EVER—CATCHER GROUP
WE CATCH THE BEST TECH. FOREVER

EVERBOUQUET INTERNATIONAL CO., LTD.
Address: 13F-3, No. 8, Lane 280, Sec. 6, Minchuan E. Rd., Nei-Hu 114, Taipei, Taiwan, R.O.C.
TEL: 886-2-2633-1253 FAX: 886-2-2631-2881

PART NO. : **MS-10-79810**

FOR MESSRS. :

CONTENTS

ACCEPTED BY : _____ PROPOSED BY : _____

RECORD OF REVISION

DATE	*PAGE*	*SUMMARY*

2. Precautions for LCM

2-1 Precautions in handling LCD Modules (hereinafter LCM's)

EVERBOUQUET INTERNTIONAL's LCM's have been assembled and accurately calibrated before delivery.
Please observe the following criteria when handling.

A. Do not subject the module to excessive shock.
B. Do not modify the tab on the metal holder.
C. Do not tamper with the printed circuit board.
D. Limit soldering of the printed circuit board to I/O terminals only.
E. Do not touch the zebra strip nor modify its location.

2-2 Static electricity warning:

EVERBOUQUET's LCM uses CMOS LSI technology. Therefore, strict measures to avoid static electricity discharge are followed through all processes from manufacturing through shipping. When handling a LCM, take sufficient care to prevent static electricity discharge as you would any CMOS IC.

A. Do not take the LCM from its anti-static bag until it's to be assembled. LCM's are individually packaged in bags specially treated to resist static electricity. When storing, keep the LCM packed in the original bags, or store them in a container processed to be resistant to static electricity, or in an electric conductive container.

B. Always use a ground strap when handling a LCM.
Always use a ground strap while working with the module, from the time it is taken out of the anti-static bag until it is assembled. When it is necessary to transfer the LCM, once it has been taken out of the bag, always place it in an electric conductive container. Avoid wearing clothes made of chemical fibers, the use of cotton or conductive treated fiber clothing is recommended.

C. Use a no-leak iron for soldering the LCM.
The soldering iron to be used for soldering the I/O terminals to the LCM are to be insulated or grounded at the iron tip.

D. Always ground electrical apparatuses required for assembly.
Electrical apparatuses required to assemble the LCM into a product, i.e. electrical screw drivers, are to be first grounded to avoid transmitting spike noises from the motor.

E. Assure that the work bench is properly grounded.

F. Peel off the LCM protective films slowly.
The module is attached with a film to protect the display surface from contamination, damage, adhesion of flux, etc. Peeling off this film abruptly could case static electricity to be generated, so peel the tape slowly.

G. Pay attention to the humidity in the work area.
50~60% RH is recommended.

2-3 Precautions for the soldering of an LCM

The following procedures should be followed when soldering the LCM:

A. Solder only to the I/O terminal.

B. Use a no leakage soldering iron and pay particular attention to the following:

(1) Conditions for soldering I/O terminals

Temperature at iron tip: 280°C + 10°C

Soldering time: 3-4 sec/terminal

Type of solder : Eutectic solder (rosin flux filled)

Note: Avoid using flux, because it could penetrate the module and the module may get contaminated during cleaning. Peel off protective film after soldering of the I/O terminals is finished. By following this procedure, the surface contamination, caused by the dispersion of flux while soldering, can be avoided.

(2) Removing the wiring

When a lead wire or a connector to the I/O terminal of the module is to be removed, remove it only after the solder at the connection has sufficiently melted since the I/O terminal is a through hole. If it is forcefully removed, it could cause the terminal to break or peel. The recommended procedure is to use a suction-type solder remover. Caution, do not reheat the I/O terminal more than 3 times.

2-4. Long-term storage

If the correct method of storage is not followed, deterioration of the display material polarizer and oxidation of the I/O terminal plating may make the soldering process difficult. Please comply with the following procedure.

