SUNLIKE DISPLAY   Model No: SD1602H

GENERAL SPECIFICATION

ITEM	DESCRIPTION		
Product No	SD1602HUOB-XA-G-G		
LCD Type	☐ STN Gray Positive	STN Yellow Green Positive	☐ STN Blue Negative
	☐ TN Negative	☐ TN Positive	
	☐ FSTN Negative White & Black	☐ FSTN Positive Black & White	
Rear Polarizer	☐ Reflective	Transflective	☐ Transmissive
Backlight Type	☐ NO B/L	LED	☐ CCFL	☐ EL
Backlight Color	☐ Yellow Green	Orange	☐ White	☐ Blue Green
View Direction	6 O'clock		☐ 12 O'clock
Temperature Range	Normal		☐ Wide
Frame	☐ Black		☐ Silver

TO BE VERY CAREFUL !

The LCD driver ICs are made by CMOS process, which are very easy to be damaged by static charge, make sure the user is grounded when handling the LCM.

SUNLIKE DISPLAY — Model No: SD1602H

Drawing dimensions (mechanical outline):

- 26.0±0.5
- 3.5 / 20.5 / 2.0
- 3.5 / 18.0 / 4.5
- 4.5 / VA16.0 / 5.5
- 3.0 / 11.5
- 66.0±0.5
- 56.0
- 54.75
- VA 52.0
- 46.86
- 5.0
- 5.625
- 7.0
- P2.54*15=38.1
- 16-φ1.0 (Padφ1.8)
- 2.0
- 1.0
- 12.0
- 2-φ4.0 (Padφ8.0)
- 12.5 / 13.5

Detail (SCALE:4/1):
- 5.94
- 5.56
- 0.66
- 0.04
- 2.96
- 2.46
- 0.46
- 0.04

Side view:
- 6.5±0.5
- 2.7
- 1.6
- HEAT SEAL

SUNLIKE DISPLAY

CUSTOMER APVL		
DWN Karin	DATE 2000.08.11	
CHKD Hsu	DATE 2000.08.11	UNIT mm
APVD	DATE	SCALE 1/1

TITLE MODULE
MODEL SD1602H
DWG NO SD-0005
REV 1
PAGE 1/1

TOLERANCE
- X. ±0.30
- .X ±0.20
- .XX±0.05

NOTE	ITEM	CONTENT	DATA	REV

Pin assignment:

PIN NO	SIGNAL
1	VSS
2	VDD
3	VO
4	RS
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	A
16	K

ABSOLUTE MAXIMUM RATING

(1) Electrical Absolute Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply for Logic	V_{DD}-V_{SS}	-0.3	7.0	Volt	
Power Supply for LCD	V_{DD}-V_{O}	-0.3	10.0	Volt	
Input Voltage	V_{I}	-0.3	V_{DD}	Volt	
LED Power Dissipation	P_{AD}	-	258	mW	
LED Forward current	I_{AF}	-	60	mA	
LED Reverse Voltage	V_{R}	-	5	V	

(2) Environmental Absolute Maximum Ratings

Item	Normal Temperature				Wide Temperature			
	Operating		Storage		Operating		Storage	
	Min,	Max.	Min,	Max.	Min,	Max.	Min,	Max.
Ambient Temperature	0	+50	-20	+70	-20	+70	-30	+80
Humidity(without condensation)	Note 2,4		Note 3,5		Note 4,5		Note 4,6	

Note 2   Ta   50   : 80% RH max

　　　　Ta>50   : Absolute humidity must be lower than the humidity of 85%RH at 50

Note 3   Ta at -20   will be<48hrs at 70   will be <120hrs when humidity is higher than 70%.

Note 4   Background color changes slightly depending on ambient temperature. This phenomenon
　　　　is reversible.

Note 5   Ta   70   : 75RH max

　　　　Ta>70   : absolute humidity must be lower than the humidity of 75%RH at 70

Note 6   Ta at -30   will be <48hrs, at 80   will be <120hrs when humidity is higher than 70%.

