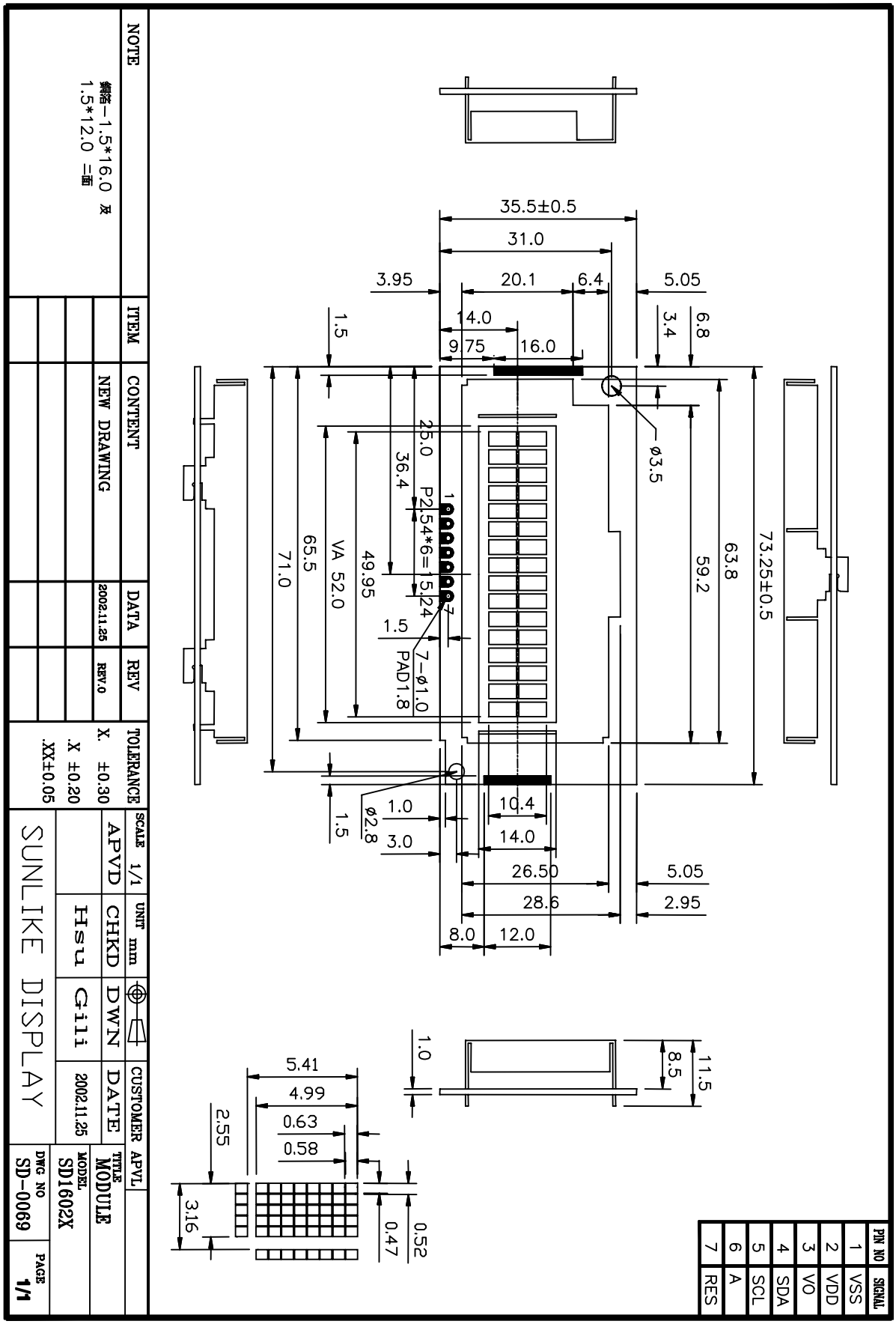
GENERAL SPECIFICATION

ITEM	DESCRIPTION
Product No	SD1602XBWB-PS-LB-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 ☐ Green ☐ Amber ■ White ☐ Other
View Direction	■ 6 O'clock ☐ 12 O'clock
Temperature Range	☐ General Temp.,5V,Single Supply Voltage ☐ Wide Temp., Single Supply Voltage ■ General Temp.,3.3V,Single Supply Voltage ☐ Wide Temp., 3.3V,Single Supply Voltage ☐ General Temp., Dual Supply Voltage ☐ Wide Temp., Dual Supply Voltage ☐ Super Wide Temp., Dual Supply Voltage
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.


