LCM12864E

图形点阵液晶显示模块原理与应用

LCM MODE: GRAPHIC

PRODUCTION CODE: LCM12864E

REVISION: A

DATE: 2003/5/16

目　录

1. MECHANICAL DATA

Item	Contents	Unit
LCD Mounting mode	LCD Panel , Frame, Zebra and PCB	
LCD Display mode	Reflective, Transflective and positive	
LCD Display type	STN: Yellow Green mode, Gray mode, Blue mode	
	FSTN	
Viewing direction	6 O'clock or 12 O'clock	
LCD Module size (LED*)	93.0(W)×70.0(H)×14.0(D,MAX)	mm
LCD Module size (EL or None*)	93.0(W)×70.0(H)×11.0(D,MAX)	mm
LCD Viewing area	70.70(W)×38.80(H)	mm
LCD Frame size (LED*)	90.0(W)×53.7(H)×14.0(D,MAX)	mm
LCD Frame size (EL or None*)	90.0(W)×53.7(H)×8.5(D,MAX)	mm
LCD Display format	128×64 dot matrix	
Dot size	0.48(W)×0.48(H)	mm
Dot pitch	0.52(W)×0.52(H)	mm
LCD Duty	1/64	
LCD Bias	1/9	
LCD Controller/driver LSI	KS0107,KS0108 (COB)	
LCM Operation temperature (N*)	0~+50	℃
LCM Storage temperature (N*)	-10~+60	℃
LCM Operation temperature (E*)	-20~+70	℃
LCM Storage temperature (E*)	-30~+80	℃
Back light	LED: Yellow green	
	Single light LED: Green, White, Blue	
	EL: White, Yellow green, Blue	
Input data	8-Bit parallel data input, using 80-family MPU Interface	
Power supply	5V single power input. Built- in DC/DC converter for LCD driving.	V
LCD Expected life	50,000	Hours

NOTICE:

LED*: LED Backlight
EL or None*: EL Backlight or no backlight
N*: Normal temperature type
E*: Extended temperature type

2. ABSOLUTE MAXIMUM RATINGS

2.1 ELECTRICAL ABSOLUTE RATINGS

Vss=0V

Item	Symbol	Min	Max	Unit	Note
Power supply for logic	Vdd-Vss	0	7.0	V	
Power supply for LCD	Vdd-Vo	0	Vdd	V	
Input voltage	Vi	0	Vdd	V	

2.2 ENVIRONMENTAL ABSOLUTE RATINGS

Item		Symbol	Min	Max	Unit
Normal type	Operating temperature	T0	0	+50	℃
	Storage temperature	Ts	-10	+60	℃
Wide type	Operating temperature	T0	-20	+70	℃
	Storage temperature	Ts	-30	+80	℃
Humidity		---	---	85	%RH

3. ELECTRRICAL CHARACTERISTICS

3.1 ELECTRRICAL CHARACTERISTICS

Vss=0V

Item		Symbol	Condition	Min	Typ	Max	Unit
Supply voltage	Logic	Vdd	----	4.75	5.0	5.25	V
	LCD drive	Vdd-Vo	----	12.2	---	13.6	V
Input voltage (DB0~DB7,E,R/W,RS)		VIH	----	0.7Vdd	---	Vdd	V
		VIL	----	0	---	0.3Vdd	V
Output voltage (DB0~DB7,E,R/W,RS)		VOH	IOH=0.205mA	VDD-0.4	---	Vdd	V
		VOL	IOL=1.2mA	0	---	0.4	V
Recommend LCD Driving voltage		Vdd-Vo	-20℃	13.4	14.1	14.8	V
		Vdd-Vo	25℃	12.2	12.9	13.6	V
		Vdd-Vo	70℃	11.0	11.7	12.4	V
Frame frequency		FELM	Vdd=5V	65	78	85	Hz
Supply current		Idd	---	---	1.9	3.8	mA

3.2 SPECIFICATION FOR LED BACKLIGHT

■ EDGE LIGHT BACKLIGHT

Item	Unit	Min	Typ	Max	Condition
LED Supply voltage	V	---	4.2	4.6	
LEDConsumption current	mA	---	160	280	

LED Color		Yellow green	

■ SINGLE LIGHT BACKLIGHT

Item	Unit	Min	Typ	Max	Condition
LED Supply voltage	V	3.2	3.4	3.6	
LED Consumption current	mA	120	140	180	
LED Color		Green			

Item	Unit	Min	Typ	Max	Condition
LED Supply voltage	V	3.2	3.4	3.6	
LED Consumption current	mA	125	150	195	
LED Color		White			

Item	Unit	Min	Typ	Max	Condition
LED Supply voltage	V	3.2	3.4	3.6	
LED Consumption current	mA	130	160	200	
LED Color		Blue			

3.3 SPECIFICATION FOR EL BACKLIGHT

Item	Unit	Min	Typ	Max	Condition
Supply voltage	V	---	100	125	
Supply frequeney	Hz	---	400	400	
Initial brightness	cd/m	40	---	--	AC 100Vrms,400Hz,Dark room
Current	mA	3.3_+30%			AC 100Vrms,400Hz,Dark room
Operating temperature	℃	-20~+50			
Storage temperature	℃	-20~+60			
Luminous color	- -	White			AC 100Vrms,400Hz,Dark room
Life time	Hrs	3,000			Note 1