SUNLIKE DISPLAY　　Model No: SD1602H

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Power Supply for Logic	V_{DD}-V_{SS}	-	4.5	5.0	5.5	Volt	
Input Voltage	V_{IL}	L level	0	-	0.6	Volt	
	V_{IH}	H level	2.2	-	V_{DD}	Volt	
LCM Recommend LCD Module Driving Voltage	V_{DD} –V_O	Ta　0	-	-	-	Volt	
		Ta　25	4.2	4.5	4.8		
		Ta　50	-	-	-		
Power Supply Current for LCM	I_{DD}	V_{DD} =5.0V V_{DD}-V_O =4.5V	-	2.0	3.0	mA	
LED Forward Voltage	V_F	If　40 mA	-	3.8	4.3	Volt	
LED Forward Current	I_F	-	-	40	-	mA	
LED Reverse Current	I_R	VR=5V	-	-	0.2	mA	

OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Viewing angle range	f(12 o'clock)	When Cr 1.4	-	20	-	Degree	9,10
	b(6 o'clock)		-	40	-		
	l(9 o'clock)		-	30	-		
	r(3 o'clock)		-	30	-		
Rise Time	Tr	V_{DD}-V_O =4.5V Ta=25		200		mS	
Fall Time	Tf			250			
Frame frequency	Frm		-	64	-	Hz	8,10
Contrast	Cr		-	3.0	-		7
The Brightness Of Backlight	L	IF=40 mA	80	100	-	cd/	
Peak Emission Wavelength	P		580	585	590	nm	

SUNLIKE DISPLAY   Model No: SD1602H

MECHANICAL SPECIFICATION

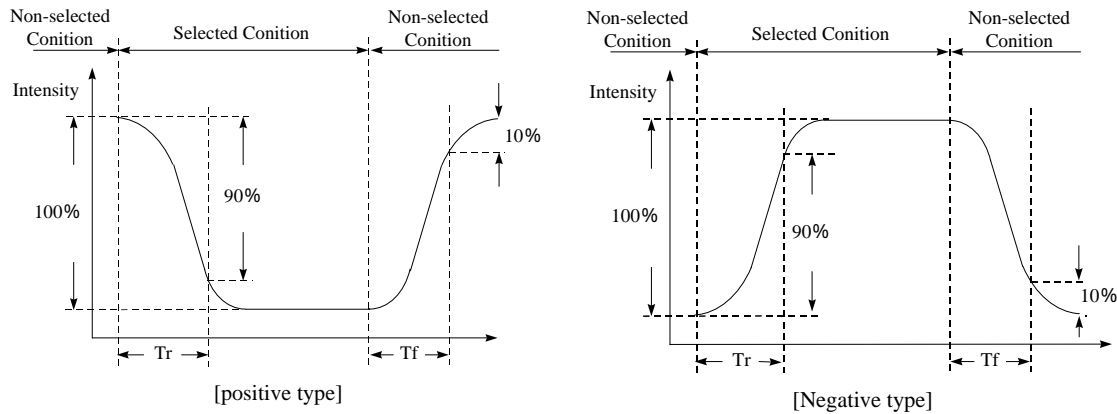| ITEM	DESCRIPTION
Product No.	SD1602H
Module Size	66.0(W)×26.0(H)×8.5 max(D)
View Area	52.0(W)×16.0(H)
Dot Size	0.46(W)mm×0.66(H)mm
Dot Pitch	0.50(W)mm×0.70(H)mm
Display Format	16 characters (W)×2 lines (H)
Duty Ratio	1/16 Duty
Controller	ST7066U or Equivalent

INTERFACE PIN ASSIGNMENT

Pin No.	Pin Out	Level	Description
1	VSS	0V	Power Supply Ground
2	VDD	5V	Power Supply Voltage
3	VO	---	Power Supply Voltage For LCD
4	RS	H/L	Register Select
5	R/W	H/L	Read / Write
6	E	H,H L	Enable Signal
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	A	3.8V	LED Power Supply (+)
16	K	0V	LED Power Supply ( )

