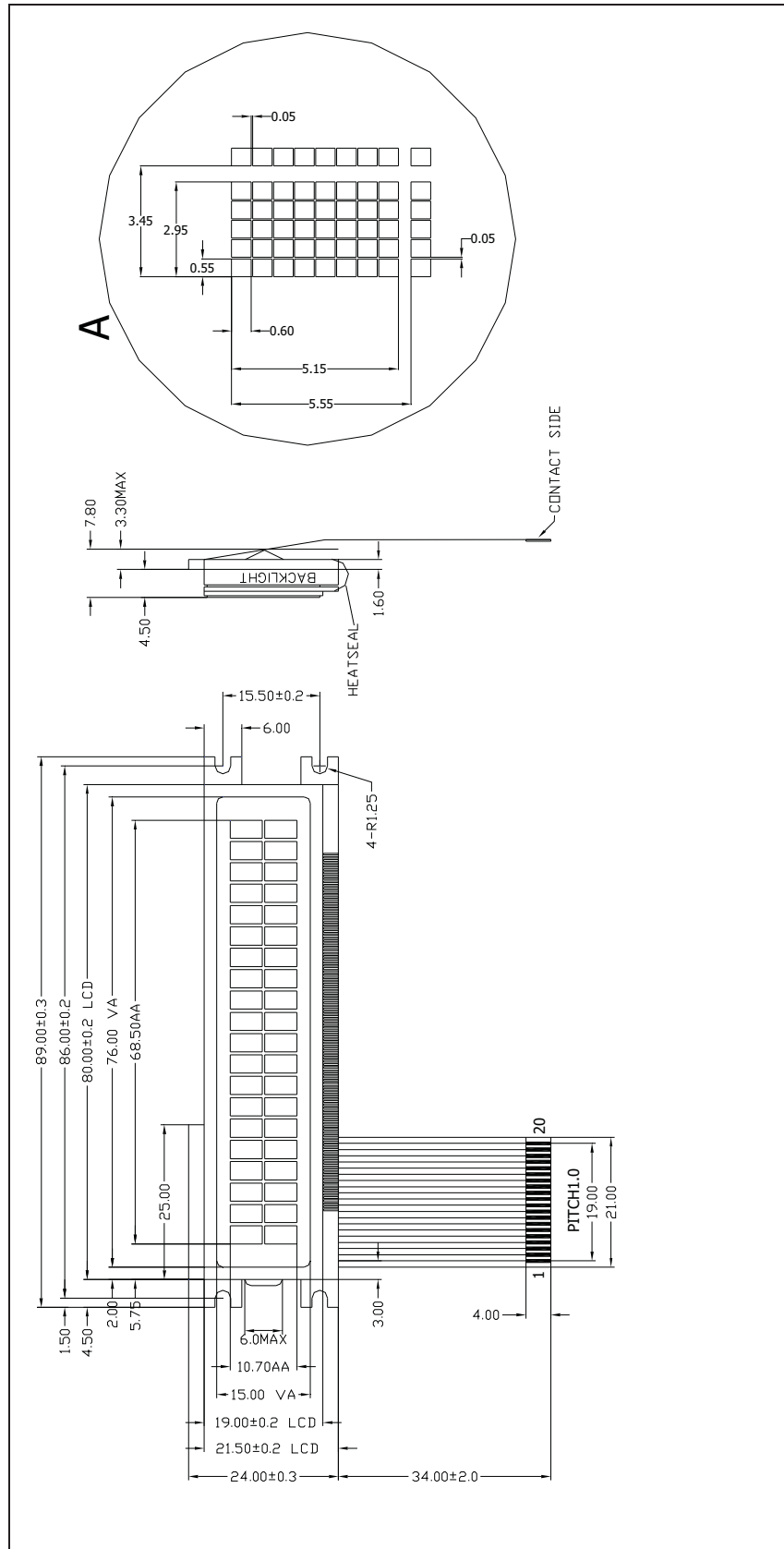
3. CIRCUIT BLOCK DIAGRAM

3.1 Electrical Block Diagram

3.2 Pins Definition

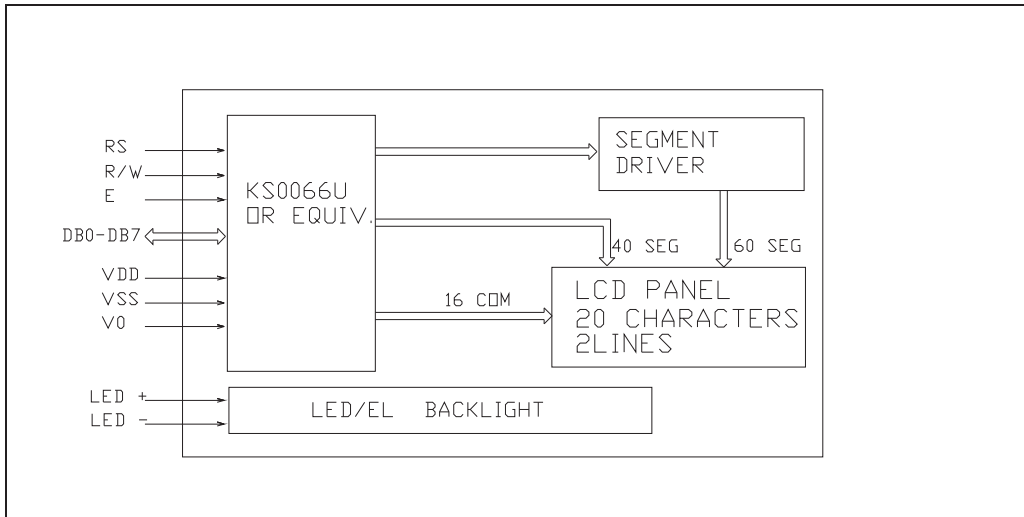| PIN	SYMBOL	FUNCTION
1	NC	No Connect
2	NC	No Connect
3	Vss	Power Supply(GND)
4	Vdd	Power Supply(+5V)
5	Vo	Contrast Adjust
6	RS	Instruction/Data Register Select
7	R/W	Data Bus Line
8	E	Enable Signal
9-16	DB0-DB7	Data Bus Line
17	A	Power Supply for LED B/L(+5V)
18	K	Power Supply for LED B/L(-)
19	Vee	Negative Voltage Output
20	NC	No Connect

3.3 Display Character Address Code

POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
LINE1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
LINE2	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53

*NOTE: ALL OF THE NUMBERS ARE IN HEX FORMAT

4. ABSOLUTE MAXIMUM RATINGS

4.1 Electrical Absolute Maximum Ratings

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT
Supply Voltage (Logic)	Vdd – Vss	-	0	7.0	V
Supply Voltage (LCD Drive)	Vdd – V0	-	0	13.0	V
Input Voltage	Vi	-	-0.3	Vdd +0.3	V

4.2 Environmental Absolute Maximum Ratings

ITEM	SYMBOL	CONDITIONS	MIN	MAX	UNIT
Operating Temp	Topr	-wide temp.	-20	70	deg C
Storage Temp	Ttsg	version-	-30	80	deg C
Humidity Endurance	RH	no condensation 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 = 5.0V + / - 5%

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply Voltage (logic)	Vdd-Vss	-	4.5	5.0	5.5	V
Supply Voltage (LCD)	V0	Vdd = 3.3V	-	1.9	-	V
Input signal Voltage (for E, DB0-7,R/W,RS)	V-ih	"H" level	2.2	-	Vdd	V
	V-il	"L" level	0	-	0.6	V
Supply Current (logic)	Icc	-	-	2	2.2	mA
Supply Current (LCD)	Io	-	0.15	0.22	0.27	mA

