PRODUCT SPECIFICATION

12864L

128×64 GRAPHICS
OLED DISPLAY MODULE

VGY(G)12864L-02 (3V)

VGY(G)12864L-04 (3V)

VGY = **Yellow**

VGY(G)12864L-03 (5V)

VGY(G)12864L-05 (5V)

VGG = **Green**

CONTENT

1   Overview

12864L is an OLED monochrome 128×64 dot matrix display module. The characteristics of this display module are high brightness, self-emission, high contrast ratio, slim/thin outline, wide viewing angle, wide temperature range, and low power consumption.

The module displays data directly from its internal 128x64bits Graphic Display Data RAM(GDDRAM). Data/Commands are sent from general MCU through the hardware selectable 6800-/8080-series compatible Parallel Interface or Serial Peripheral Interface.

The embedded on-chip oscillator and DC-DC voltage converter reduce the number of external components.

2   Features

- ➢ 128×64 pixels
- ➢ High contrast ratio
- ➢ Wide viewing angle
- ➢ Wide range of operating temperature
- ➢ low power consumption
- ➢ 8-bit 8080-Databus or 8-bit 6800-series parallel interface or series peripheral interface(S003 & S005 only have 8-bit 8080-Databus and series peripheral interface)
- ➢ Display data is stored in Display Data RAM from MPU
- ➢ Power supply to logic system: +3V±10%
- ➢ Power supply to OLED driving system: +9V to +16V
- ➢ Built-in Solomon SSD1305 standard OLED controller

3 Mechanical Data

NO.	ITEM	SPECIFICATION	UNIT
1	Dot Matrix	128(Columns) x 64(rows)	
2	Dot Size	0.45(W) x 0.45 (H)	mm
3	Dot Pitch	0.48 (W) x 0.48 (H)	mm
4	Aperture Rate	67.2	%
5	Active Area	61.41 (W) x 30.69 (H)	m^2
6	Panel Size	75(W) x 41.86 (H) x2.16(T)	mm
7	Module Size	75 (W) x 53.5 (H) x 5(MAX) (T)	mm
8	Polarizer	with	
9	Duty	1/64	

4 Recommended Operation Conditions

Symbol	ITEM	MIN	TYP	MAX	UNIT
V_{DD}	Logic supply voltage	2.4	3.0 (I-S002)	3.5	V
		4.5	5.0 (I-S005)	5.5	
V_{CC}	Operating voltage	9	12	16	V
T_{op}	Operating Temp.	-20	-	+70	℃
T_{stg}	Storage Temp	-30	-	+80	℃

5 Electrical Characteristics

symbol	ITEM	Test condition	MIN	TYP	MAX	Unit
I_{CC}	Operating supply Current	VDD=3.0	-	18	-	mA
I_{DD}	Logic supply Current	VCC=12.0	-	-	-	mA
p_T	Total Power	Note:40cd/㎡ T_{op} =25℃	-	-	250	mW
V_{IH}	Digital Input HIGH	-	2.4	-	3.5	Volts
V_{IL}	Digital Input LOW	-	0	-	$0.2V_{DD}$	Volts
F_{FRM}	Frame Frequency					Hz