Note 1: Half value of initial brightness at 20℃ 60%RH

4. OPTICAL CHARACTERISTICS

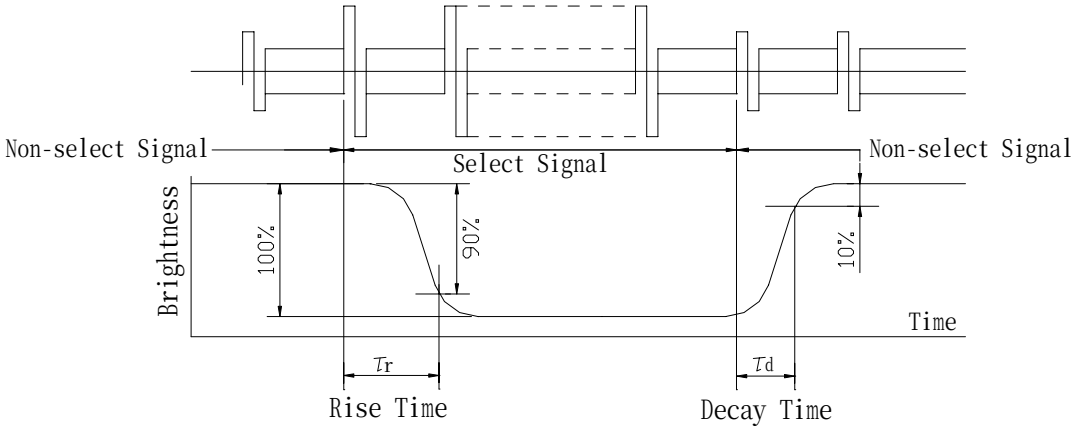
STN TYPE

Ta=25℃

Item	Symbol	Condition	Min	Typ	Max	Unit	Reference
Viewing angle	θ	K≧2.0 ϕ=0	40	---	---	deg	Note1,2
Contrast ration	K	θ=5 ϕ=0	---	5	---	---	Note3
Response time(rise)	Tr	θ=5 ϕ=0	---	110	165	ms	Note4
Response time(fall)	Tf	θ=5 ϕ=0	---	110	165	ms	Note4

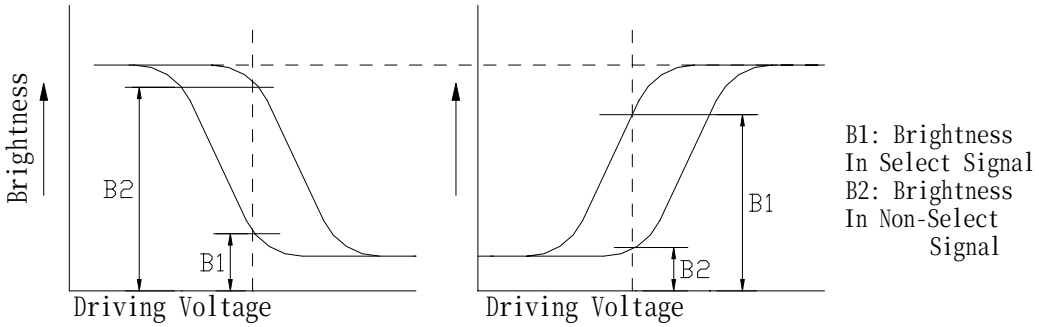
5. MEASUREMENT METHOD OF OPTICAL CHARACTERISTICS

● Definition of Optical Response Time



In case of Negative type,
wave from of changing brightness becomes reverse
(Non Select Signals:0%,Select Signals:100%

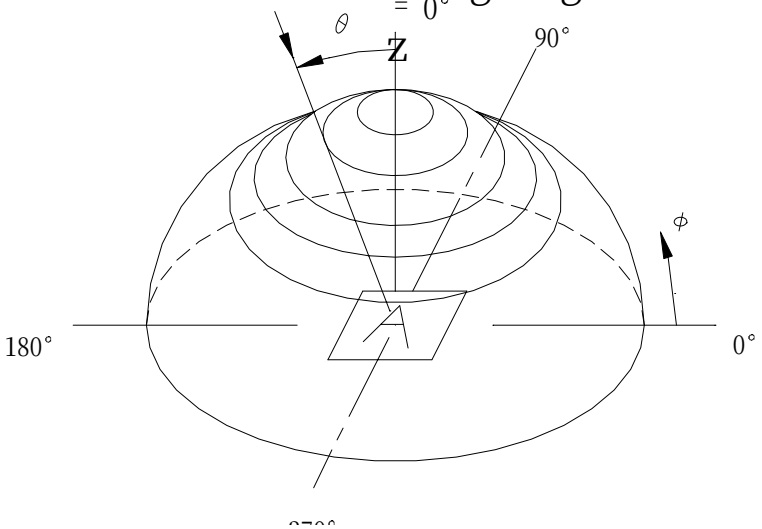
● Definition of Contrast Ratio(CR)



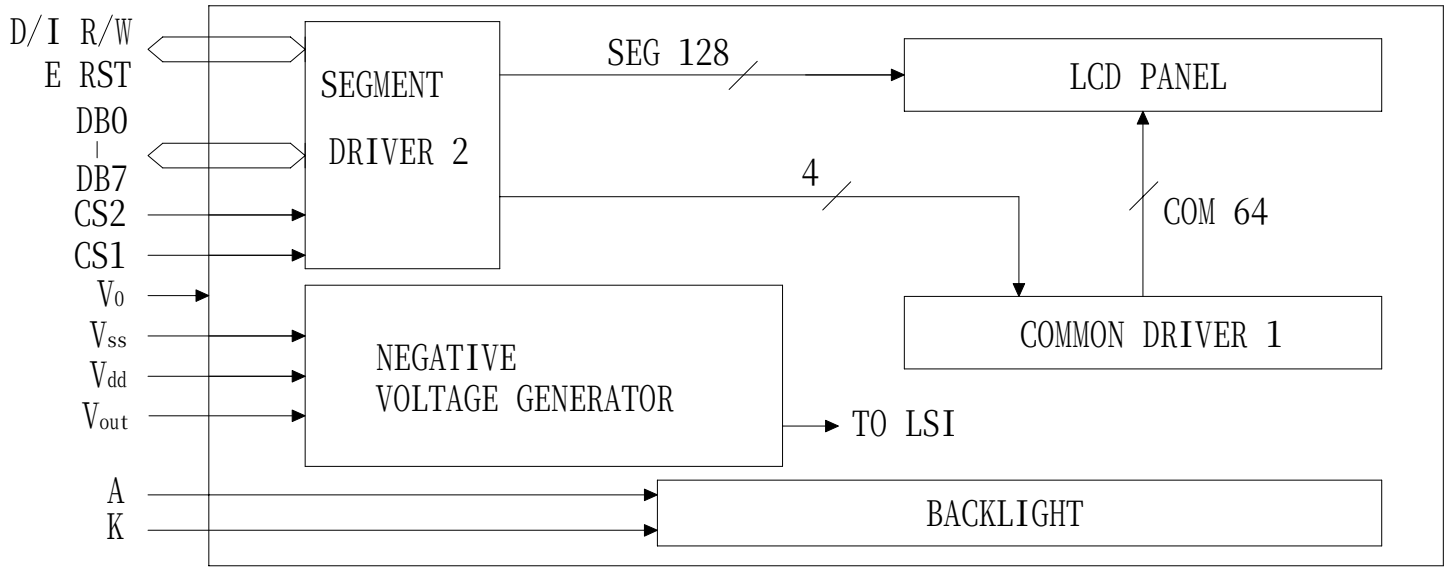
$$CR=\frac{\text{Brightness In Non-Select Signal}}{\text{Brightness In Select Signal}}$$ (Positive Type)

$$CR=\frac{\text{Brightness In Select Signal}}{\text{Brightness In Non-Select Signal}}$$ (Negative Type)