A. Store in the shipping container.

B. If the shipping container is not available, place in anti-static bags and seal the opening

C. Store the modules where they are not subjected to direct sunlight or a fluorescent lamp.

D. Sore in a temperature range of 0°C~35°C with low relative humidity.

2-5. Precautions in use of LCD modules

A. Do not give any external shock.

B. Do not wipe the surface with hard materials.

C. Do not apply excessive force on the surface.

D. Do not expose to direct sunlight or fluorescent light for a long time.

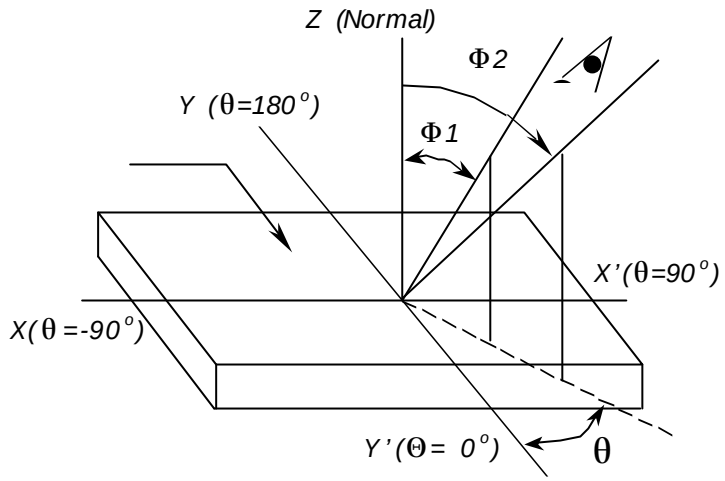
E. Avoid storage in high temperature and high humidity.

F. When storage for a long time at 40°C or higher is required, R/H shall be less than 60%.

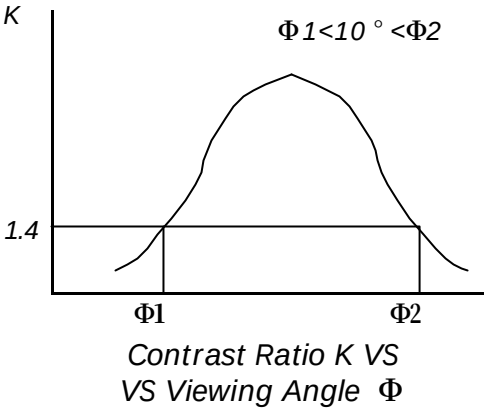
G. Liquid in LCD is hazardous substance. Must not lick, swallow when the liquid is attached to your hands, skin, clothes etc. Wash it out thoroughly.

3. Optical definitions

3.1 Definition of angle Θ and Φ



3.2 Definition of viewing angle Φ1 and Φ2

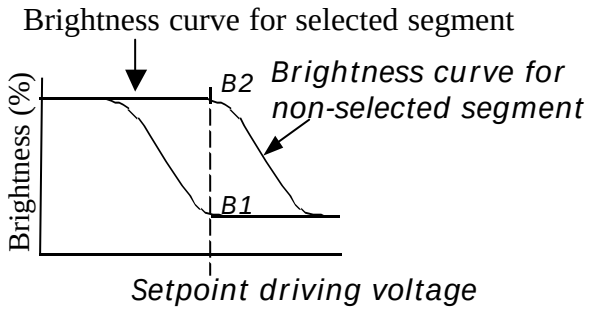


Contrast Ratio K VS
VS Viewing Angle Φ

POSITIVE TYPE

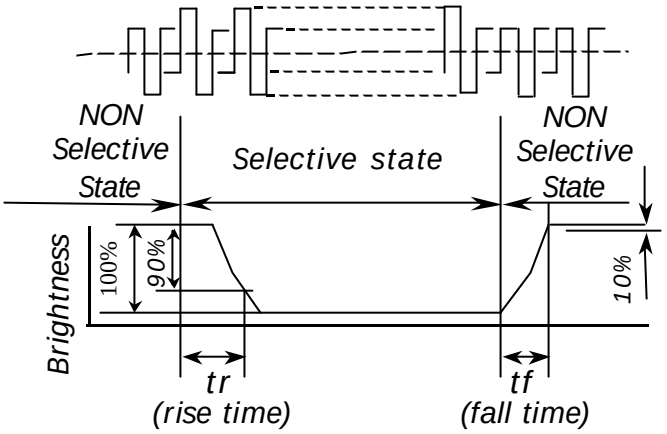
3.3 Definition of contrast "K"

$$K=\frac{\text{Brightness of non-selected segment (B2)}}{\text{Brightness of selected segment (B1)}}$$