[Note 7] Definition of Operation Voltage (Vop)

[positive type]

[Negative type]
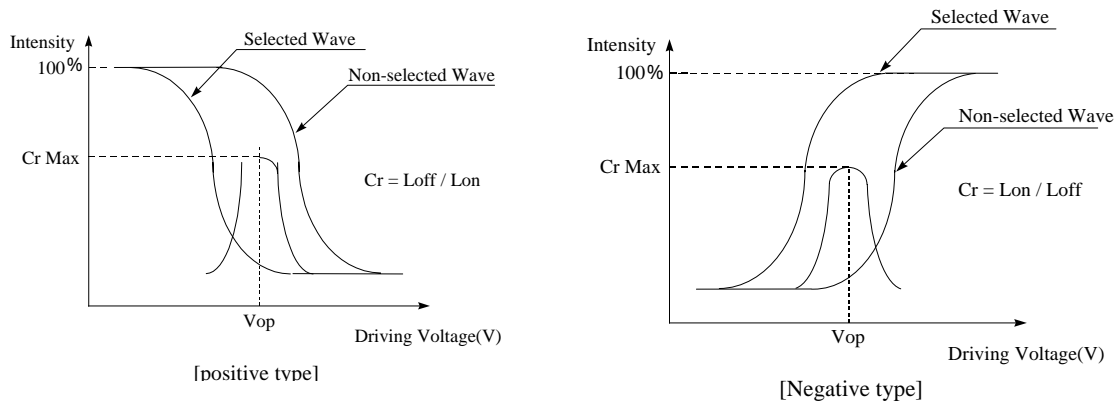
[Note 8] Definition of Response Time (Tr, Tf)

[positive type]

[Negative type]

Conditions:

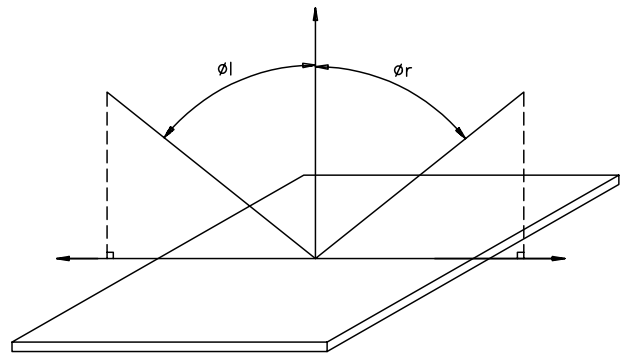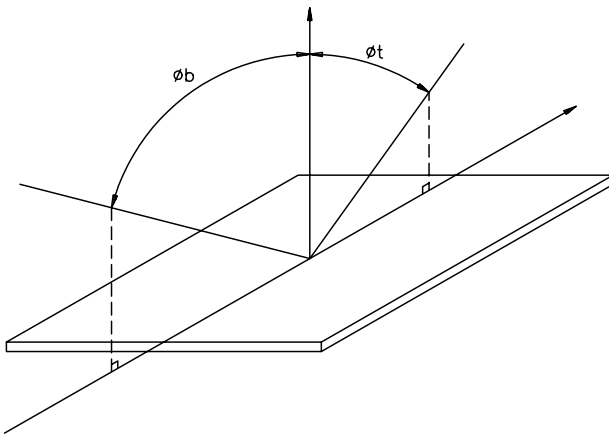Operating Voltage : Vop   Viewing Angle(　,　): 0° , 0°