● Definition of Viewing Angle θ and ϕ



6. BLOCK DIAGRAM

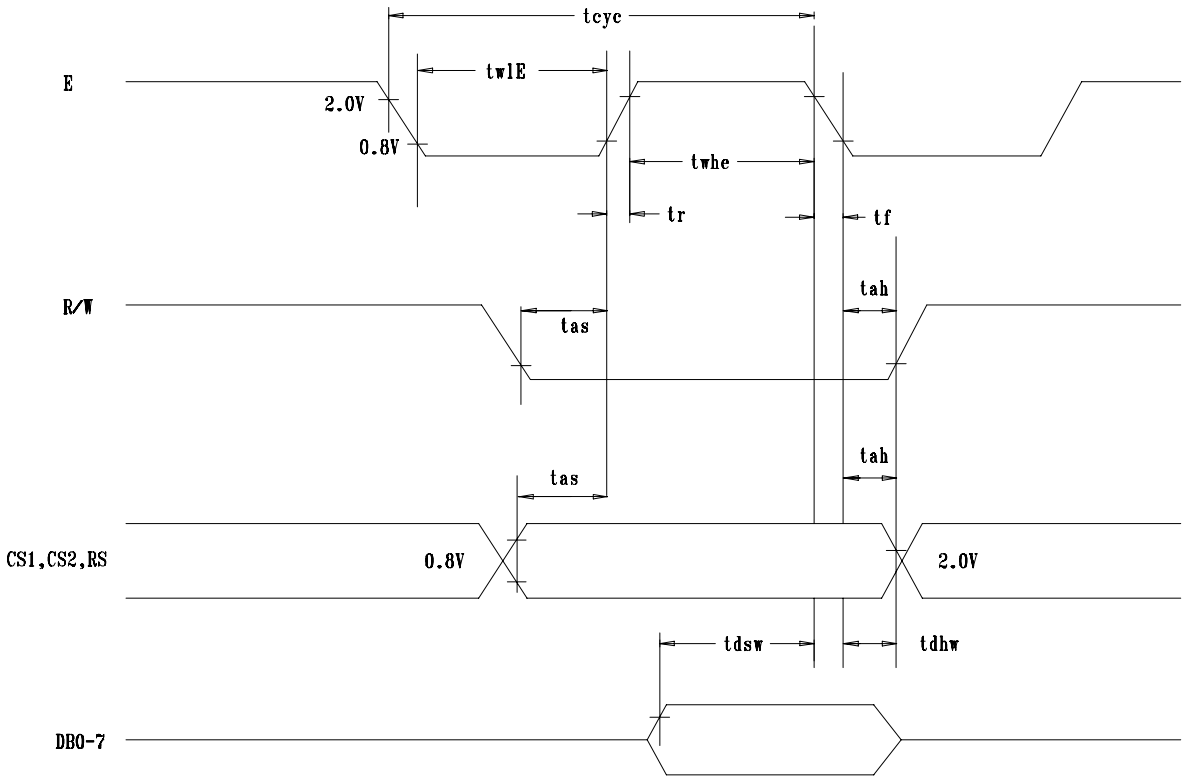


7. SIGNAL TIMING DIAGRAM

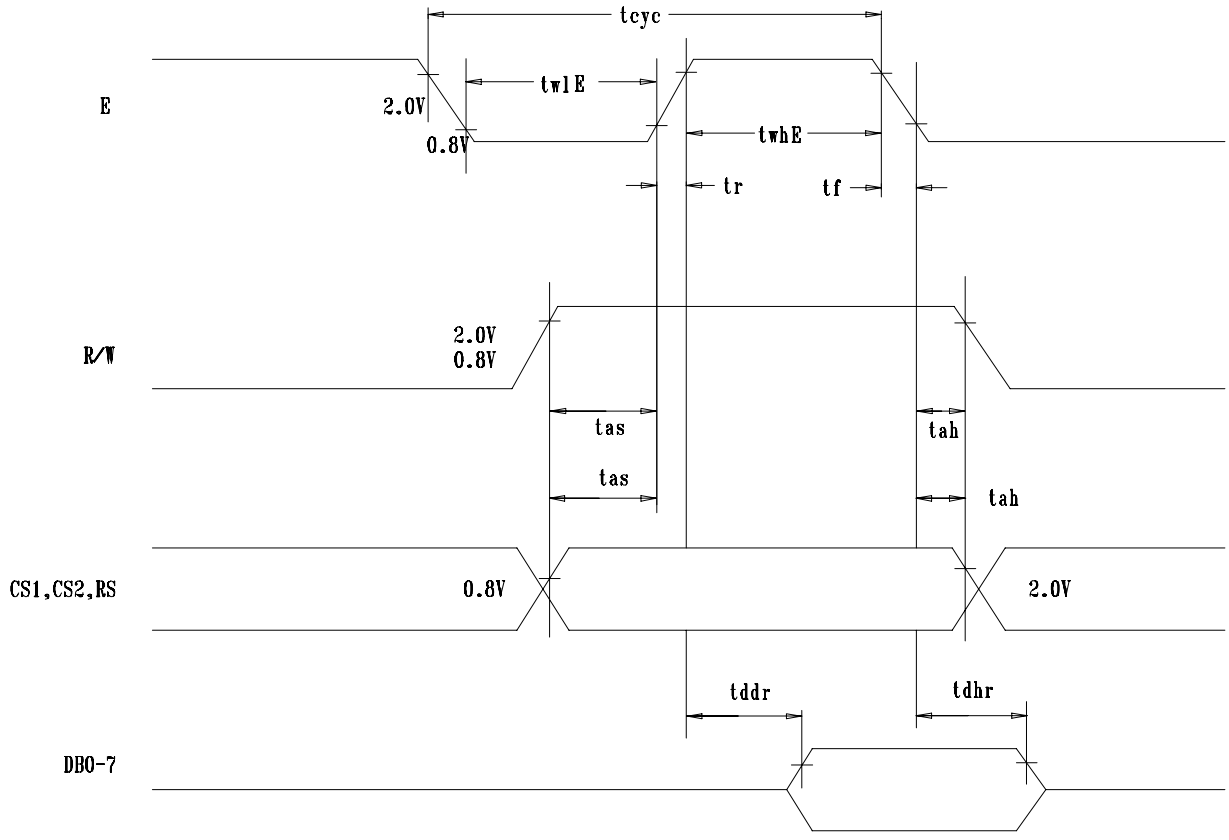
7.1 MPU INTERFACE

Characteristic	Symbol	Min	Typ	Max	Unit
E cycle	tcyc	1000	---	---	ns
E high level width	twhE	450	---	---	ns
E low level width	twlE	450	---	---	ns
E rise time	t_r	---	---	25	ns
E fall time	tf	---	---	25	ns
Address set-up time	tas	140	---	---	ns
Address hold time	tah	10	---	---	ns
Data set-up time	tdsw	200	---	---	ns
Data delay time	tddr	---	---	320	ns
Data hold time(write)	tdhw	10	---	---	ns
Data hold time(read)	tdhr	20	---	---	ns

7.2 CPU WREITE TIMING



7.3 MPU READ TIMING



8. UNIT DRIVING METHOD

8.1. FUNCTION OF EACH BLOCK

8.1-1.REGISTER

Both input register and output register are provided to interface to MPU of which the speed is different from that of internal operation. The selection of these registers depend on the combination of R/W and D/I signals.

REGISTER SELECTION (TABLE 1)

D/I	R/W	Function
1	1	Reads data out of output register as internal operation (Display data RAM → output register)
1	0	Write data into input register as internal operation (input register → display data RAM)
0	1	Busy check. Read of status data.
0	0	Instruction

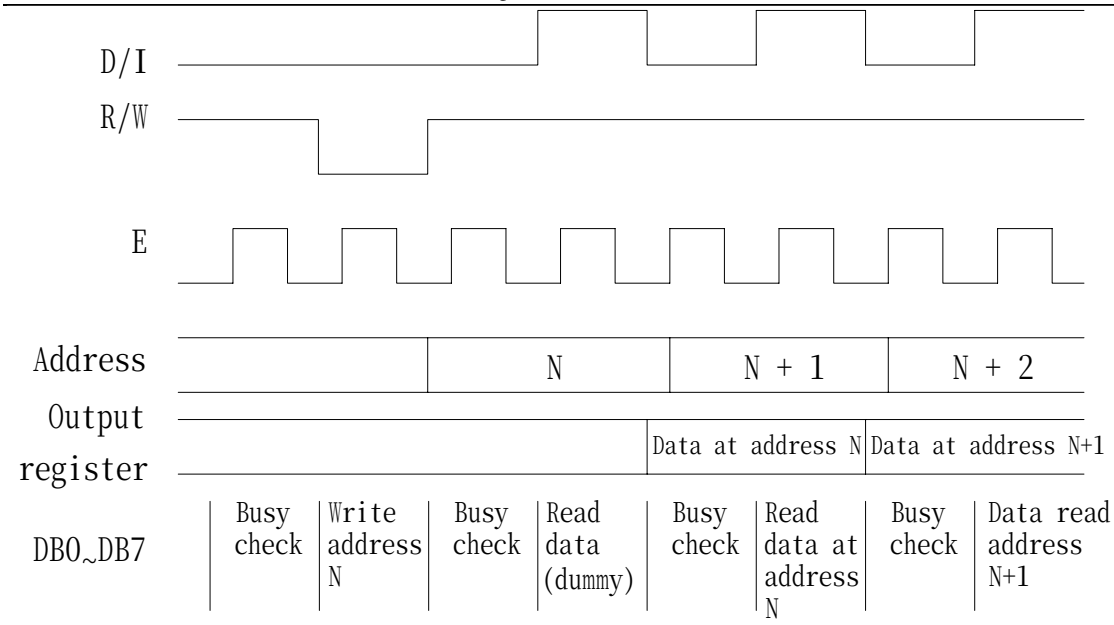
① INPUT REGISTER

Input register is used to store data temporarily before writing it into display data RAM.