POSITIVE TYPE

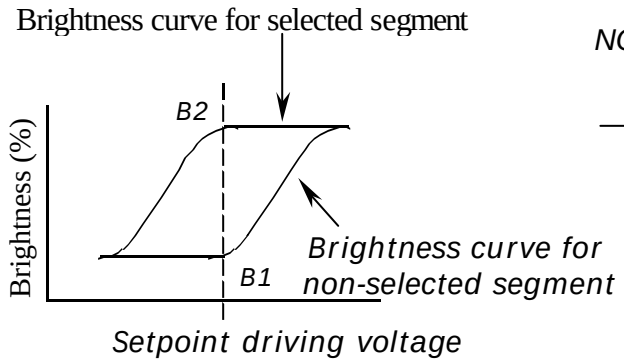
3.4 Definition of optical response



NEGATIVE TYPE

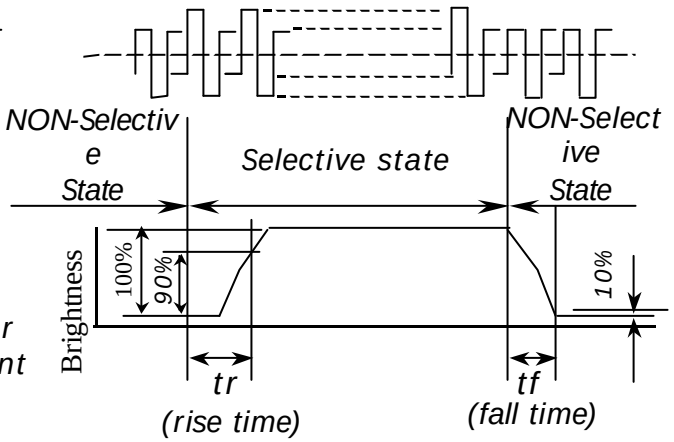
3.5 Definition of contrast "K"

$$K=\frac{\text{Brightness of selected segment (B1)}}{\text{Brightness of non-selected segment (B2)}}$$