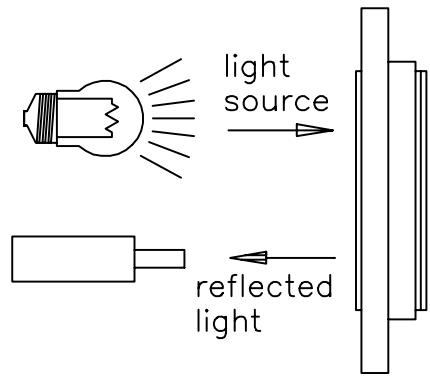Frame Frequency : 64 Hz   Driving Wave form : 1/N duty, 1/a bias

[Note 9] Definition of Viewing Direction
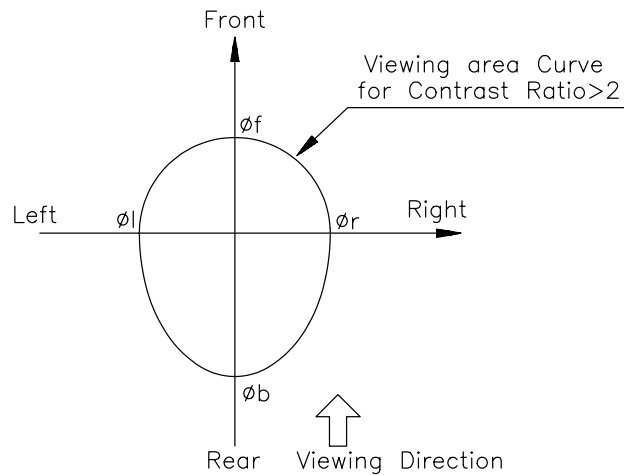
[Note 10] Definition of viewing angle
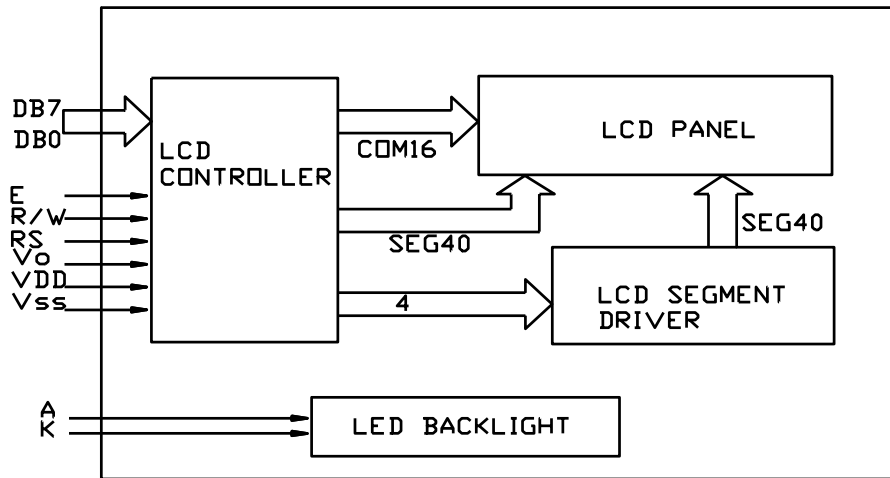

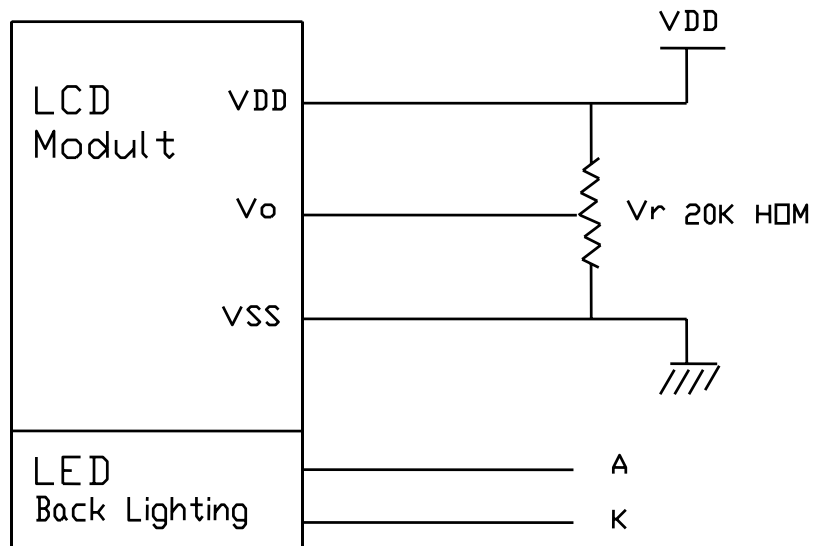**[Note 11] Description of Measuring Equipment**