Note: 40cd/㎡ with polarization film, be equal to 100cd/㎡

6   Module Drawing (12864L-S002, 12864L-S005)
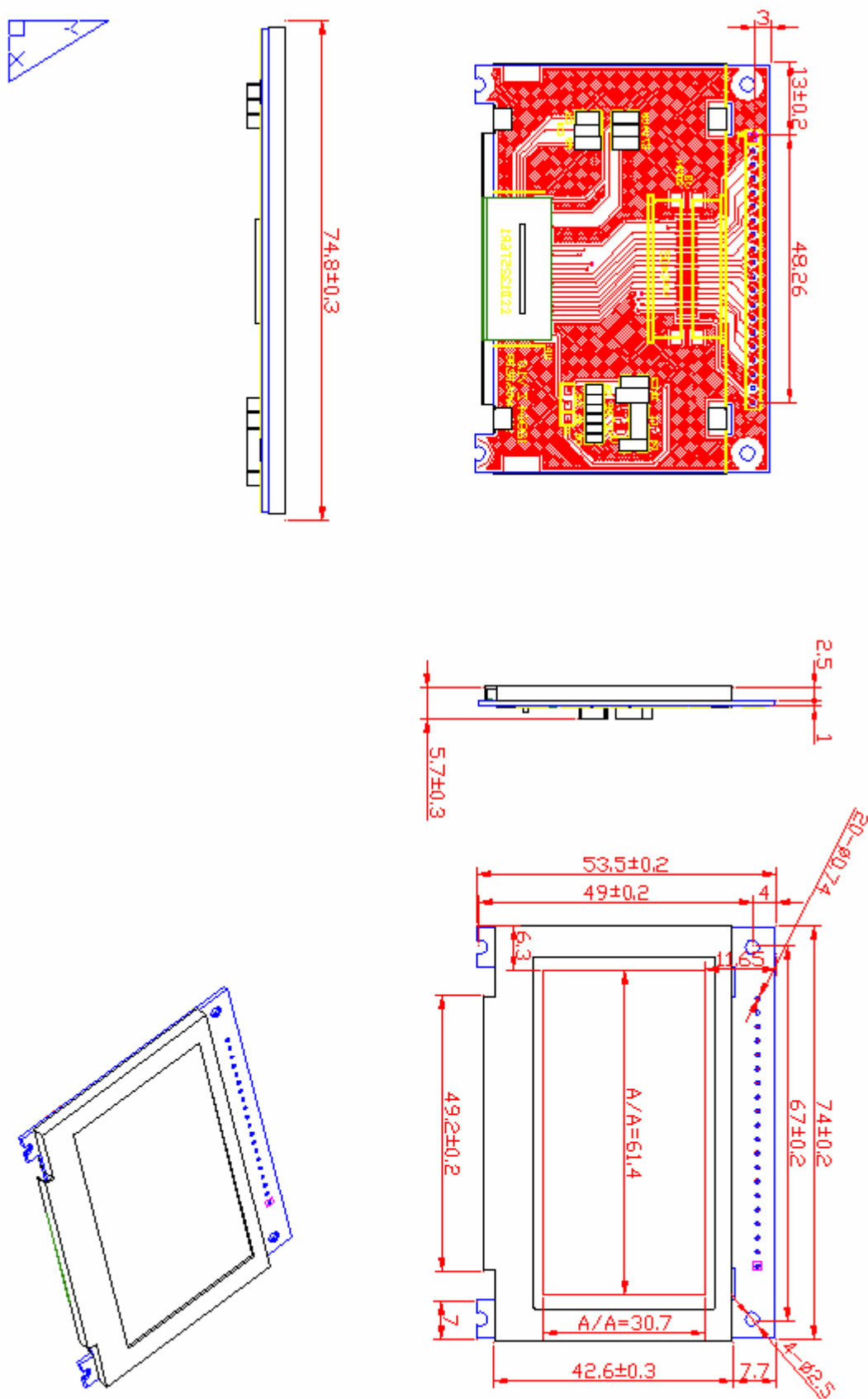
Module Drawing   (VGG12864L-S003)
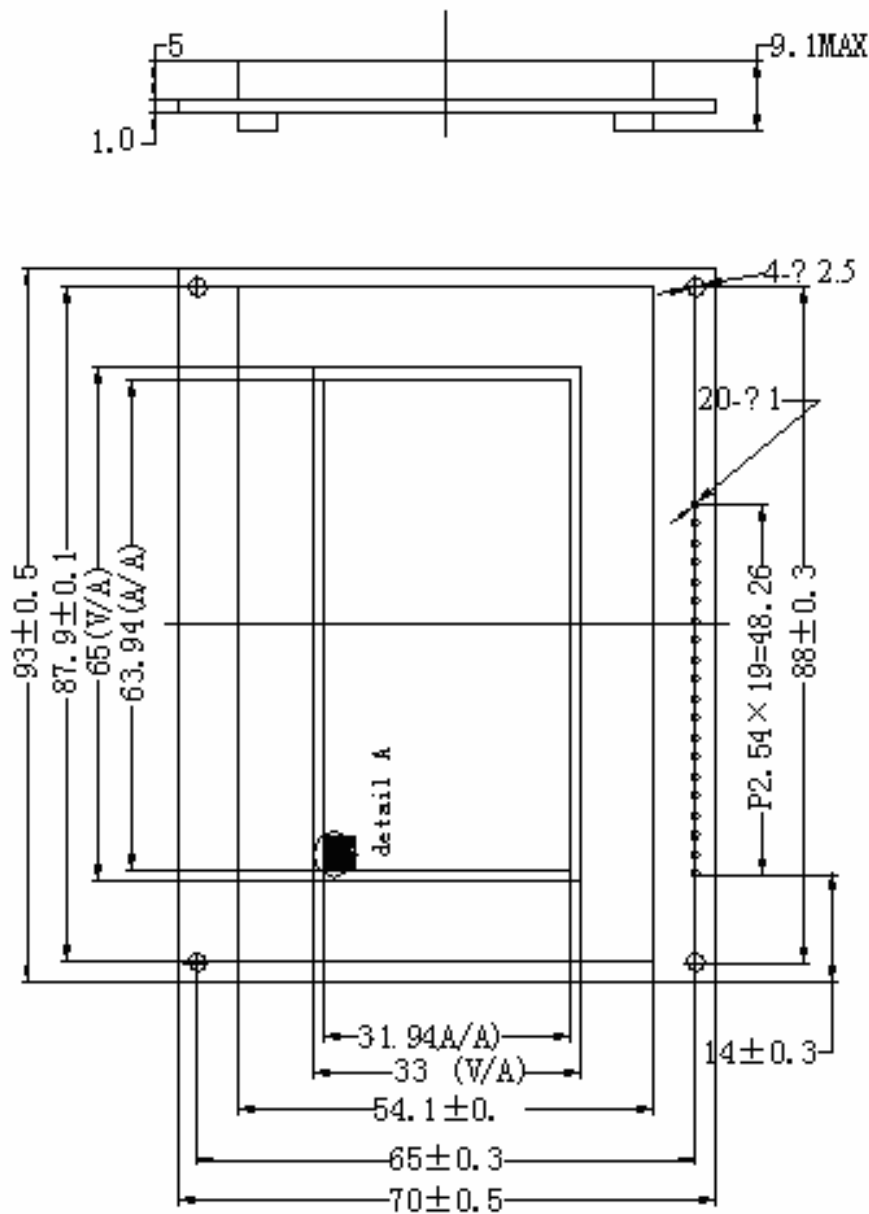
1	GND	
2	VDD	
3	VCC	
4	D\C	
5	R/W	
6	E	
7	DB0	
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	CS	
16	RES	
17	M80	
18	MS	
19	NC	
20	FG	

