

# **SPECIFICATION**

**Passive Matrix LCD Module**

**( 128 x 64 Dots )**

APPROVED BY

MODEL NO. [JA-SGB12864-YW6M-S](#)

2003-~~06~~-113

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## 1. Features

Display mode: STN POSITIVE, TRANSFLECTIVE, Y-G COLOR.

Display format: 128\*64 DOTS

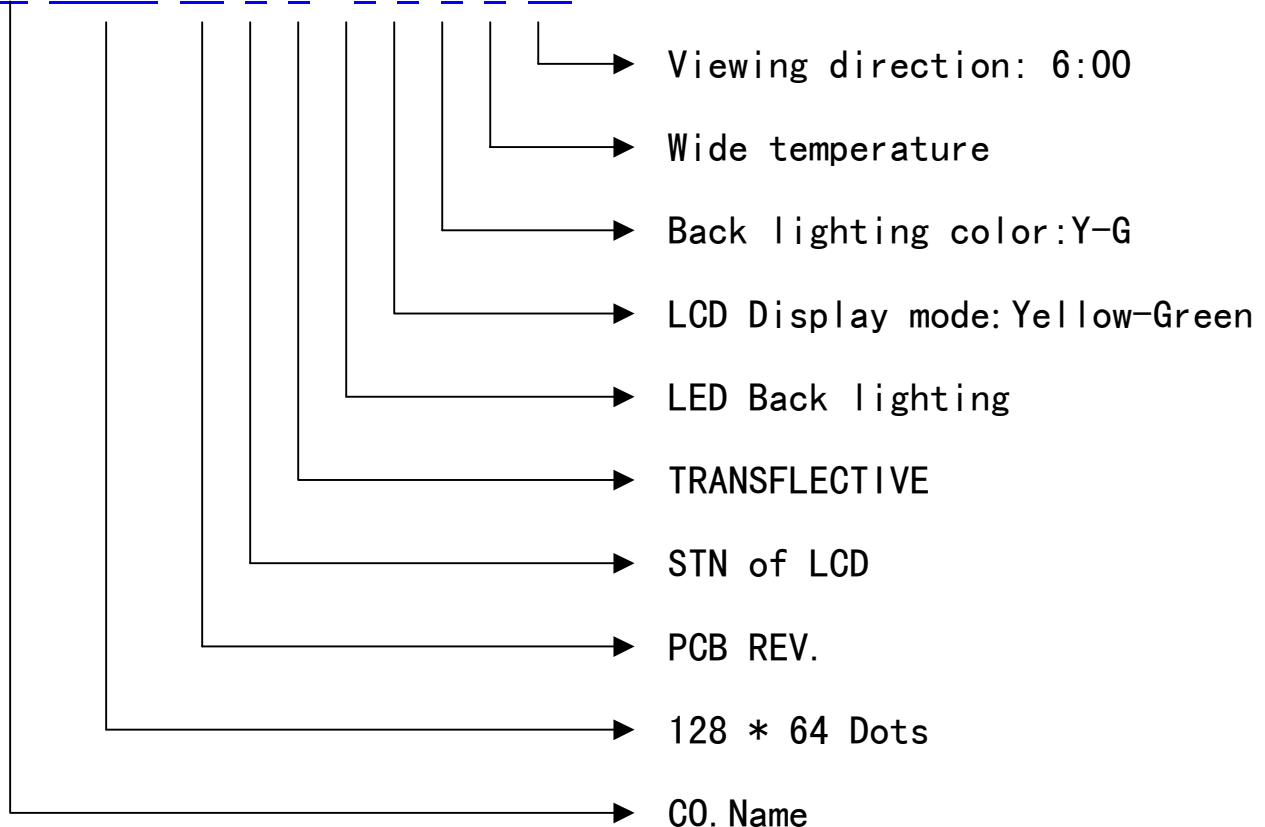