NEGATIVE TYPE

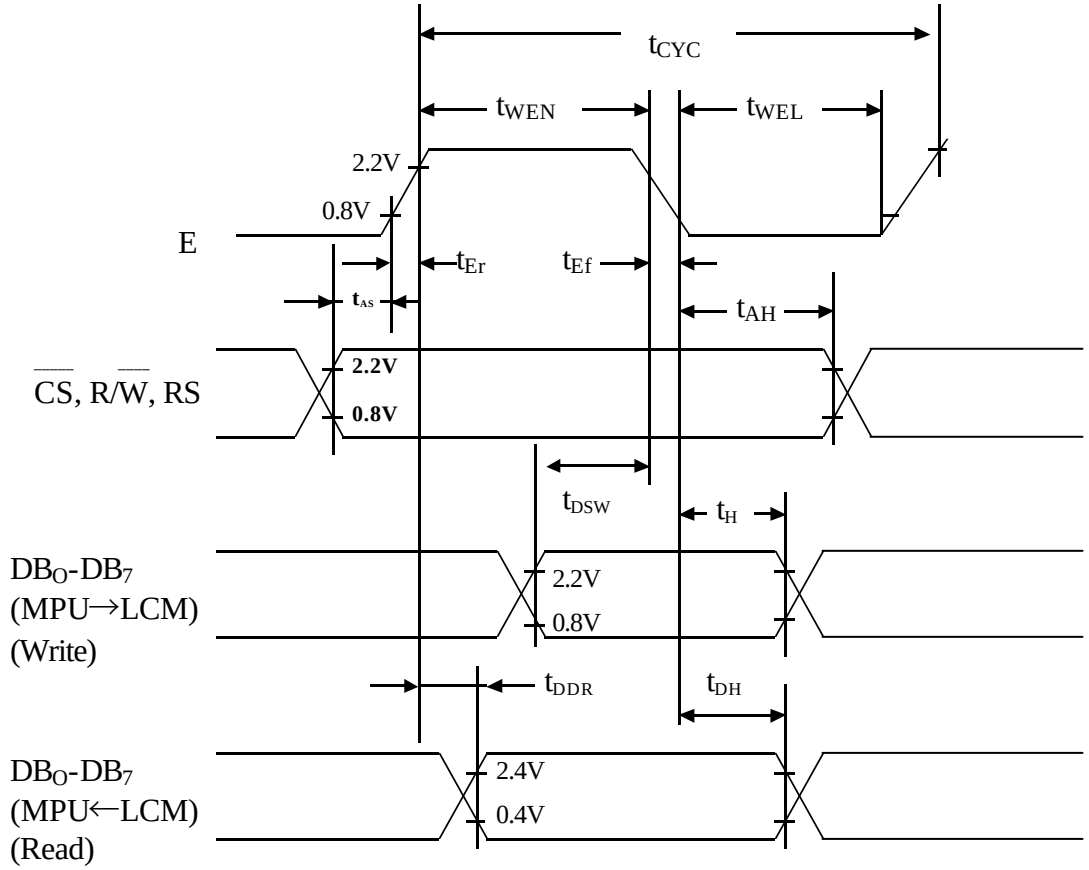
3.6 Definition of optical response



4. Timing Characteristics

MPU Interface

Item		Symbol	Min	Typ.	Max	Unit
Enable cycle time		t_{CYC}	1.0	——	——	μs
Enable pulse width	High level	t_{WEH}	0.45	——	——	μs
	Low level	t_{WEL}	0.45	——	——	μs
Enable rise time		t_{Er}	——	——	25	ns
Enable fall time		t_{Ef}	——	——	25	ns
Setup time		t_{AS}	140	——	——	ns
Data setup time		t_{DSW}	225	——	——	ns
Data delay time		t_{DDR}		——	*225*	ns
Data hold time		t_H	10	——	——	ns
Address hold time		t_{AH}	10	——	——	ns
Data hold time		t_{DH}	20	——	——	ns



5. Function of Each Block

Display Control instructions

Display is controlled by writing data into the instruction register and 13 data registers. The RS signal distinguishes the instruction register from the data registers.8-bit data is written into the instruction register with RS=1, and the data register code is specified. After that, the 8-bit data is written in the data register and the specified instruction is executed with RS=0. During the execution of the instruction, no new instruction can be accepted. Since the busy flag and make sure it is 0 before writing the next instruction.

5-1 Mode control

Code $"00"(hexadecimal) written into the instruction register specifies the mode control register.

Register	$R/\overline{W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	0	0	0	0
Mode control reg.	0	0	0	0	Mode data					

DB5	DB4	DB3	DB2	DB1	DB0	Cursor/blink	CG	Graphic/character display
I/O	I/O	0	0	0	0	Cursor off	Internal CG	Character display (character mode)
		0	1		0	Cursor on		
		1	0			Cursor off, Character blink		
		1	1			Cursor blink		
		0	0		1	Cursor off	External CG	
		0	1			Cursor on		
		1	0			Cursor off, Character blink		
		1	1			Cursor blink		
		0	0	1	0			Graphic mode
Display on/off	Master/slave	blink	cursor	Graphic/character mode	Ext./Int.CG			

1: Master mode
0: Slave mode

1: Master mode
0: Slave mode

5-2 Set character pitch

Vp indicates the number of vertical dots per character. the space between the vertically-displayed characters is included in the determination. This value is meaningful only during character display(in the character node) and becomes invalid n the graphic mode HP indicates including the space between horizontally-displayed characters. In the graphic mode, the Hp indicates the number of bits of 1-byte display data to be display.

There are three Hp values(table 1)

Register	$\overline{R/W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	0	0	0	1
Character pitch reg.	0	0	(Vp-1)binary				0	(HP-1)binary		

Table 1 Hp Values

Hp	DB2	DB1	DB0	Horizontal character pitch
6	1	0	1	6
7	1	1	0	7
8	1	1	1	8

5-3 Set number of characters

Hn indicates the number of horizontal characters in the character mode or the number horizontal bytes in the graphic mode. If the total sum of horizontal dots on the screen is taken as n,

$n=Hp \times Hn$

Hn can be set to an even number from 2 to 128(decimal)

Register	$\overline{R/W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	0	0	1	0
Number-of-characters reg.	0	0	0	(Hn-1) binary						

5-4 Set number of time divisions (inverse of display duty ratio)

Nx indicates the number of time divisions in multiple multiples display.1/Nx is the display duty ration.

A value of 1 to 128(decimal) can be set to Nx.

Register	$\overline{R/W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	0	0	1	1
Number-of-time-divisions reg.	0	0	0	(Nx-1) binary						

5-5 Set cursor position

Cp indicates the position in a character where the cursor is display in the character mode. for example, in 5×7 dot font, the cursor is displayed under a character by specifying Cp=8(decimal)can be set to Cp. If a smaller value than the vertical character pitch Vp is set (Cp≦Vp), and a character overlaps with the cursor, the cursor has higher priority of display (at cursor display on).

If Cp is greater than Vp, no cursor is displayed. The cursor horizontal length is equal to Hp.

Register	$R/\overline{W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	0	1	0	0
Cursor position reg.	0	0	0	0	0	0	(Cp-1) binary			

5-6 Set display start low order address

Cause display start addresses to be written in the display start address registers. The display start address indicates a RAM address at which the data displayed at the top left end on the screen is stored. In the graphic mode, the start address ins composed of high/low order 16 bits. In the character display, it is composed of the lower 4 bits of high order address (DB3-DB0) and 8 bit of low order address. The upper 4 bits of high order address are ignored.

