Liquid Crystal Display Technologies

CUSTOMER　　:

M O D E L　　　:　MOG-128GB11D-S Series

DESCRIPTION　:　　　LCD MODULE

◆ CUSTOMER APPROVAL

APPROVAL	CHECKED	CHECKED	APPROVAL
REMARK			

◆ SUPPLIER APPROVAL

PREPARED	CHECKED		APPROVAL

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1. General Specification

(1) Mechanical Dimension

Item	Standard Value	Unit
Number of dots	128×64	dots
Module dimension (L*W*H)	75.0 x 52.7 x 8.4	mm
View area	60.0(W)×32.6(H)	mm
Active area	56.02(W)×27.5(H)	mm
Dot size	0.41(W)×0.41(H)	mm
Dot pitch	0.43(W)×0.43(H)	mm

(2) Controller IC: KS107 / KS108

(3) Temperature Range

	Normal	Wide
Operating	0 ~+50℃	-20 ~ +70℃
Storage	-10 ~ +60℃	-30 ~ +80℃

2. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T_{OP}	-20	—	+70	℃
Storage Temperature	T_{ST}	-30	—	+80	℃
Input Voltage	V_I	0	—	V_{CC}	V
Supply Voltage For Logic	V_{CC}	0	—	67	V
Supply Voltage For LCD	V_{CC}-V_{LCD}	0	—	16.7	V
Supply Voltage For LCD	V_{OUT}	—	—	-10	V

3. Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage For Logic	V_{DD}-V_{SS}	—	4.5	5.0	5.5	V
Supply Voltage For LCD	V_{DD}-V_0	Ta=-20℃	—	9.8	—	V
		Ta=25℃	—	8.5	—	V
		Ta=+70℃	—	7.5	—	V
Input High Vol	V_{IH}	—	$0.7V_{DD}$	—	V_{DD}	V
Input Low Vol	V_{IL}	—	0	—	$0.3V_{DD}$	V
Output High Vol	V_{OH}	—	2.4	—	—	V
Output Low Vol.	V_{OL}	—	—	—	0.4	V
Supply Current	I_{DD}	—	—	6.0	—	mA

4. Optical Characteristics

a. STN

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
View Angle	(V) θ	CR≧2	10		45	deg
	(H) φ	CR≧2	-30		30	deg
Contrast Ratio	CR	—		3		—
Response Time 25℃	T rise	—		100	150	ms
	T fall	—		150	200	ms

b. FSTN

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
View Angle	(V) θ	CR≧3	10		60	deg
	(H) φ	CR≧3	-45		45	deg
Contrast Ratio	CR	—		5		—
Response Time 25℃	T rise	—		100	150	ms
	T fall	—		150	200	ms

4.1   Definitions

■View Angles

Z   (Visual angle direction)

θ

LCD

X

φ

Y

(Best visual angle direction)

■Contrast Ratio

$$CR = \frac{\text{Brightness at selected state (BS)}}{\text{Brightness at non-selected state (Bns)}}$$

Selected state

Non-selected state

Brightness (%)