The data from MPU is written into input register. Then into display data RAM automatically by internal operation. When chip select signal is in the active mode and D/I and R/W select the input register as shown in table 1. data is latched at the fall of “ E ” signal.

② OUTPUT REGISTER

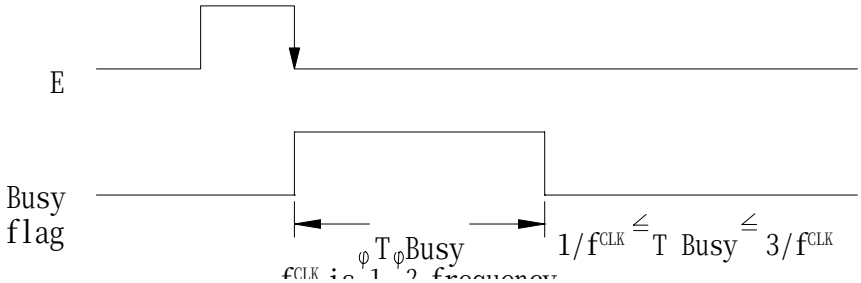
Output register is used to store data temporarily which is read from display data RAM. To read out the data from output register. Chip select signal should be in the active mode and both RS and R/W should be “1”．With read instruction. Data stored in the output register is output while “ E ” is “ H” level . Then, at the fall of “E”，The display data at indicted address is latched into the output register and address is increased by 1. The contents in the output register are rewritten with read instruction. While is held with address set instruction, etc.

Therefore, the data of the specified address can not be output with read instruction soon after is set. But can be output at the second read of data. That is to say. One dummy read is necessary. Fig 8.1. shows the CPU read timing.



8.1-2 BUSY FLAG

"1" of busy flag indicates that KS0108B is on the move and any instruction except status read instruction can not be accepted. The value of the busy flag is read out on DB7 by the status read instruction. Make sure that the busy flag is reset ("0") before the issue of instruction.