Register	$R/\overline{W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	1	0	0	0
Display start address reg.(low order byte)	0	0	(Start low order address) binary							

Set display start high order address

Register	$R/\overline{W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	1	0	0	1
Display start addre reg.(high order byte)	0	0	(start high order address) binary							

5-7 Set cursor address (low order) (RAM write low order address)

Cause cursor addresses to be written in the cursor address counters. The cursor address indicates and address for sending or receiving display data and character codes to or from the RAM.

That is ,data at the address specified by the cursor address are read/written. In the character mode, the cursor is displayed at the character specified by the cursor address.

A cursor address consists of the low-order address (8-bit) and the high- order address (8-bits). Satisfy the following requirements setting the cursor address (table 2).

The cursor address counter is a 16-bit up-counter with set and reset functions. When bit N changes from 1 to 0,bit N+1 is incremented by 1. When setting the low order address, the LSB (bit 1) of the high order address is incremented by 1 if the MSB (bit 8) of the low order address changes from 1 to 0. There fore, set both the low order address and the high order address as shown in the table 2.

Register	$\overline{R/W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	1	0	1	0
Cursor address counter (low order byte)	0	0	(cursor low order address) binary							

Set cursor address (high order) (RAM write high order address)

Register	$\overline{R/W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	1	0	1	1
Cursor address counter (high order byte)	0	0	(cursor high order address) binary							

Table 2 Cursor Address setting

Condition	Requirement
When you want to rewrite (set) both the low order address and the high order address.	Set the low order address and then set the high order address.
When you want to rewrite only the low order address	Don' t fail set the high order address again after setting the low order address.
When you want to rewrite only the high order address	Set the high order address .you don' t have to set the low order address again.

5-8 Write display data

After the code $OC" is written into the instruction register with PS=1, 8-bit data with RS=0 should be written into the data register. This data is transferred to the RAM specified by the cursor address as display data or character code. The cursor address is increased by 1 after this operation.

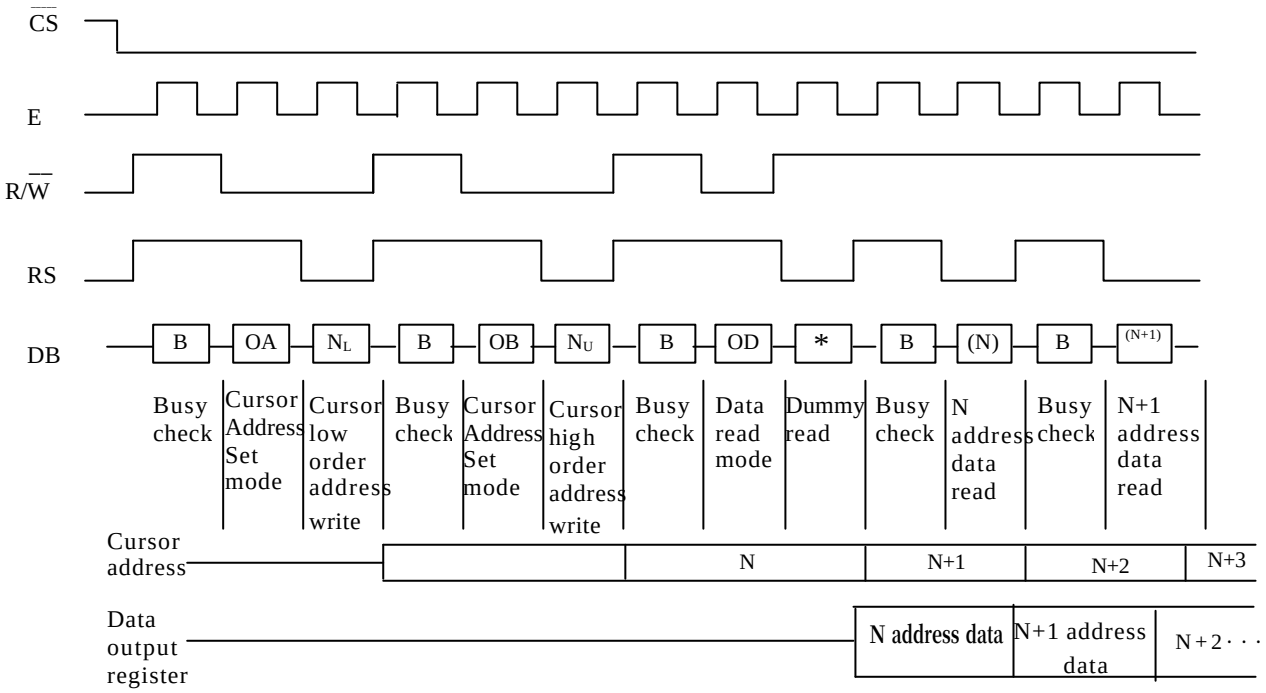
Register	$\overline{R/W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	1	1	0	0
RAM	0	0	MSB(pattern data, character code) LSB							

5-9 Read display data

Data can be read from the RAM with RS=0 after writing code $"OC" into the instruction register. Figure 1 shows the read procedure.