Reflective type
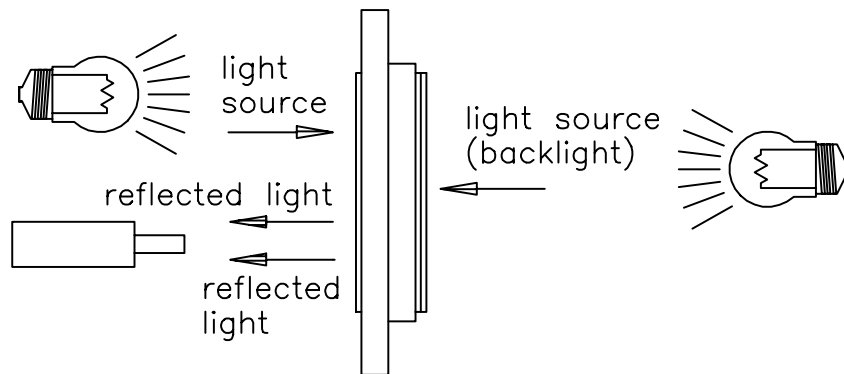
Transflective type
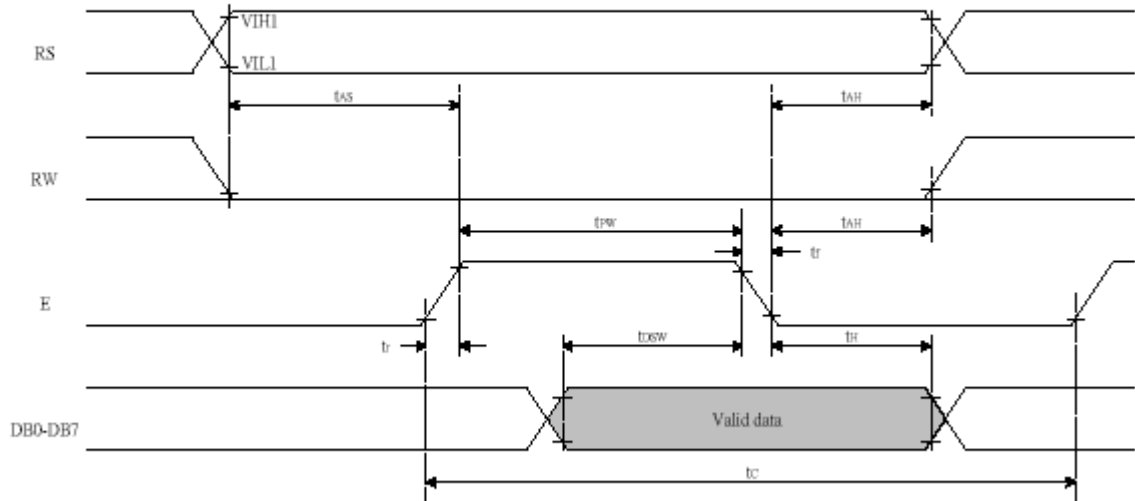
BLOCK DIAGRAM