Bs

Bns

Operating voltage for LCD driving

■Response time

Nonselected Condition   Selected Condition   Nonselected Condition

Brightness

100 %

10 %

90 %

tr

Rise Time

td

Decay Time (fall time tf)
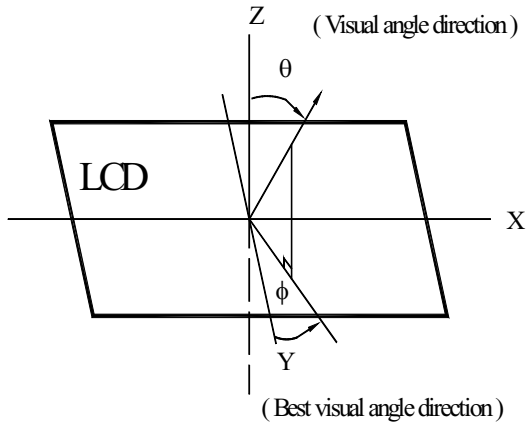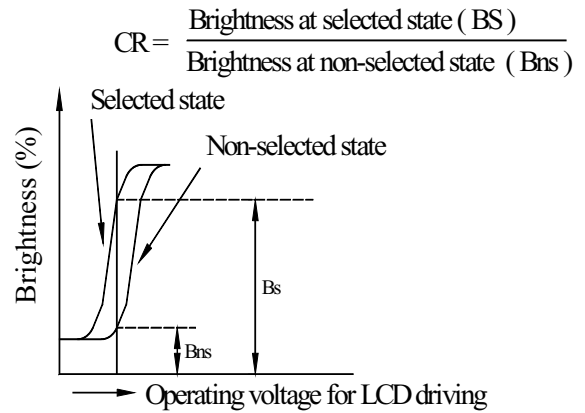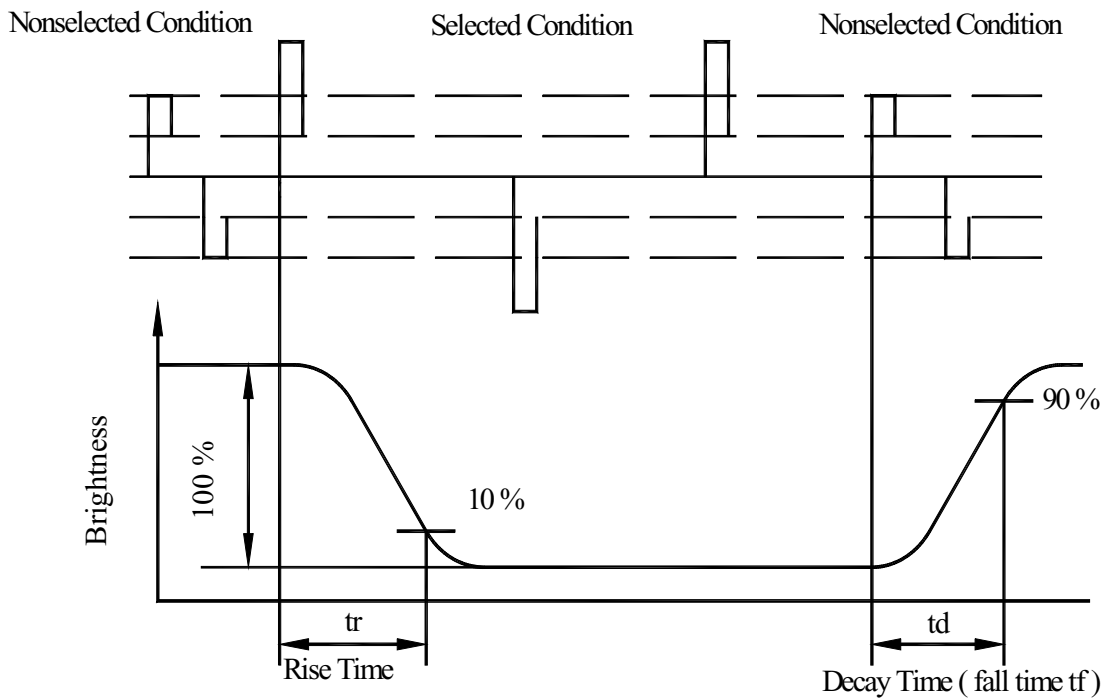
5. Interface Pin Function

Pin No.	Symbol	Level	Description
1	Vdd	5.0V	Supply voltage for logic (option +3V)
2	GND	0V	Ground
3	V_O	(Variable)	Operating voltage for LCD
4	DB0	H/L	Data bus line
5	DB1	H/L	Data bus line
6	DB2	H/L	Data bus line
7	DB3	H/L	Data bus line
8	DB4	H/L	Data bus line
9	DB5	H/L	Data bus line
10	DB6	H/L	Data bus line
11	DB7	H/L	Data bus line
12	/CS1	L	Chip Select for IC1
13	/CS2	L	Chip Select for IC2
14	/RST	L	Reset signal
15	R/W	H/L	H=Read mode , L=Write mode
16	D/I	H/L	H=Data register , L=Instruction register
17	E	H/L	Enable signal
18	Vee		Negative Voltage output –4.8V
19	A	–	Power supply for B/L (+)
20	K	–	Power supply for B/L (GND)