35.5±0.5
31.0
3.95
20.1
6.4
5.05
14.0
9.75
16.0
1.5
3.4
6.8
ø3.5
25.0
36.4
P2.54*6=15.24
65.5
71.0
VA 52.0
49.95
63.8
59.2
73.25±0.5
1.5
7-ø1.0
PAD1.8
1.0
ø2.8
3.0
10.4
14.0
26.50
28.6
5.05
2.95
8.0
12.0
1.0
8.5
11.5
5.41
4.99
0.63
0.58
2.55
3.16
0.47
0.52
NOTE
鋸齒-1.5*16.0 及
1.5*12.0 二面
ITEM
CONTENT
NEW DRAWING
DATA
2002.11.25
REV
REV.0
TOLERANCE
X. ±0.30
.X ±0.20
.XX±0.05
SCALE 1/1
UNIT mm
APVD
CHKD
DWN
DATE
Hsu
Gili
2002.11.25
CUSTOMER APVL
SUNLIKE DISPLAY
TITLE MODULE
MODEL SD1602X
DWG NO SD-0069
PAGE 1/1
PIN NO
SIGNAL
1 VSS
2 VDD
3 VO
4 SDA
5 SCL
6 A
7 RES

ABSOLUTE MAXIMUM RATING

(1) Electrical Absolute Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply for Logic	V_{DD}-V_{SS}	-0.5	6.5	Volt	
Power Supply for LCD	V_{DD}-V_O	-0.5	7.5	Volt	
Input Voltage	V_I	-0.5	V_{DD}	Volt	
LED Power Dissipation	P_{AD}	-	0.46	W	
LED Forward current	I_{AF}	-	60	mA	
LED Reverse Voltage	V_R	-	5	V	

(2) Environmental Absolute Maximum Ratings

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

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%.

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
Power Supply for Logic	V_{DD}-V_{SS}	-	2.2	3.0	3.5	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℃	4.0	4.4	5.0		
		Ta＝50℃	-	-	-		
Power Supply Current for LCM	I_{DD}	V_{DD} =3.0V	-	0.17	1.0	mA	
LED Forward Voltage	V_F	If＝ 40 mA	-	3.4	4.0	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	Φf(12 o'clock)	When Cr≧ 1.4	-	20	-	Degree	9,10
	Φb(6 o'clock)		-	40	-		
	Φl(9 o'clock)		-	30	-		
	Φr(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	300	350	-	cd/m²	
Peak Emission Wavelength	λP		X=0.29 Y=0.30	X=0.31 Y=0.32	X=0.33 Y=0.34	nm	

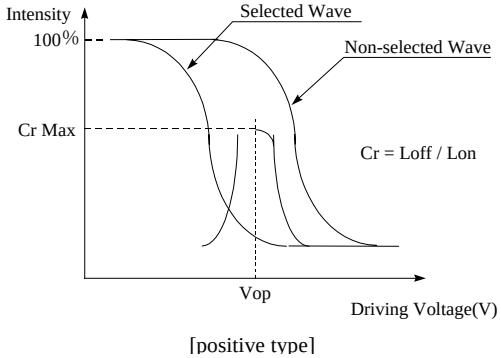
MECHANICAL SPECIFICATION

ITEM	DESCRIPTION
Product No.	SD1602X
Module Size	73.25 (W)X35.5 (H)X11.5max (D)
View Area	52.0 (W)X14.0 (H)
Dot Size	0.47 (W)mmX0.58 (H)mm
Dot Pitch	0.52 (W)mmX0.63 (H)mm
Display Format	16 characters (W)X2 lines (H)
Duty Ratio	1/16 Duty
Controller	PCF2119SU/2