5
9.1MAX
1.0

93±0.5
87.9±0.1
65(V/A)
63.94(A/A)

detail A

4-?2.5
20-?1
P2.54×19=48.26
88±0.3
14±0.3

31.94A/A)
33 (V/A)
54.1±0.
65±0.3
70±0.5

7   Function Block Diagram

128X64L OLED Module
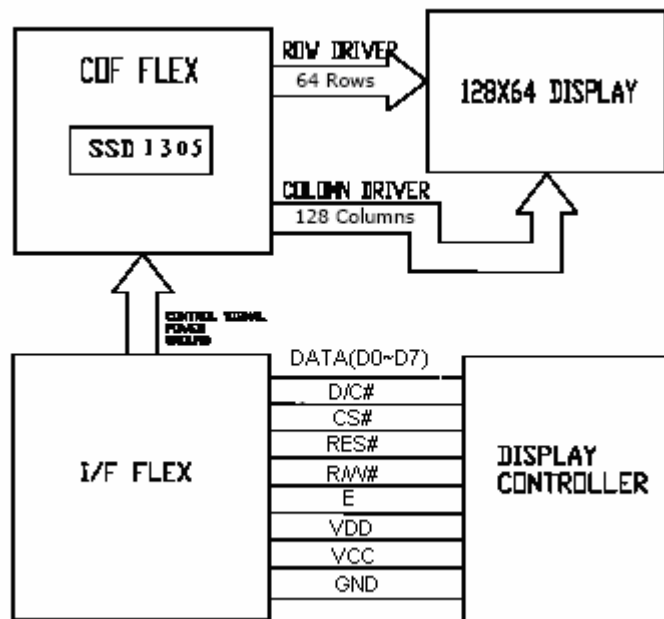
NOTE: Some pins omitted

8   Module Interface

12864L(L-S002 L-S003 L-S005)