This instruction outputs the contents of data output register on the data bus (DB0 to DB7) and then transfers RAM data specified by the cursor address to the data output register, also increasing the cursor address by 1. After setting the cursor address, correct data is not output at the first read bur at the second one. Thus, make one dummy read when reading data after setting the cursor address.

Register	R/$\overline{W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	1	1	0	1
RAM	0	0	MSB(pattern data, character code) LSB							



5-10 Clear bit

The clear/set bit instruction sets 1 bit in a byte of display data RAM to 0 or 1, respectively. The position of the bit in a byte is specified by N_B and RAM address is specified by cursor address. After the execution of the instruction , the cursor address is auto-magically increased by 1. N_B is a value from 1 to 8. N_B =1 and N_B =8 indicates LSB and MSB, respectively.

Register	$\overline{R/W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	1	1	1	0
Big clear reg.	0	0	0	0	0	0	0	(N_B-1) binary		

Set bit

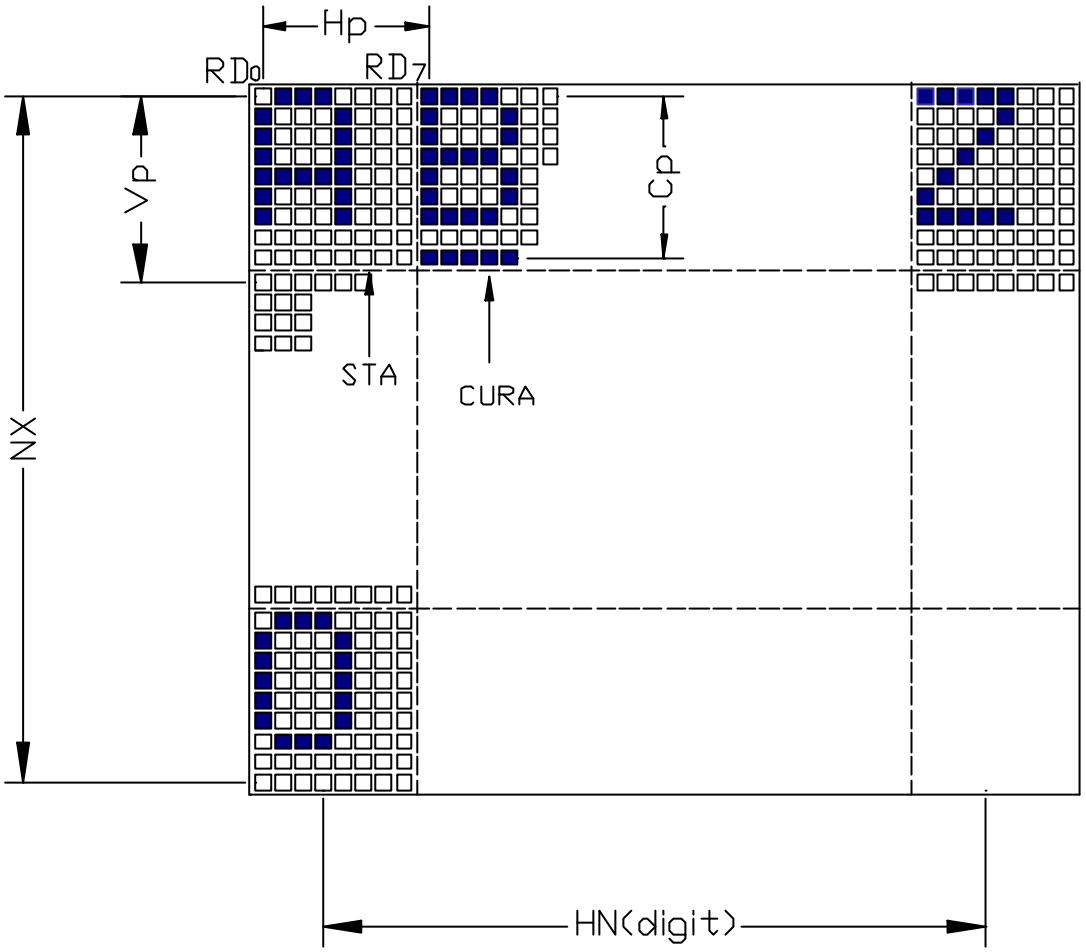
Register	$\overline{R/W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction reg.	0	1	0	0	0	0	1	1	1	1
Big set reg.	0	0	0	0	0	0	0	(N_B-1) binary		