8.1-3 DISPLAY ON/OFF FLIP FLOP

The display on/off flip flop selects one of two states. On state and off state of segments. In on state, the display data corresponding to that in RAM is output to the segments. On the other hand. The display data at all segments display in off state independent of the data in RAM. It is controlled by display on/off instruction "0" of RST signal sets the segments in off state. The status of the flip flop is output to DB5 by status read instruction. Display on/off flip flop instruction does not influence data in RAM.

8.1-4 DISPLAY START LINE REGISTER

The register specifies a line in RAM which corresponds to the top line of LCD panel. When displaying contents in display data RAM on the LCD panel. It is used for scrolling of the screen.

6-bit display start line information is written into this register by display start line set instruction. With "H" level of from signal instructing to start the display. The information in this register is transferred to Z address counter which controls the display address. And the Z address counter is preset.

8.1-5 X, Y ADDRESS COUNTER

This is 9 bit counter which designates address of internal display data RAM. X address counter of

upper 3 bits and Y address counter of low 6 bits should be set each address by respective instruction.

① X ADDRESS COUNTER

Ordinary register with no count functions. An address is set in by instructions.

② Y ADDRESS COUNTER

An address is set in by instruction and it is increased by 1 automatically by R/W operation of display data. The Y address counter loops the value of 0to 63 count.

8.1-6 DISPLAY DATA RAM

Dot data for display is stored in this RAM. 1 bit data of this RAM corresponds to light on (DATA=1) and light off (DATA=0) of 1 dot in the display panel.

8.1-7 RESET

The system can be initialized by setting RST terminal at “LOW” level when turning power on.

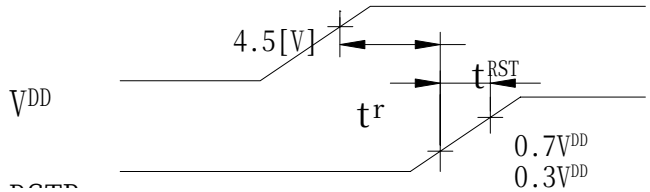
① Display off

② Set display start line register 0 line.

While RST is in low level, any instruction except status read can not be accreted. Therefore, carry out other instruction after making sure that DB4= “0” (CLEAR RESET) and DB4= “0” (READY) by status read instruction the conditions of power supply at initial power up are as follows.

Item	Symbol	Min	Typ	Max	Unit
Reset time	tRST	1.0	---	---	us
Rise time	tr	---	---	200	ns

Do not fail to set the system again because reset during operation may destroy the data in all the register except on/off register and in RAM.



8.2 DISPLAY CONTROL INSTRUCTION

Shows the instructions. read/write (R/W) signal, data instruction (D/I) signal and data bus signal (DB0 to DB7) are also called instructions because the internal operation depands on the signals from MPU. Generally, there are following three kinds of instructions.

① Instruction to give address in the internal RAM.

② Instruction to transfer data from/to the internal RAM.

③ Other instructions.

In general use. The instruction ② are used most frequently. But, since Y address of the internal RAM is increased by 1 automatically after writing (reading) data. The program can be lessened. During the execution of an instruction. The system can not accept other instructions than status read instruction. Send instruction from MPU after making sure if the busy flag is “0”, which is the proof an instructioin is not being executed.

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display ON/OFF	0	0	0	0	1	1	1	1	1	0/1	Controls the display on or off. Internal status and display RAM data are not affected. 0:OFF, 1:ON
Set Address	0	0	0	1	Y address (0~63)						Sets the Y address in the Y address counter.
Set Page (X address)	0	0	1	0	1	1	1	Page (0~7)			Sets the X address at the X address register.
Display Start Line	0	0	1	1	Display start line (0~63)						Indicates the display data RAM displayed at the top of the screen.
Status Read	0	1	BUSY	0	ON/OFF	RESET	0	0	0	0	Read status. BUSY 0 : Ready 1 : In operation ON/OFF 0 : Display ON 1 : Display OFF RESET 0 : Normal 1 : Reset
Write Display Data	1	0	Write Data								Writes data (DB0:7) into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read Display Data	1	1	Read Data								Reads data (DB0:7) from display data RAM to the data bus.