Driving method: 1/64 DUTY, 1/9 BIAS

Viewing direction: 6 CLOCK

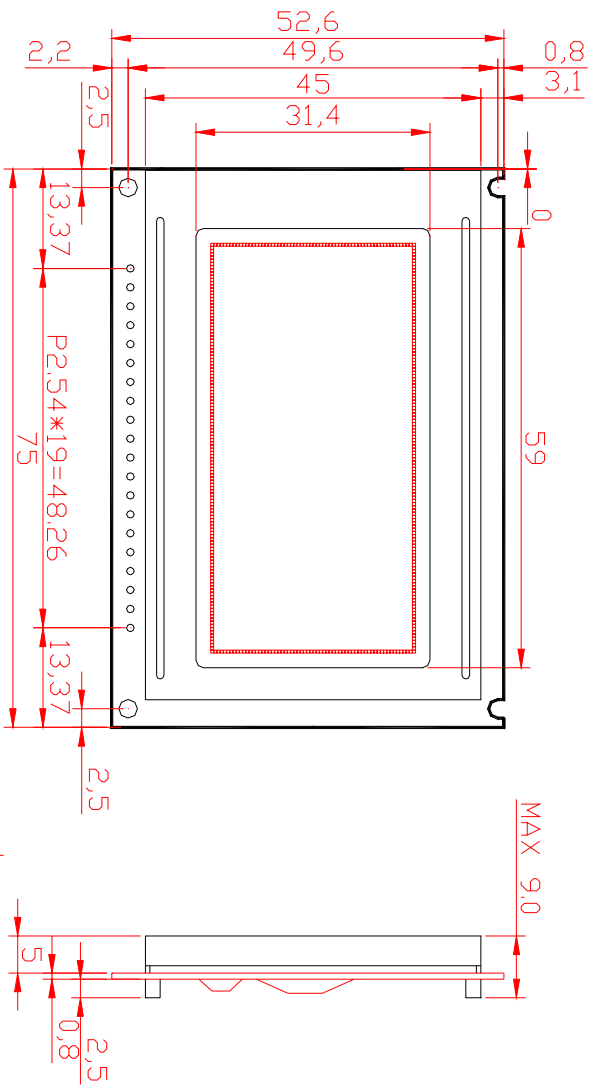
Back lighting: LED unit ( Y-G COLOR )

## 2. Classification Of Module

HQM 12864 05 S 2 L Y Y H 06

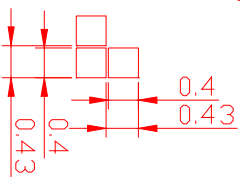


### 3. Engineering Drawing



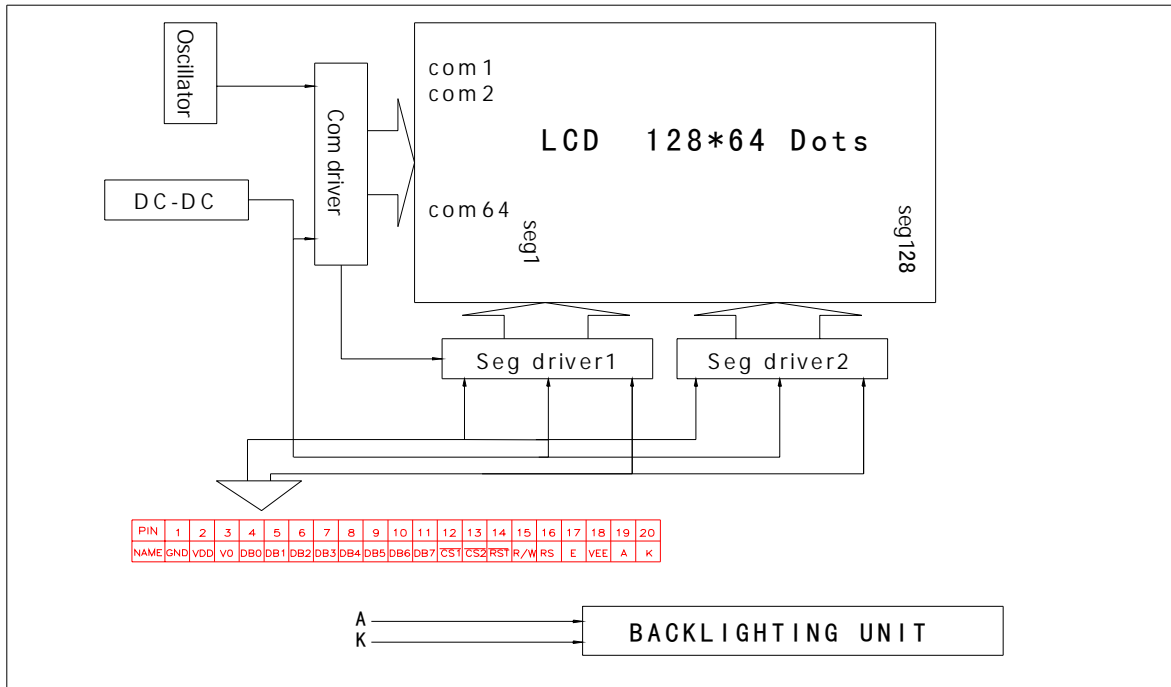
NOTE:

- 1.LCD TYPE: STN POSITIVE,TRANSFLECTIVE,Y-G COLOR.
- 2.DRIVE METHOD: 1/64DUTY,1/9BIAS, 6.0Vlcd.
- 3.VIEWING DIRECTION: 6:00 CLOCK
- 4.OPERATING TEMP: -20 ~ +70°C
- STORAGE TEMP -30 ~ +80°C
- 5.CONTROLLER: KS0107+KS0108x2
- 6.LED (YELLOW-GREEN)BACKLIGHT

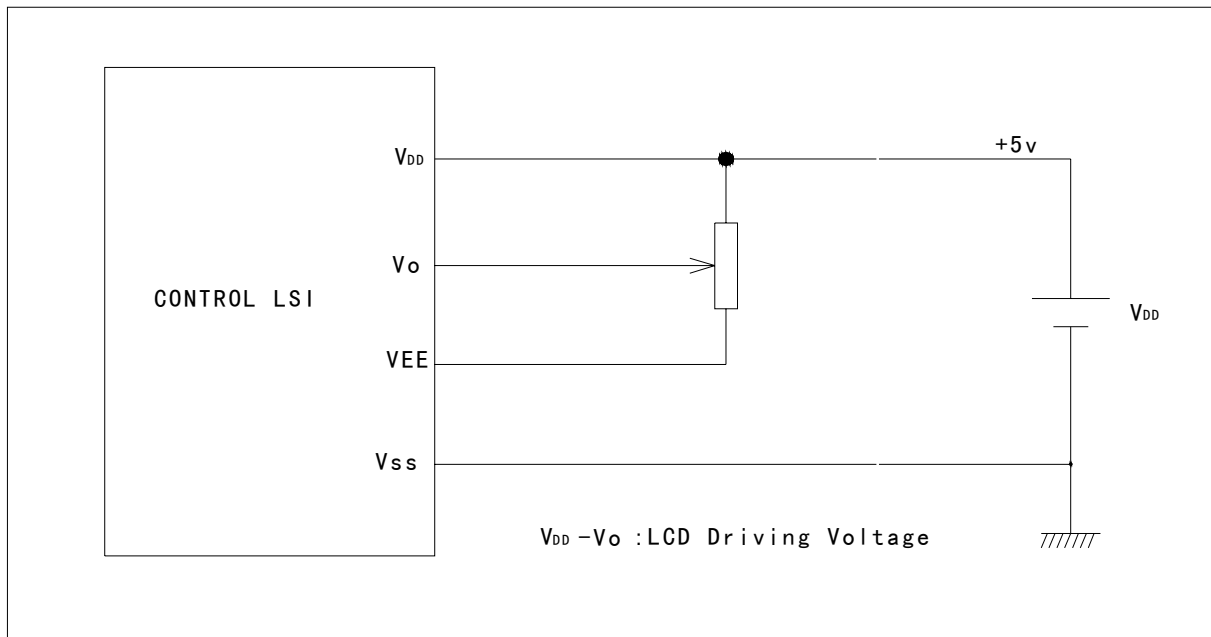


PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NAME	GND	VDD	VO	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	CS1	CS2	RST	R/W	RS	E	VEE	A	K