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6. Timing Characteristics

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	tr	–	–	25	ns
E tall 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

MPU Write Timing

E

2.0V
0.8V

twIE

tcyc

twhE

tr

tf

R/$\overline{W}$

2.0V
0.8V

tas

tah

tas

tah

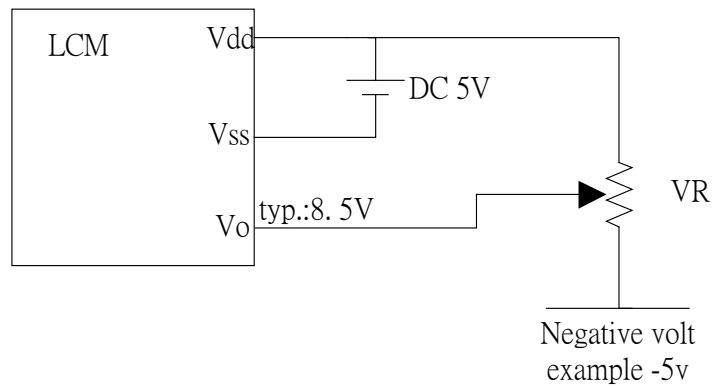CS1,CS2,D/$\overline{I}$

0.8V

2.0V

tddr

tdhr

DB0 to DB7
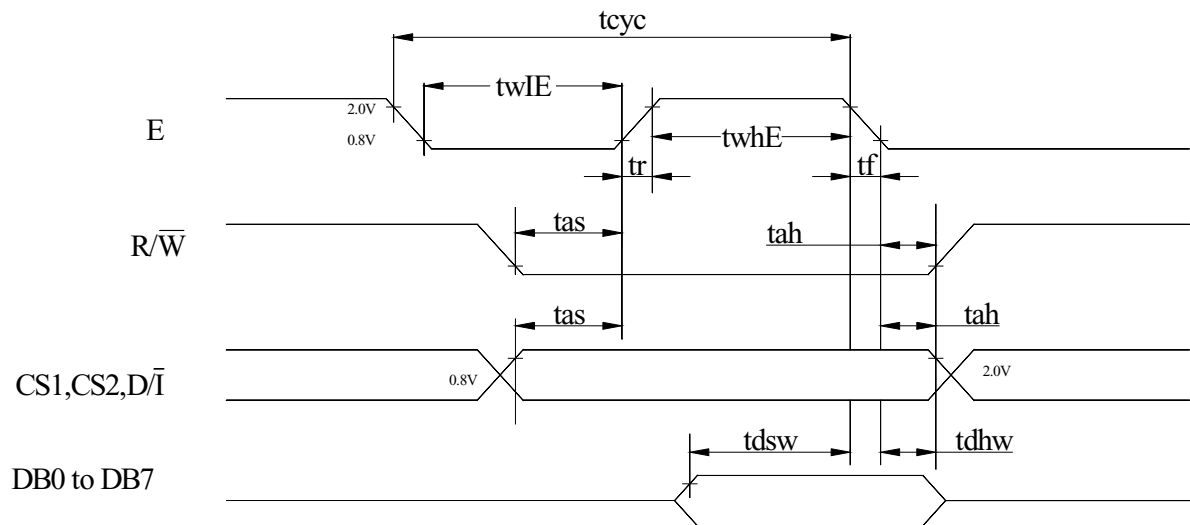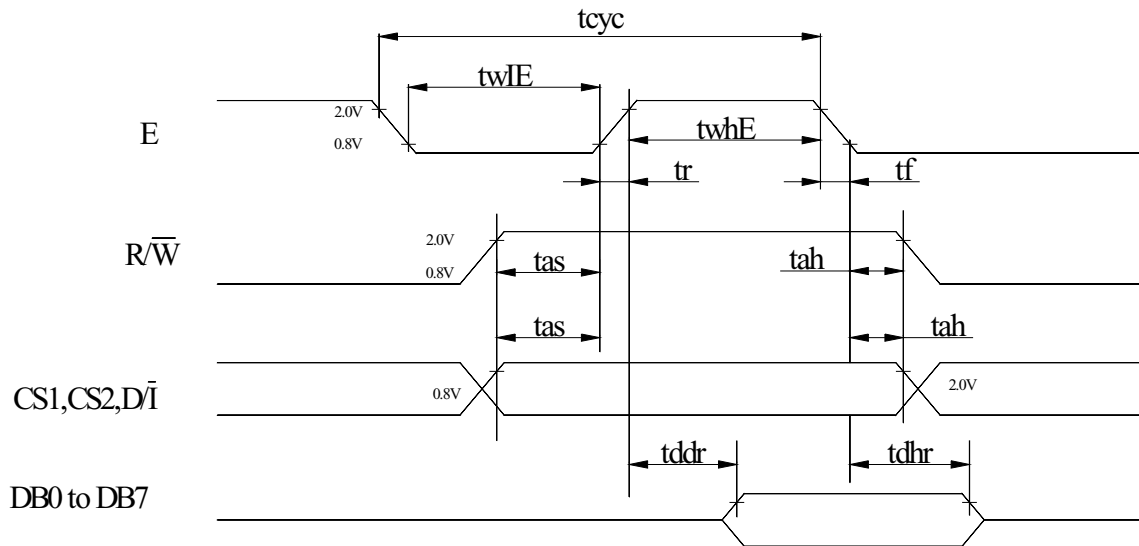
MPU Read Timing