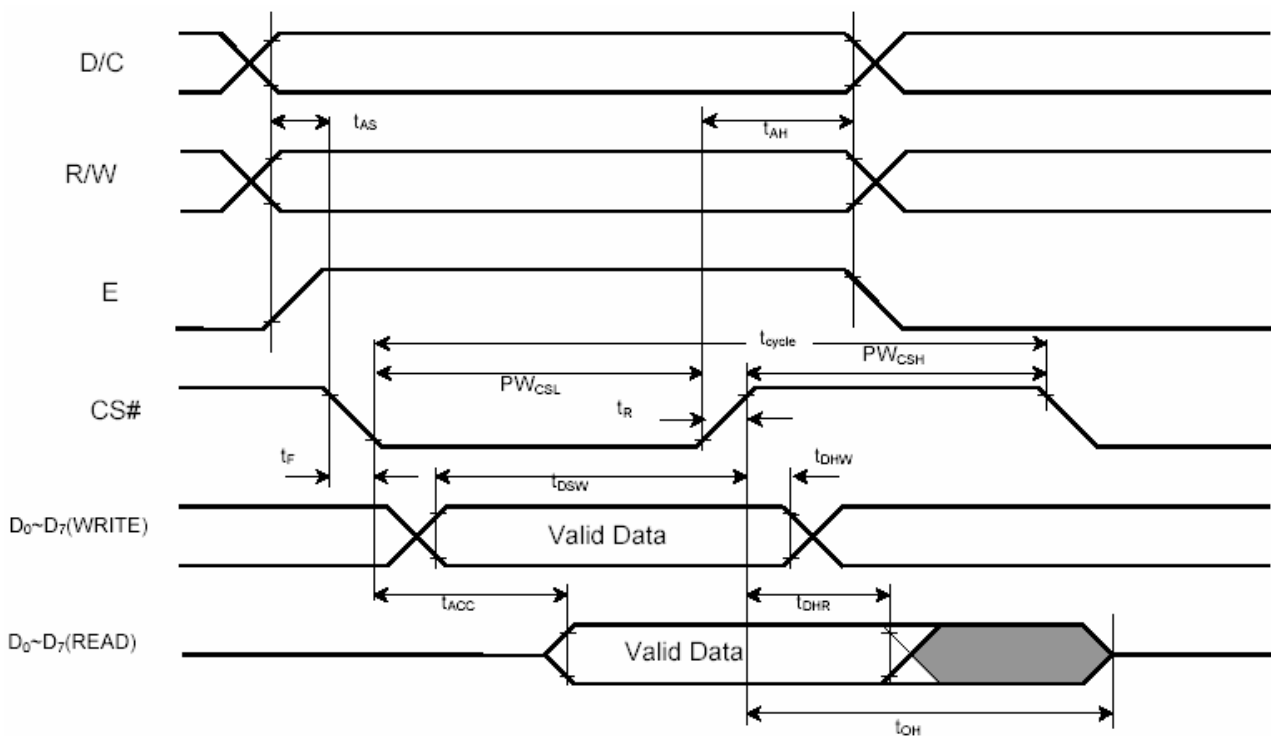| PIN NAME	PIN NO	DESCRIPTION
GND	1	Ground
VDD	2	Logic Voltage +3V(S002) +5V(S003 S005)
VCC	3	OLED drive voltage +12V (Don't care.)
D/C#	4	Data/Command Select. This is the Data/Command control pin. When it is pulled HIGH, the input at D7-D0 is treated as display data. When it is pulled LOW, the input at D7-D0 is transferred to the command registers. For detail relationship to MCU interface signals, please refer to the Timing Characteristics Diagrams.
R/W#	5	This is a MCU interface input pin. When 6800-series Parallel Interface mode is selected, this pin is used as Read/Write (R/W) selection input. Pull this pin to HIGH for read mode and pull it to LOW for write mode. When 8080-series Parallel Interface mode is selected, this pin is used as Write (WR#) selection input. Pull this pin to LOW for write mode. Data write operation is initiated when this pin is pulled LOW and the CS# is pulled LOW.

E(RD#)	6	This is a MCU interface input pin. When 6800-series Parallel Interface is selected, this pin is used as Enable (E) signal. Read/Write operation is initiated when this pin is pulled HIGH and the CS# pin is pulled LOW. When 8080-series Parallel Interface is selected, this pin is used to receive the Read Data (RD#)signal. Data read operation is initiated when this pin is pulled LOW and CS# pin is pulled LOW.
D0-D7	7-14	These are 8-bit bi-directional data bus to be connected to the microprocessor's data bus. When serial interface mode is selected, D1 will be the serial data input, SDIN, and D0 will be the serial clock input, SCLK.
CS#	15	Chip Select,active low
RES#	16	Reset,active low
M80/68#	17	These are MCU interface input selection pins. S003 & S005 only have 8-bit 8080-Databus and series peripheral interface. See the following table for selecting different interfaces:

MS	18	**Ttable**	6800-paralle interface	8080-parallel interface	Serial interface
		M80/68#	0	1	0
		MS	1	1	0

NC	19	
FG	20	Frame Ground

9   Timing Characteristics

VGG12864L

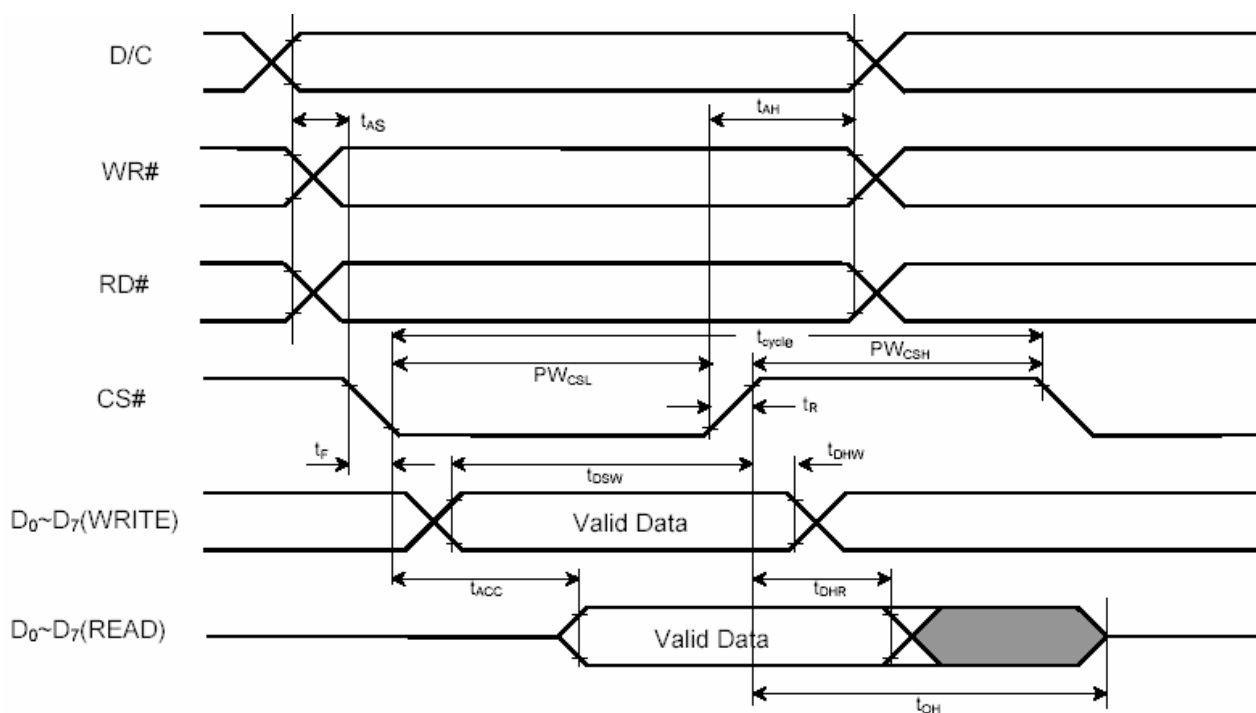6800-Series MPU Parallel Interface Timing Characteristics (VDD - VSS = 2.4 to 3.5V, TA =25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{AS}	Address Setup Time	0	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	15	-	-	ns
t_{DHR}	Read Data Hold Time	20	-	-	ns
t_{OH}	Output Disable Time	-	-	70	ns
t_{ACC}	Access Time	-	-	140	ns
PW_{CSL}	Chip Select Low Pulse Width (read) Chip Select Low Pulse Width (write)	120 60	-	-	ns
PW_{CSH}	Chip Select High Pulse Width (read) Chip Select High Pulse Width (write)	60 60	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns

6800-series MPU parallel interface characteristics(S002)

8080-Series MPU Parallel Interface Timing Characteristics (VDD - VSS = 2.4 to 3.5V, TA =25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{AS}	Address Setup Time	0	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	15	-	-	ns
t_{DHR}	Read Data Hold Time	20	-	-	ns
t_{OH}	Output Disable Time	-	-	70	ns
t_{ACC}	Access Time	-	-	140	ns
PW_{CSL}	Chip Select Low Pulse Width (read) Chip Select Low Pulse Width (write)	120 60	-	-	ns
PW_{CSH}	Chip Select High Pulse Width (read) Chip Select High Pulse Width (write)	60 60	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns

8080-series MPU parallel interface characteristics(S002 S003 S005)

Serial Interface Timing Characteristics (VDD - VSS = 2.4 to 3.5V, TA = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	250	-	-	ns
t_{AS}	Address Setup Time	150	-	-	ns
t_{AH}	Address Hold Time	150	-	-	ns
t_{CSS}	Chip Select Setup Time	120	-	-	ns
t_{CSH}	Chip Select Hold Time	60	-	-	ns
t_{DSW}	Write Data Setup Time	100	-	-	ns
t_{DHW}	Write Data Hold Time	100	-	-	ns
t_{CLKL}	Clock Low Time	100	-	-	ns
t_{CLKH}	Clock High Time	100	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns
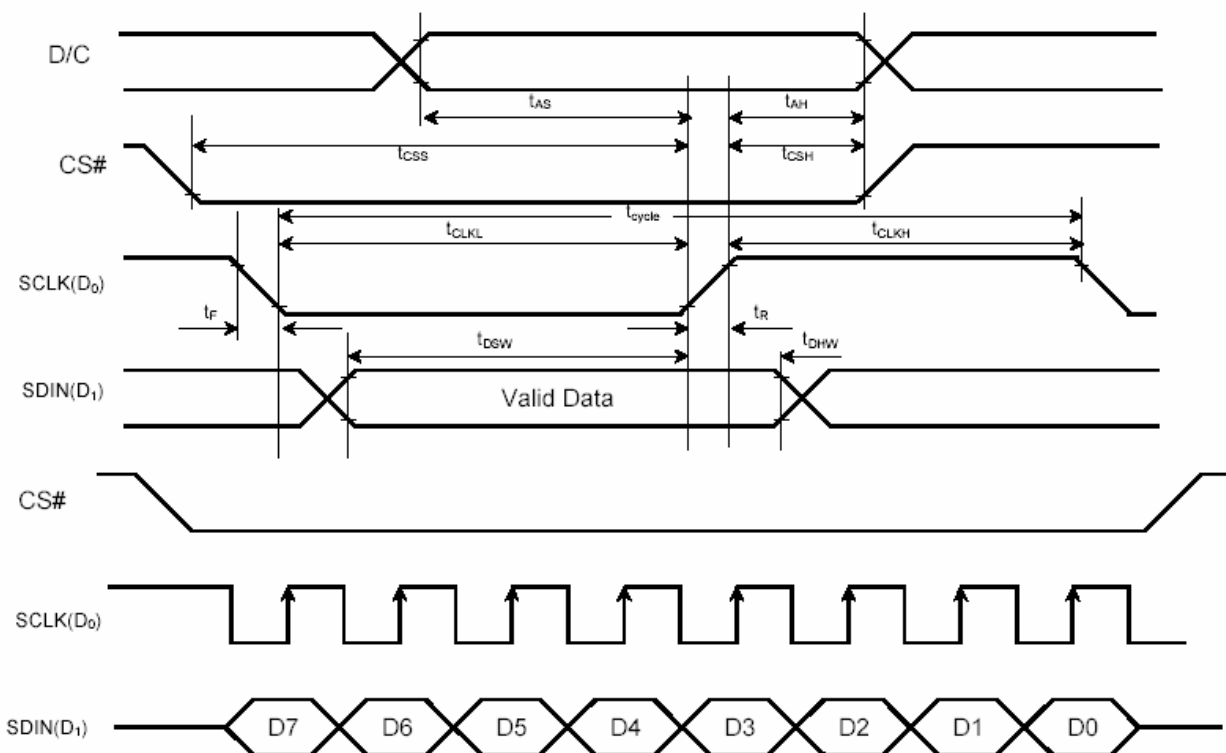
Serial interface characteristics(S002 S003 S005)

10 Display Control Instruction

Table 12 - Command Table

Command table (D/C =0, R/W (WR#)=0, E (RD#)=1)