## 4. Circuit Block Diagram



## 5. Power Supply Block Diagram



## 6. Mechanical Specifications

Item	Specification	Unit
Module Size (W*H*T)	75.0*52.6*9.0 Max	mm
Viewing Area (W*H)	59.0*31.4	mm
Dot Size (W*H)	0.40*0.40	mm
Dot Pitch (W*H)	0.43*0.43	mm
Weight	About 150	g

## 7. Electrical Specifications

### 7-1. Absolute Maximum Ratings

Item		Symbol	Value			Unit	Condition
			Min.	Typ.	Max.		
Supply Voltage	Logic	V <sub>DD</sub>	-0.3	-	+7.0	V	T <sub>a</sub> =25°C
	LCD	V <sub>DD</sub> -V <sub>0</sub>	V <sub>DD</sub> -15	-	V <sub>DD</sub> +0.3	V	T <sub>a</sub> =25°C
Input voltage		V	-0.3	-	V <sub>DD</sub> +0.3	V	T <sub>a</sub> =25°C
Operating temp		T <sub>opr</sub>	-20	-	+60	°C	-
Storage temp		T <sub>stg</sub>	-30	-	+70	°C	-

## 7-2. Electrical Characteristics

Vdd=+5V±10%, Vss=0V, Ta=0°C --50°C

Item		Symbol	Spec. Value			Unit	Condition
			Min.	Typ.	Max.		
Supply Voltage	Logic	VDD-Vss	4.5	5.0	5.5	V	-
	LCD	VDD-V0	-	9.1	-	V	Ta=-20°C θ=10, Φ=0
			8.6	8.8	9.0	V	Ta=25°C θ=10, Φ=0
			-	8.6	-	V	Ta=70°C θ=10, Φ=0
Supply Current	Logic	IDD	-	2.0	2.5	mA	VDD=+5V±10% Vss=0V Ta=25°C
	LCD	Io	-	1.0	1.5	mA	
Power Consumption		PD	-	500	-	mW	
Input Voltage "HIGH" Level		VIH	2.2	-	VDD	V	-
Input Voltage "LOW" Level		VIL	-0.3	-	0.6	V	-
Output Voltage "HIGH" Level		VOH	2.4	-	-	V	-
Output Voltage "LOW" Level		VOL	-	-	0.4	V	-

## 8. Characteristics of Backlighting(LED Unit)

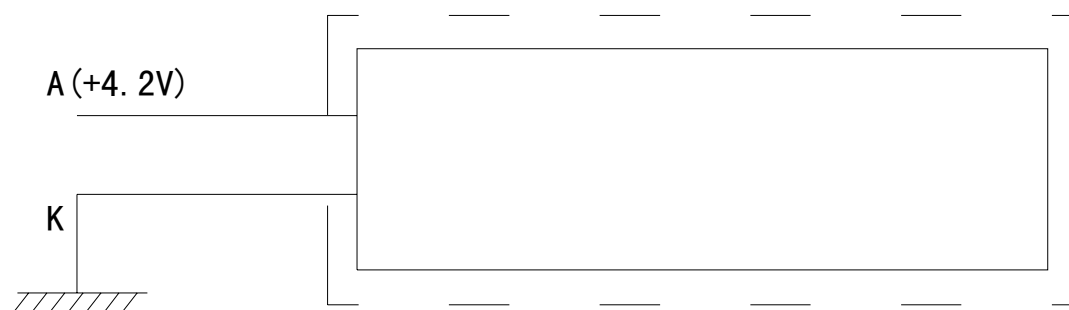
### 8-1. Absolute maximum ratings

Item	Symbol	Condition	Min.	Max.	Unit.
Forward Current	IF	Ta=25°C	-	-	mA
Reverse Voltage	VR	Ta=25°C	-	4.2	V
Power Dissipation	PD	Ta=25°C	-	-	mW

## 8-2. Opto-electric Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	$V_F$	$T_a=25^\circ\text{C}$	3.9	4.2	4.4	V
Luminous	-	$I_F=80\text{mA}$		-	-	$\text{Cd}/\text{m}^2$