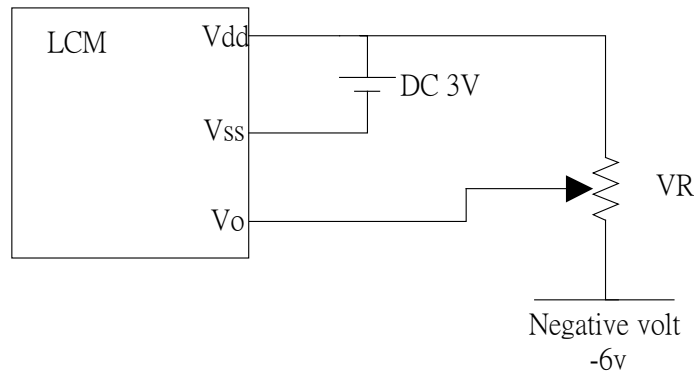**7. Power Supply for LCD Module and LCD Operating Voltage a Adjustment**

＊LCM operating on " DC 5V " input with built-in negative voltage
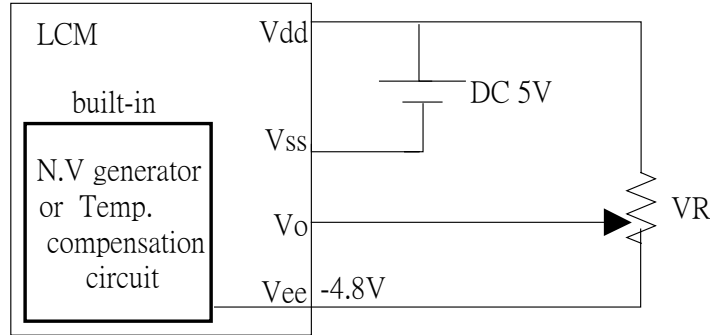
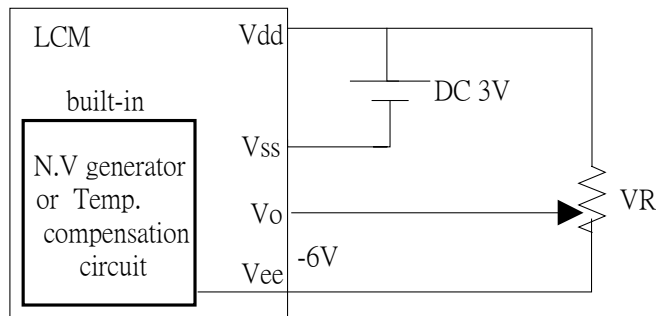＊(Option) LCM operating on " DC 5V " input with external negative voltage