POWER SUPPLY

TIMING CHARACTERISTICS

TA=25   ,VCC=5V

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
Internal Clock Operation						
f_{OSC}	OSC Frequency	R = 91KΩ	190	270	350	KHz
External Clock Operation						
f_{EX}	External Frequency	-	125	270	410	KHz
	Duty Cycle	-	45	50	55	%
T_R, T_F	Rise/Fall Time	-	-	-	0.2	μs
Write Mode (Writing data from MPU to ST7066U)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DSW}	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
Read Mode (Reading Data from ST7066U to MPU)						
T_C	Enable Cycle Time	Pin E	1200	-	-	ns
T_{PW}	Enable Pulse Width	Pin E	140	-	-	ns
T_R, T_F	Enable Rise/Fall Time	Pin E	-	-	25	ns
T_{AS}	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T_{AH}	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T_{DDR}	Data Setup Time	Pins: DB0 - DB7	-	-	100	ns
T_H	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns

Read/Write Timing Chart

● **Writing data from MPU to ST7066U**

● **Reading data from ST7066U to MPU**

SUNLIKE DISPLAY   Model No: SD1602H
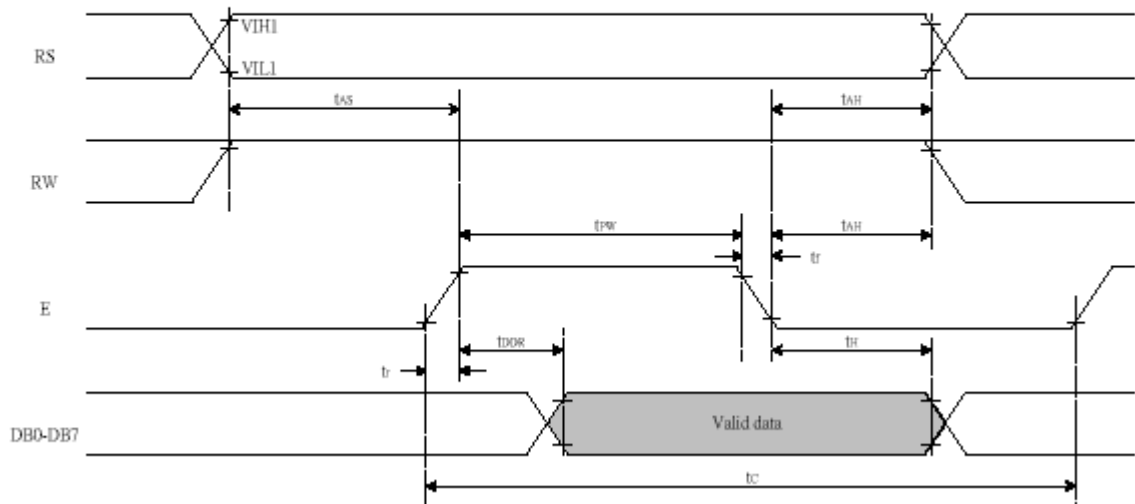
Commands

Instruction	Instruction code											Description	Execution Time(fosc is 270 kHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Clear Display	0	0	0	0	0	0	0	0	0	1		Write"20H"toDDRAM.and set DDRAM address to"00H" from AC	1.53mS
Return Home	0	0	0	0	0	0	0	0	1	*		Set DDRAM address to "00H " from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed .	1.53mS
Entry Mode	0	0	0	0	0	0	0	1	I/D	S		Assign cursor moving direction and make shift of entire display enable .	39 µS
Display ON/OFF	0	0	0	0	0	0	1	D	C	B		Set display(D), cursor(C),and blinking of cursor(B) on/off Control bit .	39 µS
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	*	*		Set cursor moving and display Shift control bit, and the Direction , without changing DDRAM data .	39 µS
Function Set	0	0	0	0	1	DL	N	F	*	*		Set interface data length (DL:4-bit/8-bit),numbers of display line(N:1-line/2-line),display font type(F:5*8 dots/5*11 dots)	39 µS
Set CG RAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0		Set CGRAM address in address counter .	39 µS
Set DD RAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0		Set CGRAM address in address Counter .	39 µS
Read Busy Flag and Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0		Whether during internal Operation or not cat be known By reading BF . The contents of Address counter can also be read .	0 µS
Write Data to ram	1	0	D7	D6	D5	D4	D3	D2	D1	D0		Write data into internal RAM (DDRAM/CGRAM) .	43 µS
Read Data From RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0		Read data from internal RAM (DDRAM/CGRAM) .	43 µS