8.3 DISPLAY CONTROL INSTRUCTION DESCRIPTION

8.3-1 DISPLAY ON/OFF

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

←High order bit low order bit→

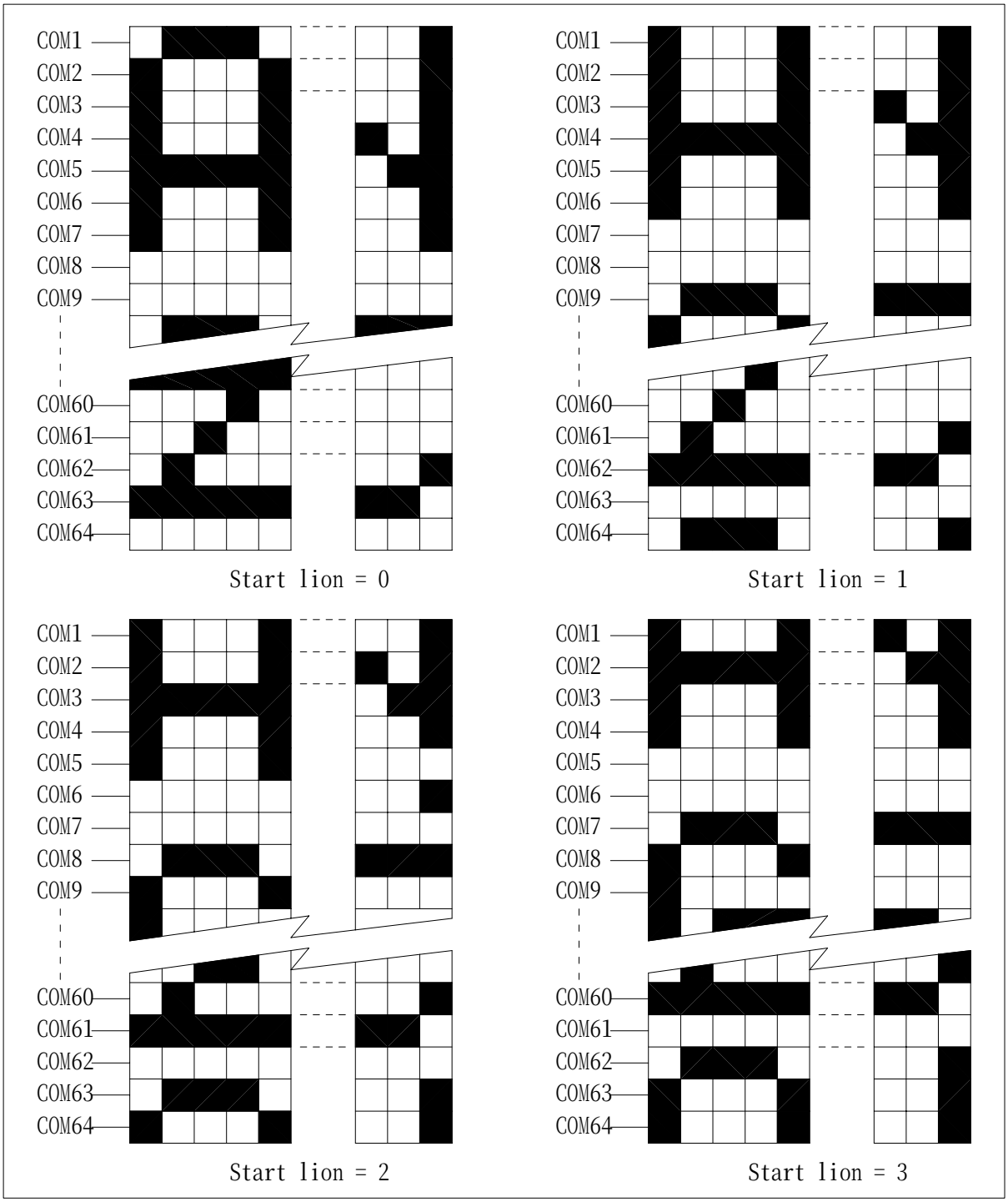
The display data appears when D is 1 and disappears when D is 0. Though the data is not on the screen with D=0, it remains in the display data RAM. Therefore, you can make it appear by changing D=0 into D=1.

8.3-2 DISPLAY START LINE

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

←High order bit　　low order bit→

Z address AAAAAA (binary) of the display data RAM is set in the display start line register and display at the top of the screen. Figure 7 shows examples of display (1/64 duty cycle) when the start line=0-3. When the display duty cycles is 1/64 or more(ex. 1/32, 1/24 etc.), the data of total line number of LCD screen, from the line specified by display start line instruction, is displayed.



8.3-3 SET PAGE (X ADDRESS)

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

←High order bit low order bit→

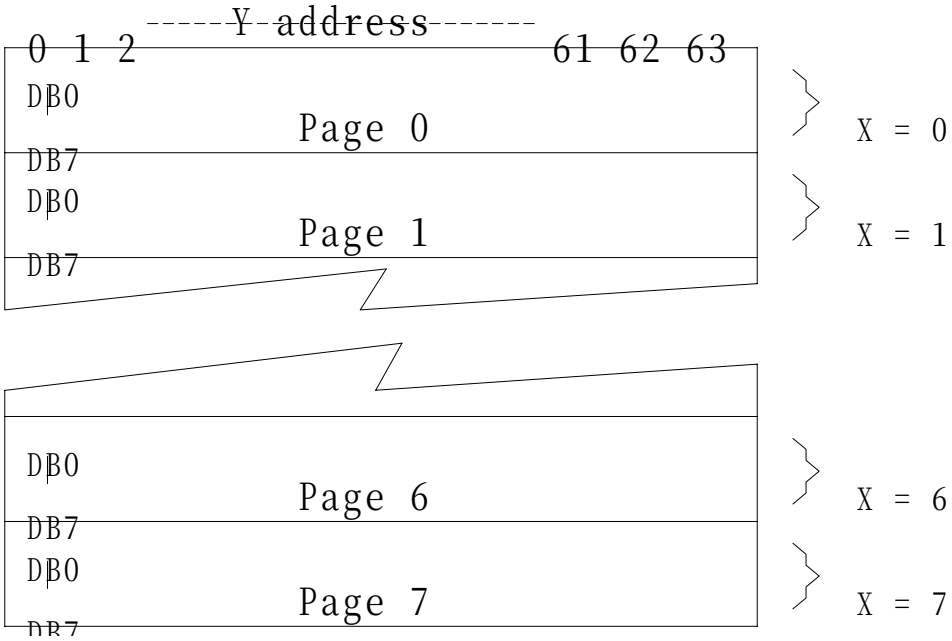
X address AAA (binary) of the display data RAM is set in the X address register. After that , writing or reading to or from MPU is executed in this specified page until the next page is set. See figure 9.

8.3-4 SET Y ADDRESS

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

←High order bit low order bit→

Y address AAAAAA (binary) of the display data RAM is set in the Y address counter. After that , Y address counter is increased by 1 every time the data is written or read to or from MPU.



8.3-5 STATUS READ

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

←High order bit low order bit→

Busy : When Busy is 1, the LSI is executing internal operations. No instructions are accepted while Busy is 1, so you should make sure that Busy is 0 before writing the next instruction.

ON/OFF: Shows the liquid crystal display conditions on condition or off condition.
When ON/OFF is 1, the display is in off condition.
When ON/OFF is 0, the display is in off condition.

RESET : RESET=1 shows that the system is being initialized. In this condition, no instructions except status read can be accepted.
RESET=0 shows that initialized has finished and the system is in the usual operation.

8.3-6 WRITE DISPLAY DATA

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

←High order bit low order bit→

Writes 8-bits data DDDDDDDD (binary) into the display data RAM. Then Y address is increased by 1 automatically.