＊(Option) LCM operating on " DC 3V " input with external negative voltage

＊(Option) LCM operating on " DC 3V " input with built-in negative voltage

8. Backlight Information

8.1 Specification

LED edge / yellow-green

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	ILED		70	100	mA	V=4.0V
Supply Voltage	V		4.0	4.2	V	－
Reverse Voltage	VR	－	－	8	V	－
Luminous Intensity	IV	18	20	－	cd/m^2	ILED=70mA
Wave Length	λp	－	574	－	nm	ILED=70mA
Life Time		－	70000	－	Hr.	V≦4.2V
Color	Yellow-green					

(2) LED white / blue

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	ILED		30	45	mA	V=3.2V
Supply Voltage	V		3.2	3.3	V	－
Reverse Voltage	VR	－	－	8	V	－
Luminous Intensity	IV	30	40	－	cd/m^2	ILED=30mA
Wave Length	λp	－		－	nm	ILED=30mA
Life Time		－	20000	－	Hr.	V≦3.3V
Color	White					

8.2 Backlight driving methods

  a.

   a-1 LED edge/yellow-green B/L drive from pin19 (LED+) pin20 (LED-)

```
                        LCM
   ┌──────────────────────────────────┐
   │  ┌─────────────┐  RL= ☐ ohm       │
   │  │             │   ‑w\w‑       ┌┤  │
   │  │  Backlight  │   PIN19       ┤├ 4.0
   │  │             │               └┤  │
   │  └─────────────┘   PIN20          │
   └──────────────────────────────────┘
```
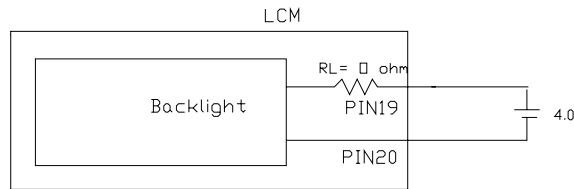
   a-2 LED white(blue) B/L drive from pin19 (LED+) pin20 (LED-)

```
                        LCM
   ┌──────────────────────────────────┐
   │  ┌─────────────┐  RL= ☐ ohm       │
   │  │             │   ‑w\w‑       ┌┤  │
   │  │  Backlight  │   PIN19       ┤├ 3.2V
   │  │             │               └┤  │
   │  └─────────────┘   PIN20          │
   └──────────────────────────────────┘
```
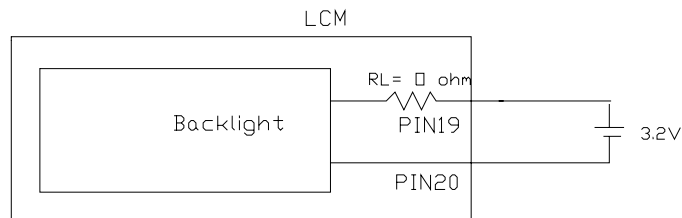
  b. ＊(Option) LED B/L drive from pin1 (Vdd) pin2 (Vss)

```
        LCM
              Vdd
   ┌────────────────────┐
   │  ┌──────────┐    ↑  │
   │  │         +│1 RL│  │
   │  │Backlight │ ‑w\w‑─┘│
   │  │         -│2      │
   │  └──────────┘   │   │
   │              Vss    │
   └────────────────────┘
```
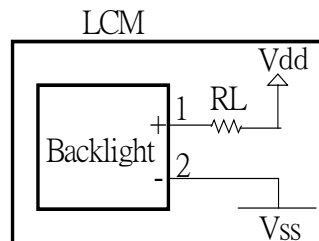
   (1) Jump 1,2 Short
   (2) Current Resistor required on RL
   (3) Jump 19,20 open
   (4) To be sure of enough current supply for both VDD + LED B/L