## 8-3. LED Circuit Diagram



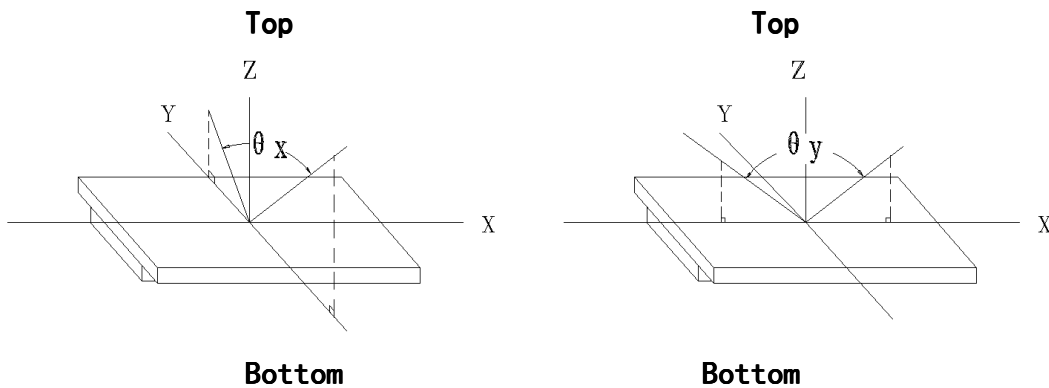
## 9. Electro-Optical Characteristics

### 9.1 Optical Characteristics

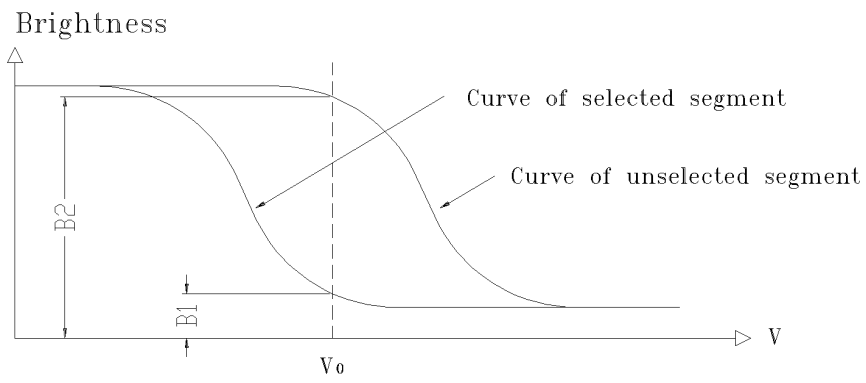
$T_a=25^\circ\text{C}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle	$\theta_x$	$Cr \geq 2$				Deg
	$\theta_y$					
Contrast Ratio	Cr	$\theta_x=0^\circ$ $\theta_y=0^\circ$	4	-	-	
Response Time	Turn on	$\theta_x=0^\circ$ $\theta_y=0^\circ$			250	ms
	Turn off					

## 9.2 Definition of Viewing Angle



## 9.3 Definition of Contrast Ratio

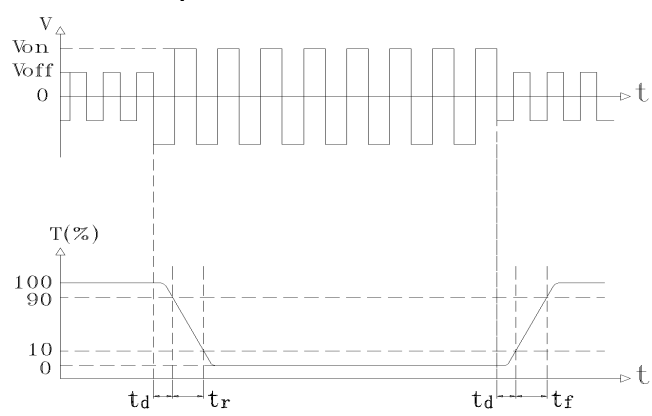


$$\text{Contrast Ratio} = B2/B1 = \frac{\text{unselected state brightness}}{\text{selected state brightness}}$$