Code		Description	Executed Time (max)
I/D=1 : Increment	DL=0:4-bit	DDRAM: Display Data RAM	fcp or fose=250kHz
I/D=0 : Decrement	N=1 : 2 lines	CGRAM: Character Generator RAM	However, when Frequency changes,
S=1 : With display shift	N=0 : 1 lines	ACG:CGRAM Address	
S/C=1 : Display shift	F=1 : 5 × 11 dots	ADD:DDRAM Address Corresponds to	execution time also changes
S/C=0 : Cursor movement	F=0 : 5 × 8 dots	cursor address.	EX
R/L=1 : Shift to the right	BF=1:Internal operation is	AC: Address Counter, used for both	if fcp or fose is 270kHz
R/L=0 : Shift to the left	being performed	DDRAM and CGRAM	40µs × 250/270=37µs
DL=1 : 8-bit	BF=0 : Instruction acceptable	* : Invalid.	

Reset Function

Initializing by Internal Reset Circuit

An internal reset circuit automatically initializes the IC when the power is turned on. The following instructions are executed during the initialization. The busy flag (BF) is kept in the busy state until the initialization ends (BF = 1). The busy state lasts for 40 ms after VCC rises to 4.5 V.

1. Display clear

2. Function set:

    DL = 1; 8-bit interface data

    N = 0; 1-line display

    F = 0; 5x8 dot character font

3. Display on/off control:

    D = 0; Display off

    C = 0; Cursor off

    B = 0; Blinking off

4. Entry mode set:

    I/D = 1; Increment by 1

    S = 0; No shift

Note:
If the electrical characteristics conditions listed in the table Power Supply Conditions are not met, the internal reset circuit will not operate normally and will fail to initialize the IC. For such a case, initialization must be performed by the MPU as explain by the following figures.

Initializing by Instruction

8 bit Interface(fosc =270KHZ)

POWER ON

Wait time >40mS
After Vcc >4.5V

Function set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	N	F	X	X

BF cannot be checked before this instruction.

Wait time >37uS

Function set

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	N	F	X	X

BF cannot be checked before this instruction.

Wait time >37uS

Display ON/OFF control

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	1	D	C	B

Wait time >37uS

Display clear

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

Wait time >1.52mS

Entry mode set

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

Initialization end

15

DD RAM ADDRESSING

For 10*4 Display

	1	2	3	4	5	6	7	8	9	10
Character DD RAM Address	00	01	02	03	04	05	06	07	08	09
	40	41	42	43	44	45	46	47	48	49
	0A	0B	0C	0D	0E	0F	10	11	12	13
	5A	5B	5C	5D	5E	5F	50	51	52	53

For 16*1 Display

Character DD RAM Address	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	00	01	02	03	04	05	06	07	40	41	42	43	44	45	46	47

For 16*2 or 8*2 Display

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Character DD RAM Address	00	01	02	03	04	05	06	07	8	9	0A	0B	0C	0D	0E	0F
	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

For 16*4 Display

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Character DD RAM Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F

For 20*2 Display

	1	2	3	4	5	6	7	8	9	10	---	---	17	18	19	20
Character DD RAM Address	00	01	02	03	04	05	06	07	08	09	---	---	10	11	12	13
	40	41	42	43	44	45	46	47	48	49	---	---	50	51	52	53

For 20*4 Display

	1	2	3	4	5	6	7	8	9	10	---	---	17	18	19	20
Character DD RAM Address	00	01	02	03	04	05	06	07	08	09	---	---	10	11	12	13
	40	41	42	43	44	45	46	47	48	49	---	---	50	51	52	53
	14	15	16	17	18	19	1A	1B	1C	1D	---	---	24	25	26	27
	54	55	56	57	58	59	5A	5B	5C	5D	---	---	64	65	66	67