  c. E/L B/L driven from A.K   directly

LCM   +110V INVERTER

EL Panel Backlight — A — AC←DC — DC +5V — K
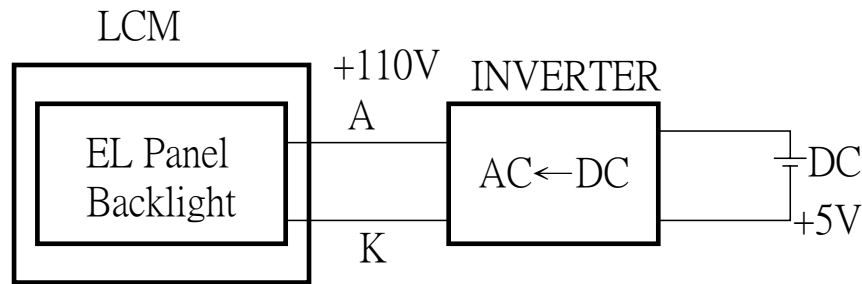
9. Display Control Instruction

The display control instructions control the internal state of the KS0108B. Instruction is received from MPU to KS0108B for the display control. The following table shows various instructions.

Instruction	D/I	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	Display Data								Writes data (DB0:7)into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read Display Data	1	1	Display Data								Reads data (DB0:7) from display data RAM to the data bus.

9.1 Detailed Explanation

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

The display data appears when D is 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.

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

Z address AAAAAA (binary) of the display data RAM is set in the display start line register and displayed at the top of the screen. Figure 2. shows examples of display (1/64 duty cycle) when the start line = 0-3. When the display duty cycle 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.

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

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 1.

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

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.

Status Read

R/W	D/I	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	Busy	0	On/Off	RESET	0	0	0	0

•Busy

When busy is 1, the LSI is executing internal operations. No instruction 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 condition: 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 on condition.

•RESET

RESET = 1 shows that the system system is being initialized. In this condition, no
   instructions except status read can be accepted.

RESET = 0 shows that initializing has system is in the usual operation condition.

Write Display Data

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

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

Read Display Data

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

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

One dummy read is necessary right after the address setting. For details, refer to the explanation of output register in "Function of Each Block".
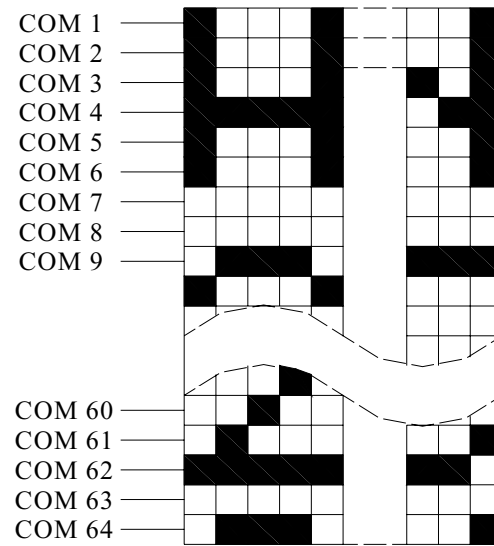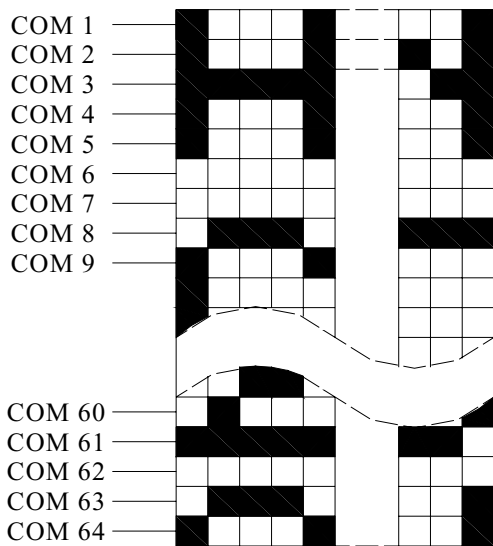
Y Address

0	1	2		61	62	63

DB0 to DB7	page 0	X = 0
DB0 to DB7	page 1	X = 1
DB0 to DB7	page 6	X = 6
DB0 to DB7	page 7	X = 7

Figure 1.