5-11 Read busy flag

When the read modes set with RS=1, the busy flag is output to DB7. The busy flag is set to 1 during the execution of any of the other instructions. After the execution, it is set to 0. The next instruction can be accepted. No instruction can be accepted when busy flag=1. Before executing an instruction or writing data, perform a busy flag check to make sure the busy flag is 0. When data is written in the register (RS=1),no busy flag changes. Thus, no busy flag check is required just after the write operation into the instruction register with RS=1.

The busy flag can be read without specifying any instruction register.

Register	$\overline{R/W}$	RS	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Busy flag	1	1	I/O							



Symbol	*Name*	*Meanin*	*Value*
H_P	Horizontal character pitch	Horizontal character pitch	6 to 8 dots
H_N	Number of horizontal characters	Number of horizontal characters per line (number of digits)in the character mode or number of bytes per ling in the graphic mode.	2 to 128 digits (an even num-ber)
V_P	Vertical character pitch	Vertical character pitch	1 to 16 dots
C_P	Cursor position	Line number on which the cursor can be displayed	1 to 16 lines
N	Number of time divisions	Inverse of display duty ratio	1 to 128 lines

Note: If the number of vertical dots on the screen is m. and the number of horizontal dots is n.

1/m=1/Nx=display duty ratio
n=Hp ×HN, m/Vp =Number of display lines
Cp≦Vp

Figure 2 Display variables

Display Mode

Display mode	*Display data from MPU*	*RAM*	*Liquid Crystal Display Panel*
Character display	*Character code (8-bits)*	*Start address*	Hp:6,7,or 8 dots
Graphic	*Character pattern (8-bits)*	*Start address*	Hp: 8 dots

Internal character generator patterns and character codes

6.Quality and reliability

6-1 Test condition

test should be conducted under the following conditions:

Ambient temperature: 25±5°C

Humidity :60±20%RH

6-2 Sampling plan

Sampling method shall be in accordance with MIL-STD-105D, inspection level II, normal inspection, and single sampling plan tables for normal tightened, and reduced inspection.

6-3 Acceptable quality level

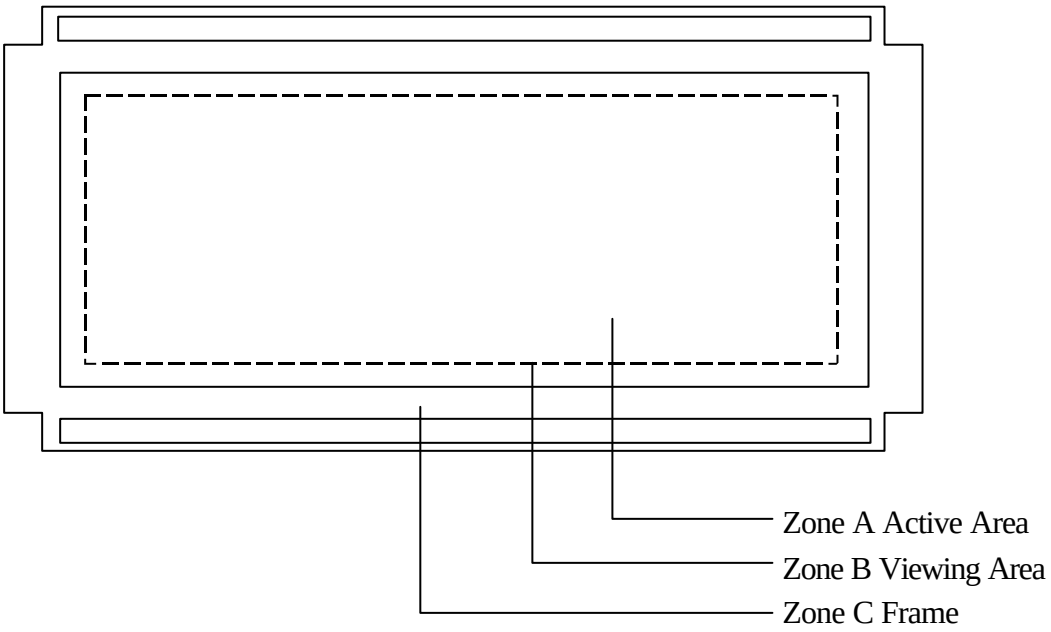
A major defect is a defect that could result in failure or materially reduce that the usability of the unit of product for its intended purpose.