For 40*2 Display

	1	2	3	4	5	6	7	8	9	10	---	---	37	38	39	40
Character DD RAM Address	00	01	02	03	04	05	06	07	08	09	---	---	24	25	26	27
	40	41	42	43	44	45	46	47	48	49	---	---	64	65	66	67

For 40*4 Display

	E	1	2	3	4	5	6	7	8	9	10	---	---	37	38	39	40
Character DD RAM Address	E1	00	01	02	03	04	05	06	07	08	09	---	---	24	25	26	27
		40	41	42	43	44	45	46	47	48	49	---	---	64	65	66	67
	E2	00	01	02	03	04	05	06	07	08	09	---	---	24	25	26	27
		40	41	42	43	44	45	46	47	48	49	---	---	64	65	66	67

SUNLIKE DISPLAY   Model No: SD1602H

CG RAM MAPPING

Character Code (DD RAM data) 7 6 5 4 3 2 1 0 High — Low		CG RAM Address 5 4 3 2 1 0 High — Low		Character Patterns (CG RAM data) 7 6 5 4 3 2 1 0 High — Low		
0 0 0 0 * 0 0 0		0 0 0	0 0 0	* * *	0 1 1 0 0	Character Pattern
			0 0 1		1 0 0 1 0	
			0 1 0		0 0 1 0 0	
			0 1 1		0 1 0 0 0	
			1 0 0		1 1 1 1 0	
			1 0 1		0 0 0 0 0	
			1 1 0		0 0 0 0 0	
			1 1 1		0 0 0 0 0	Cursor
0 0 0 0 * 0 0 1		0 0 1	0 0 0	* * *	1 1 1 1 1	Character Pattern
			0 0 1		1 0 0 0 1	
			0 1 0		1 0 1 0 1	
			0 1 1		1 0 1 1 1	
			1 0 0		1 0 1 0 1	
			1 0 1		1 0 0 0 1	
			1 1 0		1 1 1 1 1	
			1 1 1		0 0 0 0 0	Cursor
⋮		⋮	⋮	⋮	⋮	
0 0 0 0 * 1 1 1		1 1 1	0 0 0	* * *	1 1 1 1 1	Character Pattern
			0 0 1		1 0 0 0 1	
			0 1 0		1 1 1 0 1	
			0 1 1		1 0 0 0 1	
			1 0 0		1 0 1 1 1	
			1 0 1		1 0 0 0 1	
			1 1 0		1 1 1 1 1	
			1 1 1		0 0 0 0 0	Cursor

18

CHARACTER FONT TABLE

HANDLING PRECAUTION

1. Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizes which easily get

damaged since the Module is fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be taken when handling the LCD Modules.

2. Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and

Wipe lightly.

-Isopropyl alcohol

-Ethyl alcohol

-Trichlorotriflorothane

Do not wipe the display surface with dry or hard materials that will damage the polarize

surface.

Do not use the following solvent

-Water

-Kettle

-Aromatics

3. Caution against static charge

The LCD Module use C-MOSLSI drivers, so we recommend end that you connect any unused

input terminal to VDD or VSS, do not input any signals before power is turned on. And ground

your body, Work/assembly table. And assembly equipment to protect against static electricity.

4. Packaging

-Modules use LCD elements, and must be treated as such. Avoid in tense shock and falls from

a height.

-To prevent modules from degradation. Do not operate or store them exposed directly to

sunshine or high temperature/humidity.

5. Caution for operation

-It is indispensable to drive LCD's with in the specified voltage limit since the higher voltage than the limit shorten LCD life.

An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.

-Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's. Which will come back in the specified operating temperature range.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.

-A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the relative condition of 40   , 50%RH or less is required.

6. Storage

In the case of storing for a long period of time (for instance. For years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.

- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.

-Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

7. Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol. Which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.