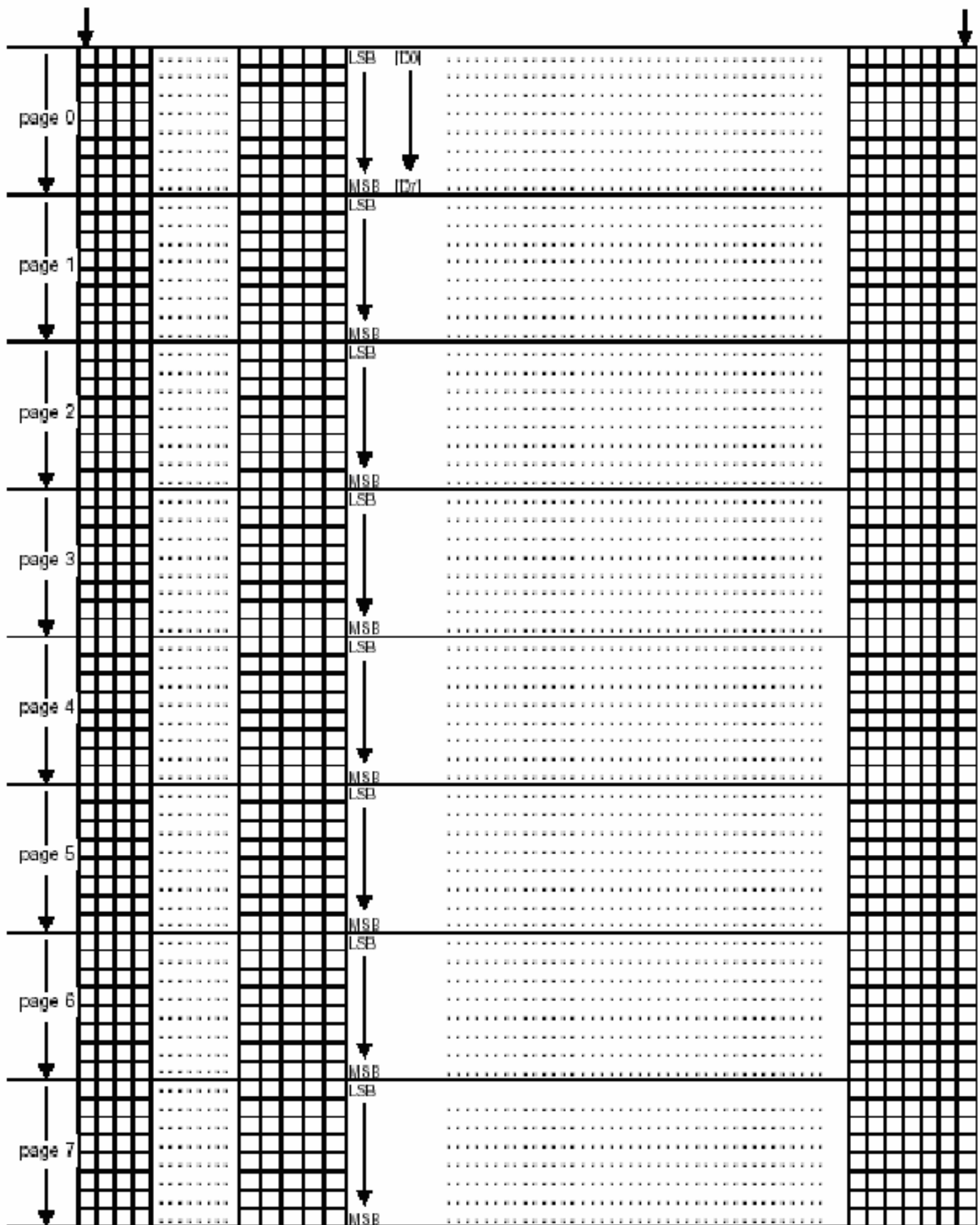| Bit Pattern	Command	Description
0000 X3X2X1X0	Set Lower Column Address **	Set the lower nibble of the column address register using X3X2X1X0 as data bits. The initial display line register is reset to0000b after POR.
0001 X3X2X1X0	Set Higher Column Address **	Set the higher nibble of the column address register using X3X2X1X0 as data bits. The initial display line register is reset to 0000b after POR.
00101111	Activate horizontal scroll	Start horizontal scrolling
00101110	Deactivate horizontal scroll	Stop horizontal scrolling

001001100 A[2:0] B[2:0] C[1:0] D[2:0]	Horizontal scroll setup	A[2:0] Set the number of column scroll per step Valid value: 001b, 010b, 011b, 100b
		B[2:0] Define start page address
		C[1:0] Set time interval between each scroll step in terms of frame frequency
		    00b – 12 frame
		    01b – 64 frames
		    10b – 128 frames
		    11b – 256 frames
		D[2:0] Define end page address Set the value of D[2:0] larger or equal to B[2:0]