8.3-7 READ DISPLAY DATA

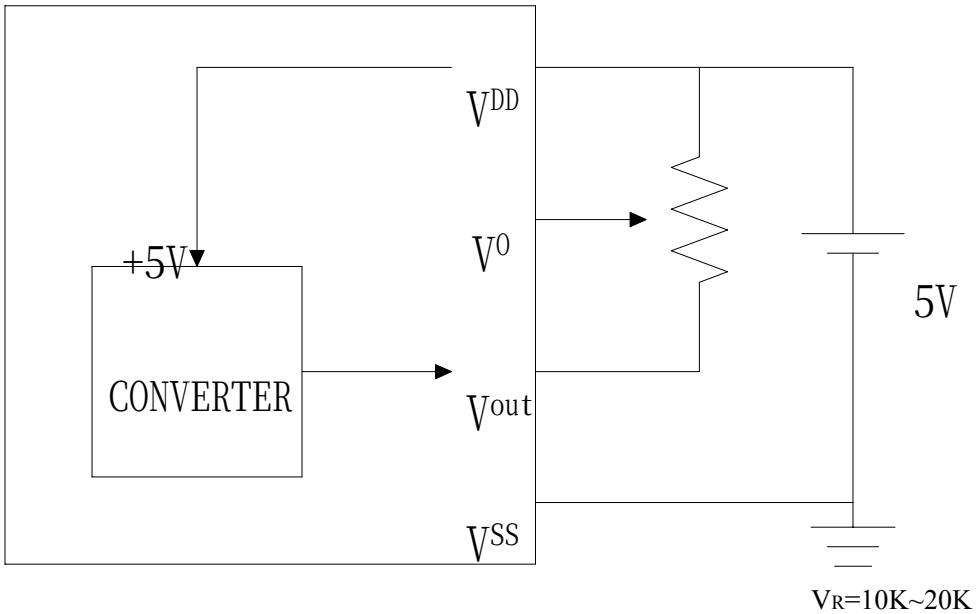
R/W	D/I	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	1	D	D	D	D	D	D	D	D

←High order bit low order bit→

Reads out 8-bits data DDDDDDDD (binary) from the display data RAM. Then Y address is increased by 1 automatically.

One dummy read is necessary soon after the address setting. For details, refer to the explanation of output register in “FUNCTION OF EACH BLOCK”.

9. POWER SUPPLY



VR=10K~20K

10. RELIABILITY TEST

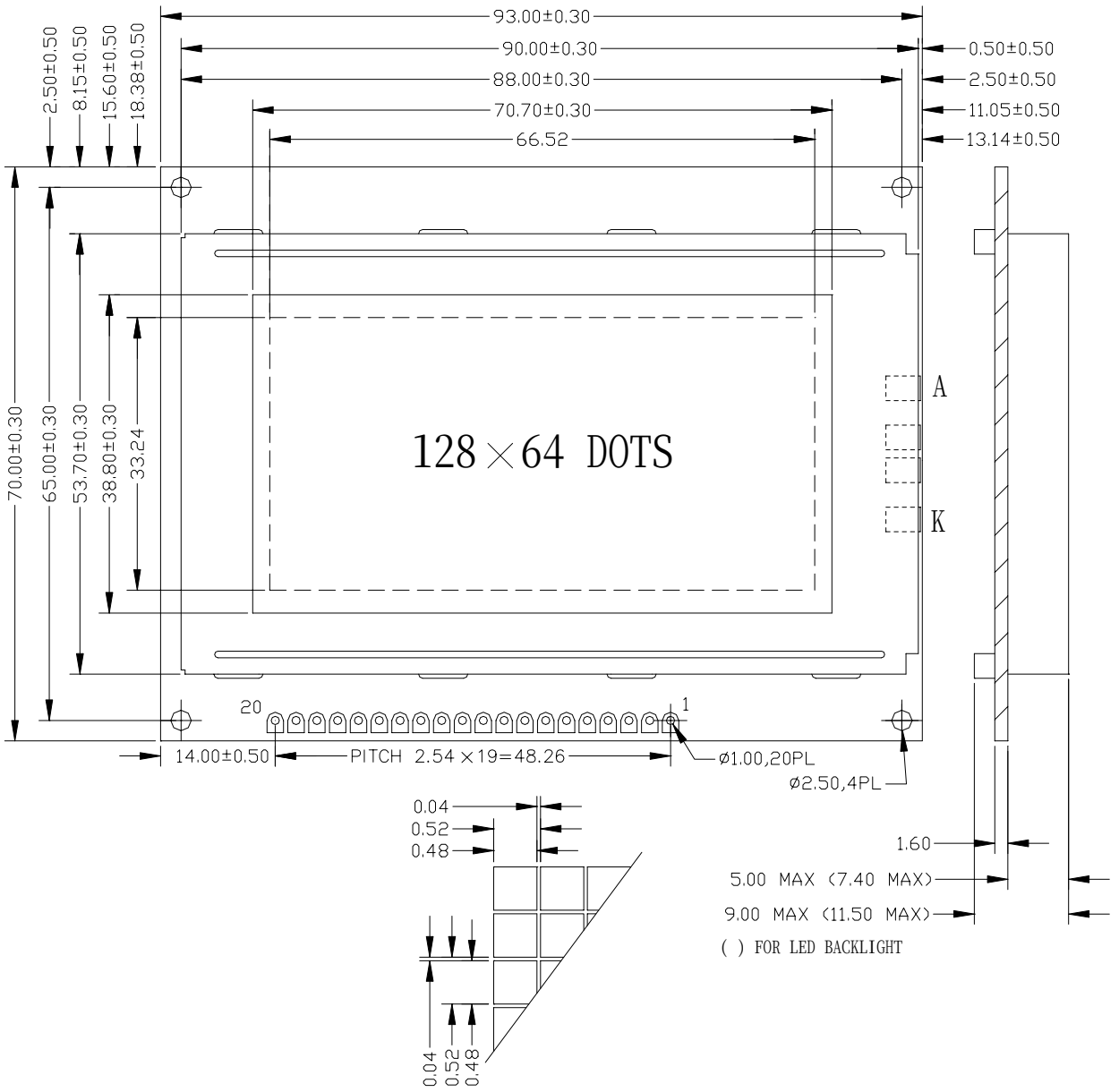
Vdd=5V Ta=25℃

Item	Condition	Standard	Note
High temp. storage	80℃,120 hrs	Appearance without defect	---
Low temp. storage	– 30℃,120 hrs	Appearance without defect	---
High temp. operation	70℃,240 hrs	Appearance without defect	---
Low temp. storage	– 20℃,240 hrs	Appearance without defect	---
High temp. & humi. storage	50℃,90% RH,120 hrs	Appearance without defect	---
High temp .& humi. operation	40℃,90% RH,120 hrs	Appearance without defect	---
Thermal shock	-20 ℃ ,30min → +25 ℃ ,5min → +60 ℃,30min	Appearance without defect	10 cycles