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COM 1
COM 2
COM 3
COM 4
COM 5
COM 6
COM 7
COM 8
COM 9

COM 60
COM 61
COM 62
COM 63
COM 64

Start line = 0

COM 1
COM 2
COM 3
COM 4
COM 5
COM 6
COM 7
COM 8
COM 9

COM 60
COM 61
COM 62
COM 63
COM 64

Start line = 1

COM 1
COM 2
COM 3
COM 4
COM 5
COM 6
COM 7
COM 8
COM 9

COM 60
COM 61
COM 62
COM 63
COM 64

Start line = 3

COM 1
COM 2
COM 3
COM 4
COM 5
COM 6
COM 7
COM 8
COM 9

COM 60
COM 61
COM 62
COM 63
COM 64

Start line = 4

Figure 2.

10. Quality Assurance

Screen Cosmetic Criteria

| No.	Defect	Judgement Criterion	Partition

1	Spots	A) Clear
		
		    Size:d mm Acceptable Qty in active area
		    $d \leqq 0.1$ Disregard
		    $0.1 < d \leqq 0.2$ 6
		    $0.2 < d \leqq 0.3$ 2
		    $0.3 < d$ 0
		Note:Including pin holes and defective dots which must be within one pixel size.
		B) Unclear
		
		    Size:d mm Acceptable Qty in active area
		    $d \leqq 0.2$ Disregard
		    $0.2 < d \leqq 0.5$ 6
		    $0.5 < d \leqq 0.7$ 2
		    $0.7 < d$ 0
			Minor

2	Bubbles in Polarizer	Size:d mm Acceptable Qty in active area
		    $d \leqq 0.3$ Disregard
		    $0.3 < d \leqq 1.0$ 3
		    $1.0 < d \leqq 1.5$ 1
		    $1.5 < d$ 0
			Minor

3	Scratch	In accordance with spots cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.	Minor
4	Allowable Density	Above defects should be separated more than 30mm each other.	Minor
5	Coloration	Not to be noticeable coloration in the viewing area of the LCD panels. Back-light type should be judged with back-light on state only.	Minor

11. Reliability

Content of Reliability Test

No.	Test Item	Content of Test	Test Condition	Applicable Standard
		Environmental Test		
1	High Temperature storage	Endurance test applying the high storage temperature for a long time.	80℃ 200hrs	——
2	Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-30℃ 200hrs	——
3	High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70℃ 200hrs	——
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20℃ 200hrs	——
5	High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	60℃,90%RH 96hrs	——
6	High Temperature/ Humidity Operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	40℃,90%RH 96hrs	——
7	Temperature Cycle	Endurance test applying the low and high temperature cycle. -30℃ 25℃ 80℃ 30min 5min 30min 1 cycle	-30℃/80℃ 10 cycles	——
		Mechanical Test		
8	Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hrs	——
9	Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G Half sign wave 11 msedc 3 times of each direction	——
10	Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air.	115mbar 40hrs	——
		Others		
11	Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V,RS=1.5kΩ CS=100pF 1 time	——