### Measuring Conditions:

- 1) Frame frequency: 100.0Hz

## 9.4 Definition of Response time



Turn on time:  $t_{on} = t_d + t_r$       Turn off time:  $t_{off} = t_d + t_r$

### Measuring Condition:

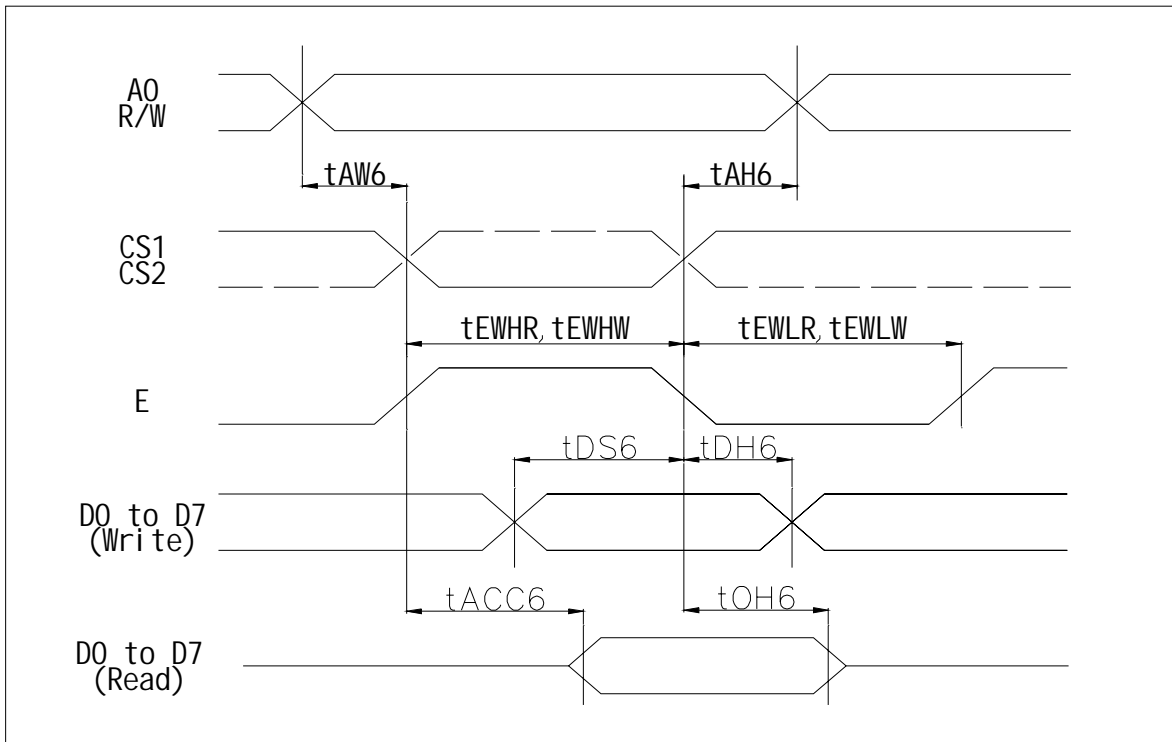
- 1) Operating Voltage: 6.5V
- 2) Frame frequency: 100.0Hz

## 10. Pin Assignment

Pin No.	Symbol	Level	Function
1	V <sub>SS</sub> (GND)	0V	Ground
2	V <sub>DD</sub> (V <sub>CC</sub> )	+5V	Logic Supply Voltage
3	V <sub>O</sub>	/	
3	DB0	H/L	Data Bus Line
4	DB1	H/L	
5	DB2	H/L	
6	DB3	H/L	
7	DB4	H/L	
8	DB5	H/L	
9	DB6	H/L	
10	DB7	H/L	
11	CS0	H/L	Select Master IC
12	CS1	H/L	Select Master IC
13	RES	/	
14	R/W	H/L	H:DATA Read L:Data Write
15	RS	H/L	H:Data Input L:Instruction Input
16	E	H, H→L	Enable Signal
17	VEE	/	
18	A		Power Backlighting
19	K		

# 11. Timing Characteristics

## (1) System Bus Read/Write Characteristics (MPU→LCD MODULE)



(VDD = 4.5 V to 5.5 V, Ta = -40 to 8 °C )