A minor defect is one that does not materially reduce the usability of the unit of product for its intended purpose or is a departure from established standards having no significant bearing on the effective use or operation of the unit.

6-4 Appearance

appearance test is to be conducted by human eyes at approximately 30 cm distance from LCD module under the single fluorescent light.

The inspection area of LCD panel shall be within the range of following limits.



6-5 Inspection quality criteria

ITME	*DESCRIPTION OF DEFECTS*			*Class of defects*	*Acceptable level (%)*
FUNCTION	Short circuit or Pattern cut			Major	0.65
DIMENSION	Refer to individual acceptance specification			Major	2.5
BLACK SPOTS	Ave. dia. D	area A	area B	Minor	2.5
	D ≦ 0.2	disregard			
	0.2 < D ≦ 0.3	3	4		
	0.3 < D ≦ 0.4	2	3		
	0.4 < D	0	1		
BLACK LINES	Width W, Length L	A	B	Minor	2.5
	W ≦ 0.03	Disregard			
	0.03 < W ≦ 0.05	3	4		
	0.05 < W ≦ 0.07, L ≦ 3.0	1	1		
	See line criteria				
BUBBLES IN POLARIZER	Average diameter D 0.2 < D < 0.5 mm for N = 4 , D > 0.5 for N =1			Minor	2.5
COLOR UNIFORMITY	Rainbow color or Newton ring.			Minor	2.5
GLASS SCRATCHES	Obvious visible damage.			Minor	2.5
VIEWING ANGLE	See note 2			Minor	2.5
CONTRAST RATIO	See note 3			Minor	2.5
RESPONSE TIME	See note 1			Minor	2.5

6-6 Reliability

The LCD module should have no failure in the following reliability test.

TEST ITEM	*TEST CONDITIONS*	*NOTE*
HIGH TEMPERATURE OPERATION	60°C , 200 hr.	NOTE
LOW TEMPERATURE STORAGE	-10°C , 200 hr.	NOTE
HUMIDITY STORAGE	60°C , 90%RH , 96hr.	NOTE
HIGH TEMPERATURE OPERATION	40°C, typical operating conditions, 200hr.	NOTE
TEMPERATURE CYCLING	-10°C~70°C 10min. between each step temp. 50min. at each step temp. 5 cycles.	NOTE
MECHANICAL VIBRATION	10~55Hz sweep, 3G. amp1 =10mm(max) XYZ for 10min. each.	NOTE

NOTE1: The module should not have condensation of water on the module.

NOTE2: The module shelled be inspected after 1 hour storage in normal conditions (15~35°C, 45~65%RH).

DEFINITIONS OF LIFE END POINT:

(1) Current drain should be smaller than the specified value.

(2) Function of the module should be maintained.

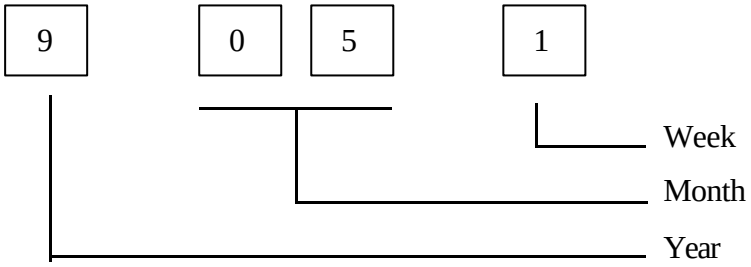
(3) Appearance and display quality should not have distinguished degradation.

(4) Contrast ratio should be larger than 50% of initial value.

8. Designation of lot mark

8-1 Lot mark

Lot mark is consisted of 4 digit number.



YEAR	FIGURE IN LOT MARK
1999	9
2000	0
2001	1
2002	2
2003	3
2004	4

MONTH	FIGURE IN LOT MARK	MONTH	FIGURE IN LOT MARK
Jan.	01	July	07
Feb.	02	Aug.	08
Mar.	03	Sept.	09
Apr.	04	Oct.	10
May.	05	Nov.	11
Jun.	06	Dec.	12

WEEK (DAY INCALENDAR)	FIGURE IN LOT MARK
1~7	1
8~14	2
15~21	3
22~28	4
29~31	5