***Supply voltage for logic system=5V. Supply vo

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12.Outline Dimension
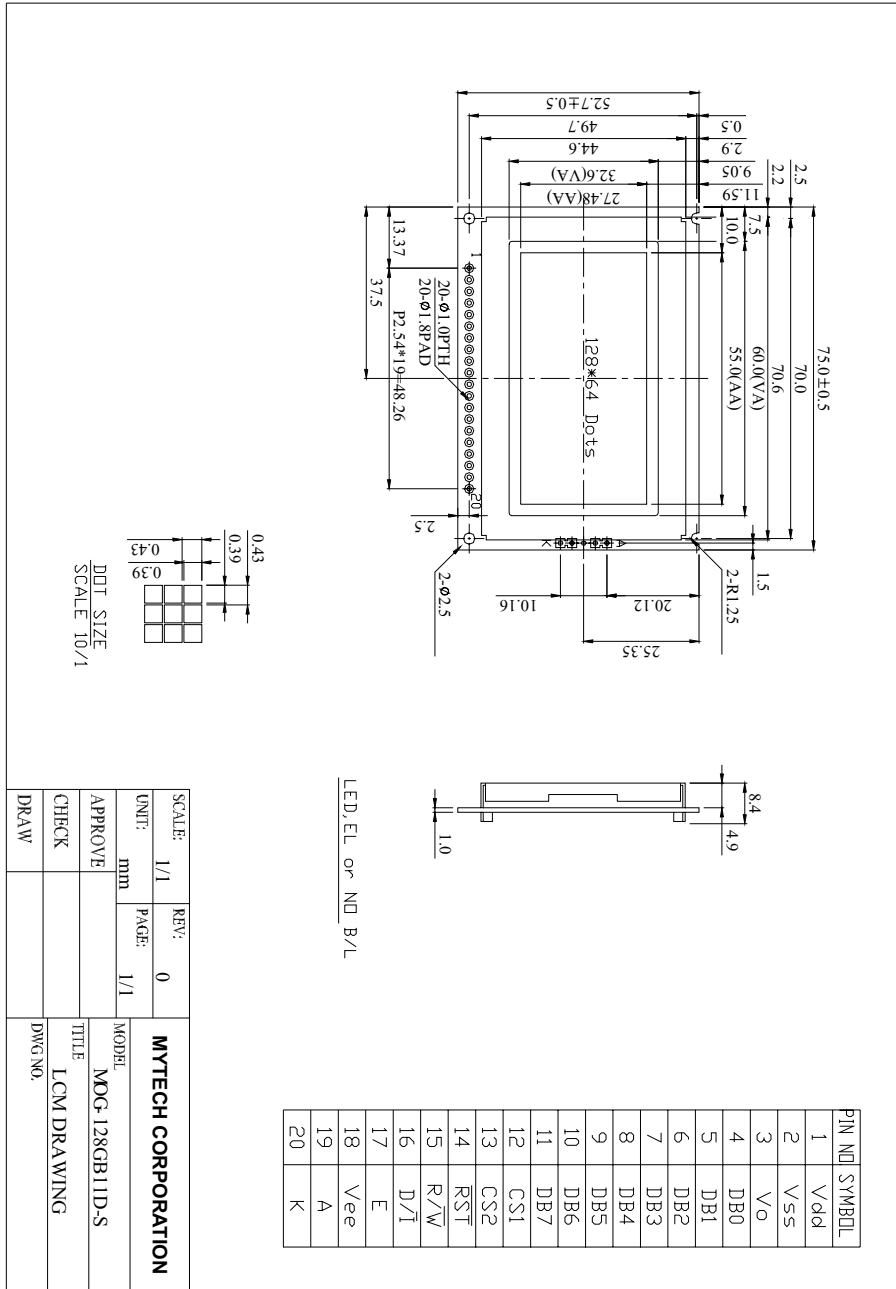
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MODEL	MOG-128GB11D-S
TITLE	LCM DRAWING
DWG NO.	

SCALE:	1/1	REV:	0
UNIT:	mm	PAGE:	1/1
APPROVE			
CHECK			
DRAW			

PIN NO	SYMBOL
1	Vdd
2	Vss
3	Vo
4	DB0
5	DB1
6	DB2
7	DB3
8	DB4
9	DB5
10	DB6
11	DB7
12	CS1
13	CS2
14	RST
15	R/W
16	D/I
17	E
18	Vee
19	A
20	K

DOT SIZE
SCALE 10/1

LED,EL or NO B/L

128*64 Dots