Item	Signal	Symbol	Condition	Rating		Units
				Min	Max	
Address hold time	A0	tAH6		0	—	ns
Address setup time	A0	tAW6		0	—	ns
System cycle time	A0	tCYC6		7254	—	ns
Data setup time	D0 to D7	tDS6		25	—	ns
Data hold time		tDH6		0	—	ns
Access time		tACC6	CL = 100 pF	—	170	ns
Output disable time		tOH6		10	130	ns
Enable pulse width	Read Write	E		2260	—	ns
				tEWHW	1980	—
Enable pulse width	Read Write	E		104	—	ns
				tEWLW	7150	—

## 12. Instruction Set

The KS0108 chip identify the data bus signals by a combination of D/I, R/W, E signals. Command interpretation and execution does not depend on the external clock, but rather is performed through internal timing only.

The interface is placed in a read mode when an “H” signal is input to the R/W terminal and placed in a write mode when a “L” signal is input to the R/W terminal and then the command is launched by inputting a high pulse to the E terminal. (See Timing Characteristics” regarding the timing.)

### (1). Display ON/OFF

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.

R/W	D/I	D7 D6 D5 D4 D3 D2 D1 D0	Setting
0	0	0 0 1 1 1 1 1 0	Display OFF
			Display ON

### (2) Display Start Line

Z address D5 - D0 (binary) of the display data RAM is set in the display start line register and is displayed at the top of the screen.

R/W	D/I	D7 D6 D5 D4 D3 D2 D1 D0	Line address
0	0	1 1 0 0 0 0 0 0	0
			1
			2
			↓
			62
			63

### (3) Set Page (X Address)

X address D2 –D0 (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.

R/W	D/I	D7 D6 D5 D4 D3 D2 D1 D0	Page address
0	0	1 0 1 1 1 0 0 0	0
			1
			↓
			6
			7

#### (4) Set Y Address

Y address D5 - D0 (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.

R/W	D/I	D7 D6 D5 D4 D3 D2 D1 D0	Y address
0	0	0 1 0 0 0 0 0 0	0
		0 0 0 0 0 1	1
		0 0 0 0 1 0	2
		↓	↓
		1 1 1 1 1 0	62
		1 1 1 1 1 1	63

#### (5) Status Read

R/W	D/I	D7	D6	D5	D4	D3	D2	D1	D0
1	0	BUSY	0	ON/OFF	RESET	0	0	0	0

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 on 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 initializing has finished and the system is in the usual operation condition.

#### (6) Write Display Data

Writes 8-bit data D7 – D0 (binary) into the display data RAM. Then Y address is increased by 1 automatically.

R/W	D/I	D7	D6	D5	D4	D3	D2	D1	D0
1	0	Write data							

#### (7) Read Display Data

Reads out 8-bit data D7 – D0 (binary) from the display data RAM. Then Y address is increased by 1 automatically.

R/W	D/I	D7	D6	D5	D4	D3	D2	D1	D0
1	0	Read data							

Instructions	Command Code									Functions		
	R/W	D/I	D7	D6	D5	D4	D3	D2	D1		D0	
(1) Display ON/OFF	0	0	0	0	1	1	1	1	1	0	LCD display ON/OFF 1: ON, 0: OFF	
(2) Display start line	0	0	1	1	Display start line (0-63)						Specifies the RAM line displayed at the top of the screen.	
(3) Set page (X address)	0	0	1	0	1	1	1	Page (0-7)			Sets the page (X address) of RAM at the page (X address) register.	
(4) Set Y address	0	0	0	1	Y address (0-63)						Sets the Y address in the Y address counter.	
(5) Status read	1	0	busy 0 on/off res 0 0 0 0									Reads the status. RESET 1: Reset 0: Normal ON/ OFF 1: Display off 0: Display on Busy 1: Internal operation 0: Ready
(6) Write Display data	0	1	Write data									Writes data DB0 (LSB) to DB7 (MSB) on the data bus into display RAM
(7) Read Display data	1	1	Read data									Reads data DB0 (LSB) to DB7 (MSB) from the display RAM to the data bus.

Note: Busy time varies with the frequency (f CLK) of  $\phi 1$ , and  $\phi 2$ . ( $1/f CLK \leq T_{busy} \leq 3/f CLK$ )