5.2 AC Characteristics

TIMING SPECIFICATIONS at Ta = 25 deg C, Vdd = 5.5V+/-10%, Vss =0V

For Write mode

ITEM	SYMBOL	MIN	MAX	UNIT
E cycle time	tc	1000	-	ns
E rise time	tR	-	25	ns
E fall time	tF	-	25	ns
E-pulse width (H, L)	tw	450	-	ns
R/W and RS set-up time	tsul	60	-	ns
R/W and RS hold time	tH1	20	-	ns
Data set-up time	tsu2	195	-	ns
Data hold time	tH2	10	-	ns

For Read mode

ITEM	SYBOL	MIN	MAX	UNIT
E cycle time	tc	1000	-	ns
E rise time	tR	-	25	ns
E fall time	tF	-	25	ns
E-pulse width (H, L)	tw	450	-	ns
R/W and RS set-up time	tsu	60	-	ns
R/W and RS hold time	tH	20	-	ns
Data output delay	tD	-	120	ns
Data hold time	tDH	5	-	ns

WRITE MODE TIMING DIAGRAM
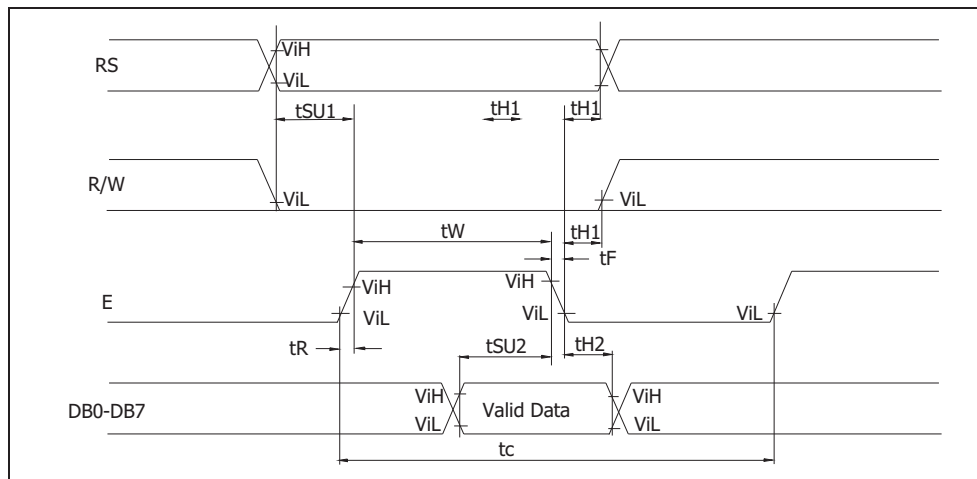
READ MODE TIMING DIAGRAM
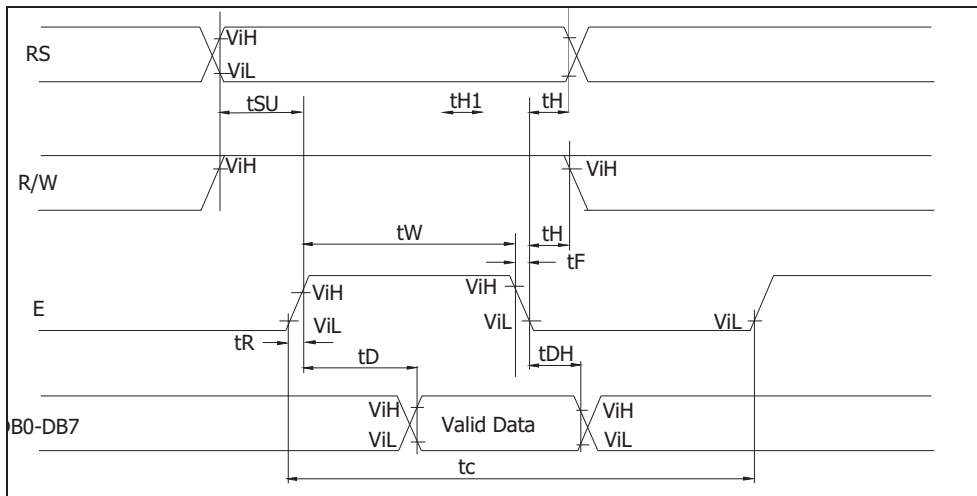
6. BACKLIGHT CHARACTERISTICS