11. INTERNAL PIN CONNECTIONS

Pin No.	Symbol	Level	Function
1	VSS	0V	Signal ground
2	VDD	5.0V	Power supply voltage for logic
3	VO	---	Power supply voltage for LCD drive(variable)
4	D/I	H/L	H : Data signal, L : Instruction signal
5	R/W	H/L	H : Read mode, L : Write mode
6	E	H, H → L	Operation start signal for data READ/WRITE
7	DB0	H/L	Data bit 0
8	DB1	H/L	Data bit 1
9	DB2	H/L	Data bit 2
10	DB3	H/L	Data bit 3
11	DB4	H/L	Data bit 4
12	DB5	H/L	Data bit 5
13	DB6	H/L	Data bit 6
14	DB7	H/L	Data bit 7
15	CS1	H	Chip select signal for IC1(KS0108B 1)
16	CS2	H	Chip select signal for IC2(KS0108B 2)
17	RST	L	Reset signal
18	VOUT	-5V	Output voltage for LCD DRIVING
19	LA	4.2V	Side light anode
20	LK	0V	Side light cathode

12. DIMENSIONAL OUTLINE



BEIJING QINGYUN HI-TECH CO.,LTD			
DUTY: 1/64	MODEL NAME: LCM12864E		REV: A
BIAS: 1/9	DRAWN NO: LCM12864E-01		SCALE: 1:1
O.V: 8.5 V	DRAWN:	APPROVED:	UNIT: mm
O'CLOCK: 6:00	DATE:MAY 07,2003		PAGE: 1/1

13. PRECATIONS IN USE OF LCD MODULE

13.1 LCD MODULE

▼Precautions for handling LCD modules

Our LCM have been assembled and adjusted accurately before delivery; therefore, observe the following points for handing:

(1) Do not subject it to excessive shocks by dropping it.
(2) Do not modify the tab of the metal holder nor make any arrangement to it.
(3) Do not work on the printed circuit board
(4) Limit the soldering to the printed circuit board only to I/O terminals.
(1)Do not touch the connection rubber (inter-connector), nor modify is location.

▼warning for static electricity

Our LCM uses CMOS LSI. Therefore, cuntermeasures for static electricity is taken through all the process from manufacturing into shipping. When using, taken sufficient care to prevent static electricity as in the case of a normal CMOS IC.

(1) Do not take LCM from its packing bag until it is assembled.
LCM are individually packing in bags treated to resist static electricity. Control them so they are not taken out of the bag until just before the soldering operation for the LCM terminals. When storing them keep them as packed in the bags, or store them in a container processed to be resistant to static electricity, or in a electric conductive container.

(2) Always use a human body grounded when handing LCM.
Always apply grounding to your body while you are working with LCM from the time it is taken out of the anti-static bag until it is assembled in a set to keep the human body and LCM at the same potential. When it is necessary to transfer LCM after it is taken out of the bag, always place it in a electric conductive container.
Moreover, avoid wearing clothes of chemical fiber. Cotton or conductive treated fiber clothes are recommended.

(3) Use a no-leak iron for soldering LCM.
The soldering iron to be used for soldering of I/O terminals LCM, is to be insulated at the iron tip, or grounded at the iron tip.

(4) Grounded electrical apparatus are always required for assembly.
Electrical apparatuse required to assemble LCM in set, specially electric drivers, are to be grounded to avoid the efforts of transmitting spike noise generated when the motor is rotated.

(5) Make the potential of operation bench equal to the grounded potential.
When the operation bench is grounded with aluminum or steel plate, there is a possibility of damag-ing the LCM, or in race cases of electric shocks being generated because the impedance is too low; therefore, it is recommended to use an electric conductive(rubber) mat.

(6) Peel off the LCM protective film slowly.
Our LCM are attached with protective film to protect the display surface from contanmination, flaw, adhesion of flux, etc, however, peeling it off abruptly may cause some static electricity to be generated, so pay attention when peeling off the tape slowly.

(7) Pay attention to the humidity of the work shop.

50~60%RH is statisfactory.

▼Cautions for soldering to LCM

The following shall be soldering the LCM, as already explained:

※ Soldering is to be applied only to the I/O terminals.

※ Use a soldering iron with no leakage.

In addition to the above, pay attention to be following.

(1) Conditions for soldering I/O terminals

Temperature at iron tip: 280□+10□

Soldering time: 3-4sec./terminal

Type of solder: Eutectic solder (rosin flux filled)

Avoid using flux, because it may penetrate the LCM , and the LCM may be contaminated when cleaning is required. Moreover, peel off the protective film after soldering the I/O terminals is completed. In this way surface contamination caused by the dispersion of flux while soldering can be avoided.

(2) Removing the wiring

When a lead wire or a connector solder to the I/O terminals of LEM is to be removed, remove it after the solder at the connection part has melted sufficiently because the I/O terminals is insterted into a through hole. If forcefully removed, it may cause the terminal to break or peel. It is recommended to use a suction-type solder sucker. Moreover, do not repeat wiring by soldering more than 3 times.

▼Long-term storage

When long-term storage of MDL is necessary, please com-ply with the following procedure:

If the method of storage is bad, deterioration of the display waterial (polarizer), generation of oxide on the I/O terminals plating (flush plating with gold) may make the soldering process difficult (adhesion of solder becomes worse).

(1) Store as packed in the condition it is delivered from us as far as possible.

(2) If the LCM is independent, place it in anti-static bag, seal the opening, and store it where it is not subjected to direct sunshine, or to the light of a fluorescent lamp.

(3) In either case store them in the temperature rang of 0□~35□ and at low humidity.

Please refer to a separated specification sheet for each module about requirement of storage temperature and humidity resistance.

▼Excess electric current protection

Excess electric current protection circuit is not equipped in LCM. Therefore, in preparing for the worst, use electric source which has excess electric current protection circuit.

13.2 PRECAUTIONS IN USE OF LCDS

(1) Do not give any external shock.
(2) Do not wipe the surface with hard materials.
(3) Do not apply excessive force on the surface.
(4) Do not drive by DC voltage.
(5) Do not expose to direct sunlight or fluorecent light for a long time.
(6) Avoid storage in high temperature and high humidity.
(7) When storage for a long time at 40□ or higher is required, R/H shall be less than 60%.
(8) 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.