10000001 A[7:0]	Set Contrast Control Register **	Double byte command to select 1 out of 256 contrast steps. Contrast increases as the value increases. (POR = 80h)
1010010X0	Set Entire Display ON/OFF **	X0=0: normal display (POR) X0=1: entire display ON
1010011X0	Set Normal/Inverse Display **	X0=0: normal display (POR) X0=1: inverse display
10101000 A[5:0]	Set Multiplex Ratio **	The next command, A[5:0] determines multiplex ratio N from 16MUX-64MUX, POR= 64MUX
1010111X0	Set Display ON/OFF **	X0=0: turns OFF OLED panel (POR) X0=1: turns ON OLED panel
1011X3X2X1X0	Set Page Address **	Set GDDRAM Page Address (0~7) for read/write using

		X3X2X1X0
1100X3 * * *	Set COM Output Scan Direction **	X3=0: normal mode (POR) Scan from COM 0 to COM [N –1] X3=1: remapped mode. Scan from COM [N-1] to COM0 Where N is the Multiplex ratio.
11010011 A[5:0]	Set Display Offset **	Set vertical scroll by COM from 0-63. The value is reset to 00H after POR.
11011001 X7X6X5X40010	Set Pre-charge period	Set length of pre-charge period in number of DCLK Default value of X7X6X5X4 is 0010b
11011010 000X40010	Set COM pins hardware configuration	X4=0, Sequential COM pin configuration (i.e. COM31, 30, 29….0 ; SEG0-132; COM31,32….62,63) X4=1(POR), Alternative COM pin configuration (i.e. COM62,60,58,…2,0; SEG0-132;COM1,3,5…61,63)
11100010	Reserved	Reserved
11100011	NOP **	Command for No Operation

Column address 00H

Column address 7FH

page 0

page 1

page 2

page 3

page 4

page 5

page 6

page 7

LSB   [D0]

MSB   [D7]

LSB

MSB

LSB

MSB

LSB

MSB

LSB

MSB

LSB

MSB

LSB

MSB

LSB

MSB

12　　Precautions for operation and Storage

12.1　Precautions for Operation

(1) Since OLED panel is made of glass, in order to prevent from glass broken, please do not apply any mechanical shock or impact or excessive force to it when installing the OLED module. Any strong mechanical impact due to falling dropping etc. may cause damage (breakage or cracking).

(2) The polarizer on the OLED surface is made of soft material and is easily scratched. Please take most care when handing.

(3) If OLED surface is contaminated, please wipe it off gently by using moisten soft cloth with normal ethanol, do not use acetone, ketone, isopropyl alcohol or water. If there is saliva or water on the OLED surface, please wipe it off immediately.

(4) When handling OLED module, please be sure that the body and the tools are properly rounded. And do not touch I/O pins with bare hands or contaminate I/O pins, it will cause disconnection or defective insulation of terminals.

(5) Do not attempt to disassemble or process the OLED module.

(6) OLED module should be used under recommended operating conditions shown in the specification. Since the higher voltage leads to the shorter lifetime, be sure to use the specified operating voltage.

(7) Foggy dew, moisture condensation or water droplets deposited on surface and contact terminals will cause polarizer stain or damage, the deteriorated display quality and electrochemical reaction then leads to the shorter life time and permanent damage to the module probably. Please pay attention to the environmental temperature and humidity.

12.2　Soldering

(1) Use the high quality solder. (60-63% tin mixed with lead)

(2) Iron: no higher than 260℃ and less than 3~4 sec during soldering.

(3) Soldering: only to the I/O terminals.

(4) Rewiring: no more than 3 times.

12.3　Precautions for Storage

(1) Please store OLED module in a dark place, avoid exposure to sunlight, the light of fluorescent lamp or any ultraviolet ray.

(2) Keep the environment temperature at between 10°C and 35°C and the relative humidity less than 60%. Avoid high temperature, high humidity.

(3) That keeps the OLED modules stored in the container shipped from supplier before using them is recommended.

(4) Do not leave any article on the OLED module surface for an extended period of time.

12.4　Warranty period

VT Co. Ltd. warrants for a period of 12 months from the shipping date when stored or used under normal condition.

12.5   Test Status

TEST ITEM	TEST CONDITION	QUANTITY
High temperature (storage)	70°C,240 hours	3pcs
Humidity (storage)	+85°C, 100%RH, 24hours	3pcs
Low temperature (storage)	–25℃,120 hours	3pcs
Low temperature (operating)	-25°C, 120 hours	2pcs
High temperature (operating)	70°C, 120hours	2pcs

Note: After test 2 hours (room temperature), check function & appearance.