6.1　Absolute Maximum Ratings

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT
Forward Current	Ifm	-	-	60	mA
Reverse Voltage	Vr	-	-	8	V
Power Dissipation	Pd	-	-	200	mW

6.2　Operating Parameters

ITEM	SYMBOL	CONDITION	MIN	TYP.	MAX	UNIT
Forward Voltage	Vf*	If=40mA-	-	3.0	5.0	V
Peak Wavelength	λ	If=40mA-	-	568	-	nm

*Vf is the voltage applied to Pin15 and Pin16. There is a current limiting resistor of 24 Ohm on the PCB.

7. ELECTRO-OPTICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REF.
Contrast	CR	25℃	--	12	--		Note1
Rise Time	tr	25℃	--	160	240	ms	Note2
Fall Time	tf	25℃	--	100	150	ms	note 2
Viewing Angle	θ1-θ2	25℃	--	--	60	DEG	Note 3
	Ø1, Ø2		-40	--	40		
Frame Frequency	Ff	25℃	--	70	--	Hz	note 2

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

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

(a) Temperature------------25C
(b) Frame Frequency------64Hz
(c) Viewing angle---------- θ =0, Ø=0

Note (2): Definition of response time:

+Vop

1/f F

0

-Vop

1-brightness

90%

10%

tr

tf
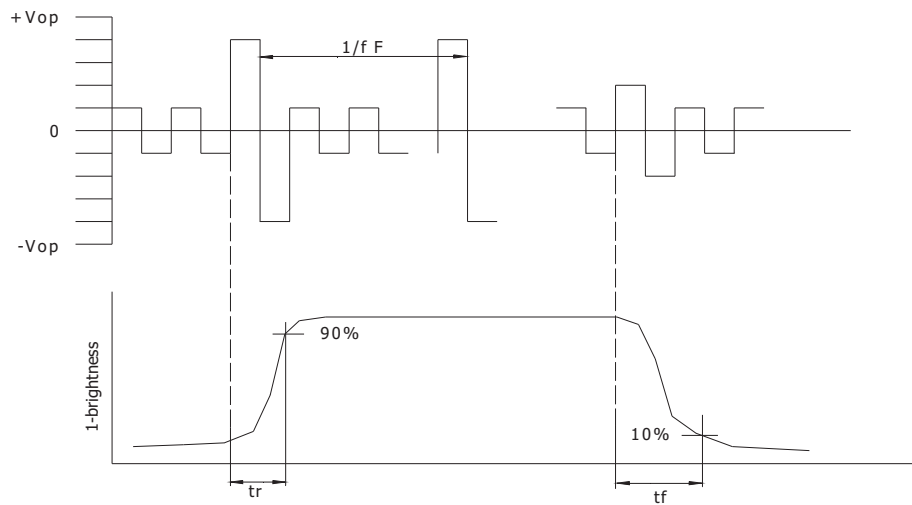
Condition:

(a) Temperature------------25C
(b) Frame Frequency------64Hz
(c) Viewing angle---------- θ =0, Ø=0
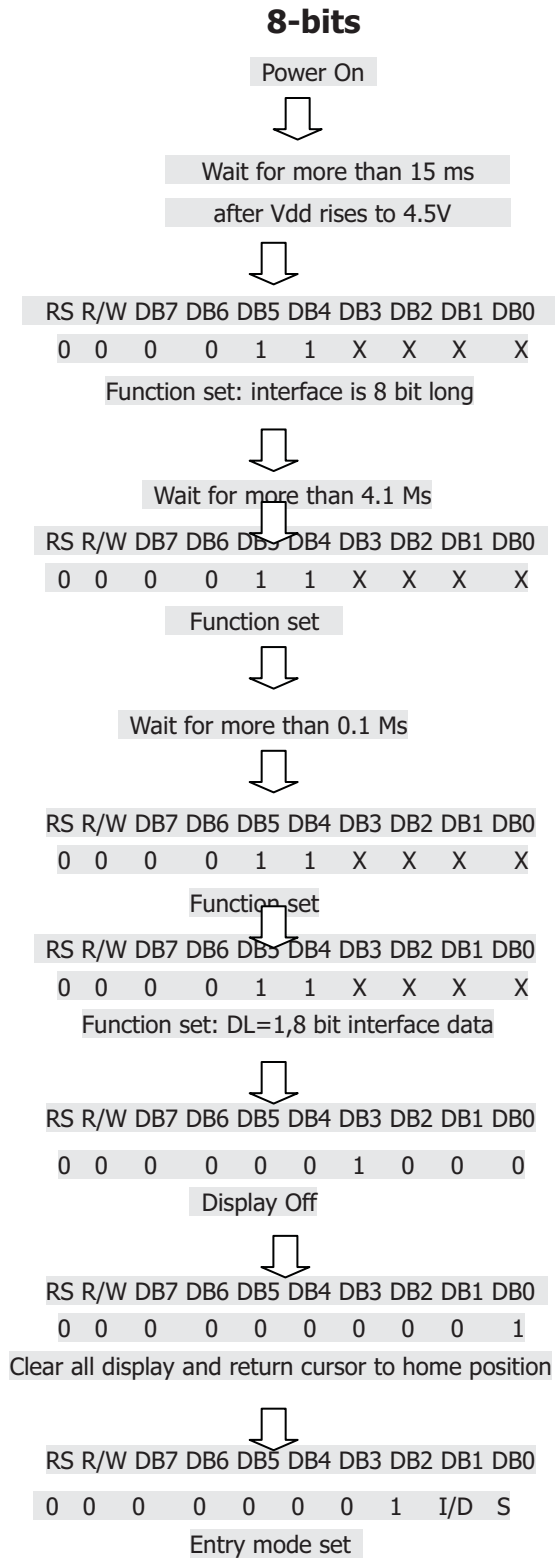
Note (3): Definition of view angle:

TOP-BOTTOM DIRECTION

TOP

θ1

θ2

BOTTOM

RIGHT-LEFT DIRECTION

Ø1 Ø2

LEFT

RIGHT
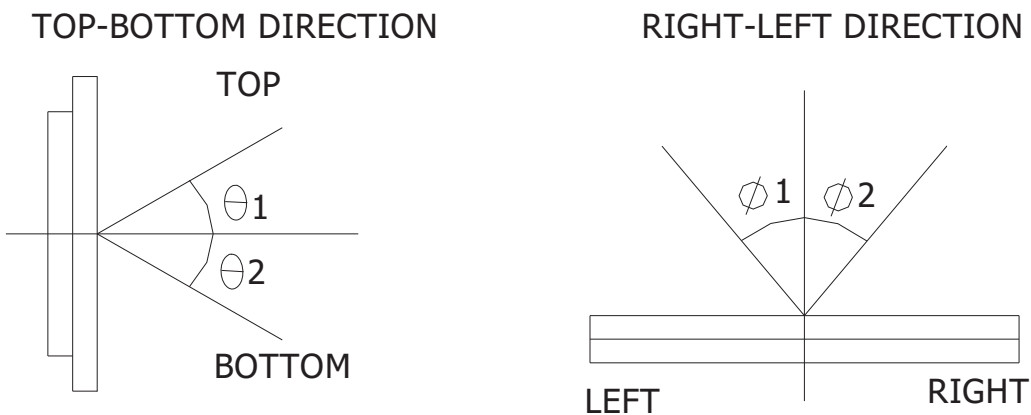
8. DISPLAY CONTROL INSTRUCTION

8.1 Instruction Table

Function	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description	Execu Time* (Max)
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears entire display and returns the cursor to home position (address 0)	1.64mS
Return Home	0	0	0	0	0	0	0	0	1	X	Return the cursor to the home position. DD RAM contents remain unchanged. Set DD RAM address to zero.	1.64mS
Entry mode set	0	0	0	0	0	0	0	1	1/D	S	Set cursor moving direction and enable the shift of the display. These operations are performed during data write/read of DD RAM/CG RAM. 1/D=1: increment; 1/D=0: decrement; S=1: whole display shift when data is written.	40 μS
Display ON/OFF control	0	0	0	0	0	0	1	D	C	B	Set display (D),cursor(C) and blinking of cursor(B) ON/OFF. D=1:display ON; D=0: display OFF. C=1:Cursor ON; C=0:cursot OFF. B=1:Blink ON; B=0, Blink OFF.	40 μS
Cursor or Display shift	0	0	0	0	0	1	S/C	R/L	X	X	Move the cursor and shift the display without changing DDRAM contents. S/C=1: Display Shift; S/C=0:Cursor move. R/L=1:shift to right; R/L=0:shift to left.	40 μS
Function Set	0	0	0	0	1	DL	N	F	X	X	Set interface data length (DL), number of display lines (N) and character font (F).DL=1: 8 bits; DL=0: 4 bits. N=1: 2 lines; N=0: 1 lines. F=1: 5X11 dots; F=0: 5X7 dots.	40 μS
Set CG RAM add	0	0	0	1	ACG						Set CG RAM address. CG RAM data is sent and received after this setting.	40 μS
Set DD RAM Add	0	0	1	ADD							Set DD RAM address. DD RAM data is sent and received after this setting.	40 μS
Read BF & Addr	0	1	BF	AC							Read BUSY FLAG (BF) and the contents of the address counter. BF=1: internal operation; BF=0: can accept instruction.	0 μS
Write Data to RAM	1	0	WRITE DATA								Write data into DD RAM or CG RAM.	40 μS**
Read Data from RAM	1	0	READ DATA								Read data from DD RAM or CG RAM.	40 μS**

8.2 Character Table -- For (–B0)

Upper 4 bit / Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL				0	@	P	`	p				―	タ	ミ	α	p
LLLH			!	1	A	Q	a	q			。	ア	チ	ム	ä	q
LLHL			"	2	B	R	b	r			「	イ	ツ	メ	β	θ
LLHH			#	3	C	S	c	s			」	ウ	テ	モ	ε	∞
LHLL			$	4	D	T	d	t			、	エ	ト	ヤ	μ	Ω
LHLH			%	5	E	U	e	u			・	オ	ナ	ユ	σ	Ü
LHHL			&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	Σ
LHHH			'	7	G	W	g	w			ア	キ	ヌ	ラ	g	π
HLLL			(	8	H	X	h	x			イ	ク	ネ	リ	√	x
HLLH			)	9	I	Y	i	y			ゥ	ケ	ノ	ル	⁻¹	y
HLHL			*	:	J	Z	j	z			エ	コ	ハ	レ	j	千
HLHH			+	;	K	[	k	{			オ	サ	ヒ	ロ	×	万
HHLL			,	<	L	¥	l	|			ャ	シ	フ	ワ	¢	円
HHLH			-	=	M	]	m	}			ュ	ス	ヘ	ン	Ł	÷
HHHL			.	>	N	^	n	→			ョ	セ	ホ	゛	ñ	
HHHH			/	?	O	_	o	←			ッ	ソ	マ	゜	ö	■

8.3 Initialization by Instruction

8-bits

Power On

⇓

Wait for more than 15 ms
after Vdd rises to 4.5V

⇓

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	X	X	X	X

Function set: interface is 8 bit long

⇓

Wait for more than 4.1 Ms

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	X	X	X	X

Function set

⇓

Wait for more than 0.1 Ms

⇓

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	X	X	X	X

Function set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	X	X	X	X

Function set: DL=1,8 bit interface data

⇓

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	1	0	0	0

Display Off

⇓

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	0	1

Clear all display and return cursor to home position

⇓

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	1	I/D	S

Entry mode set

4—bits

Power On

⇓

Wait for more than 15 mS
after Vdd rises to 4.5V

⇓

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	1

Function set: DL=1,8 bit interface data.

⇓

Wait for more than 4.1 Ms

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	1

DL=1,8 bit interface data

⇓

Wait for more than 0.1 Ms

⇓

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	0

DL=0,4 bit interface data

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	1	0
0	0	N	F	X	X

Function set: DL=0,4 bit interface data

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	0	0
0	0	1	0	0	0

Display Off

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	0	0
0	0	0	0	0	1

Function set: DL=0,4 bit interface data

RS	R/W	DB7	DB6	DB5	DB4
0	0	0	0	0	0
0	0	0	1	I/D	S

Entry mode set

END OF INITIALIZATION   END OF INITIALIZATION

9. INSPECTION STANDARDS

9.1 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.
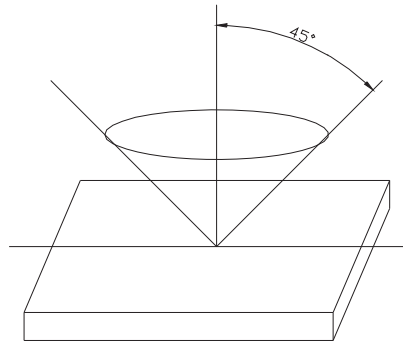
9.2 Definition of Applicable Zone
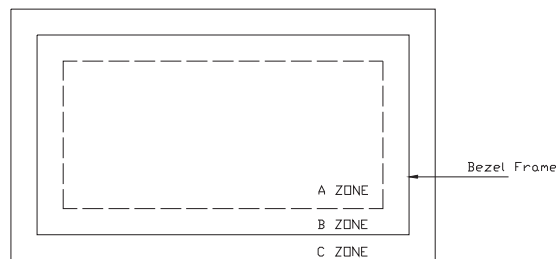
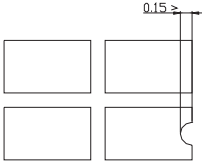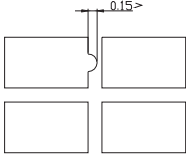A Zone: Active Display Area
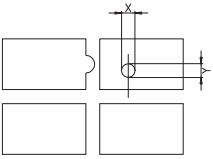B Zone: Area from Bezel Frame to A Zone
C Zone: Rest Area of Bezel
A Zone + B Zone = Effective Viewing Area

9.3 Standards

NO	PARAMETER	CRITERIA			
1	Black and White Spots, Foreign Substances	Round Shape			
		Zone / DIMENSION(MM)	Acceptable Number		
			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		
	Zone	A	B	C
-	0.02≥W	*	*	*
2.0≥L	0.03≥W	3	3	*
1.0≥L	0.04≥W	1	2	*
1.0≥L	0.05≥W	0	2	*
-	0.05<W	Not acceptable		

X: Length   Y: Width   * Disregard

Total defects shall not exceed 5.

2	Air Bubbles (Between glass and polarizer)	Dimension(mm)	Zone	Acceptable Number		
				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	*

*:   Disregard
Total defects shall not exceed 3.

3	The Shape of Dot	(1) Dot Shape(with dent)

(1) Dot Shape(with dent)

As per the sketch of left hand.

(2) Dot Shape(with Projection)

Should not connect to next dot.

(3) Pin Hole

		  (X+Y)/2<0.2mm (less than 0.1mm is not counted Total defects shall not exceed 5.
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.

10. PRECAUTIONS IN USING LCM

1. LIQUID CRYSTAL DISPLAY (LCD)

LCD is made up of glass, organic sealant, organic fluid, and a polymer based polarizer. 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 polarizer's 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 elastomeric connector; especially insert a backlight panel (for example, EL).

(4) When mounting an LCM it is important that the PCB is not under any stress such as bending or twisting. Elastomeric 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 elastomeric 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 commutation sparks.

(5) The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.

(6) Since dry air is inductive to static, 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℃±10℃

(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 V0.

(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 times.