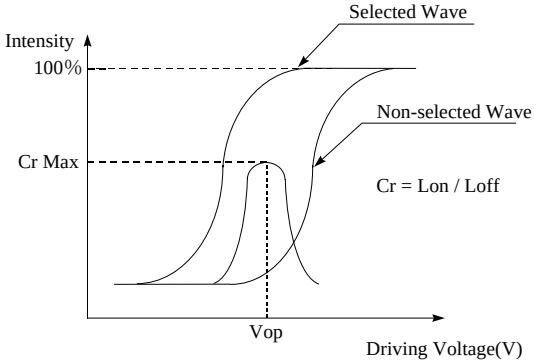
INTERFACE PIN ASSIGNMENT

Pin No.	Pin Out	Level	Description
1	VSS	0V	Power Supply Ground
2	VDD	3.0V	Power Supply Voltage
3	Vo	---	Contrast Adj
4	SDA	H/L	IIC Bus Serial Data Input/Output
5	SCL	H/L	IIC Bus Serial Clock Input
6	A	3.4V	LED Power Supply (＋)
7	RES	H	Reset Input

[Note 7] Definition of Operation Voltage (Vop)

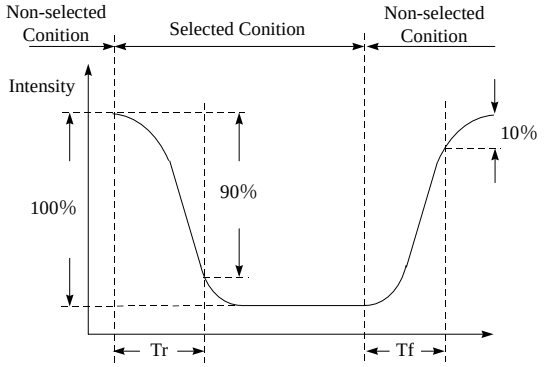


[positive type]

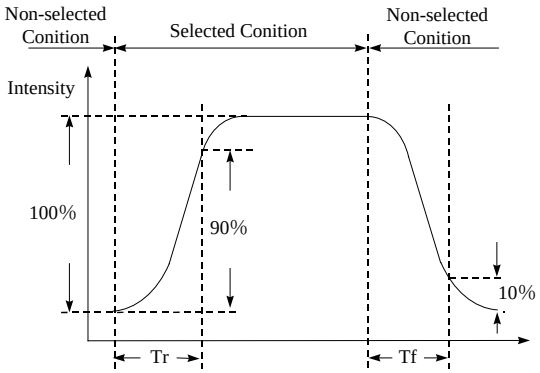


[Negative type]

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



[positive type]



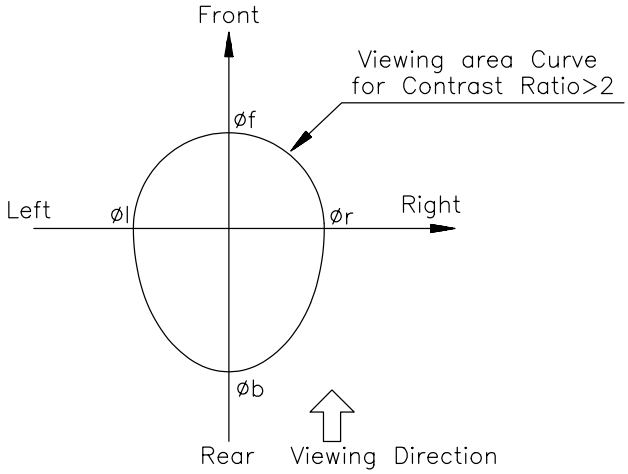
[Negative type]

Conditions:

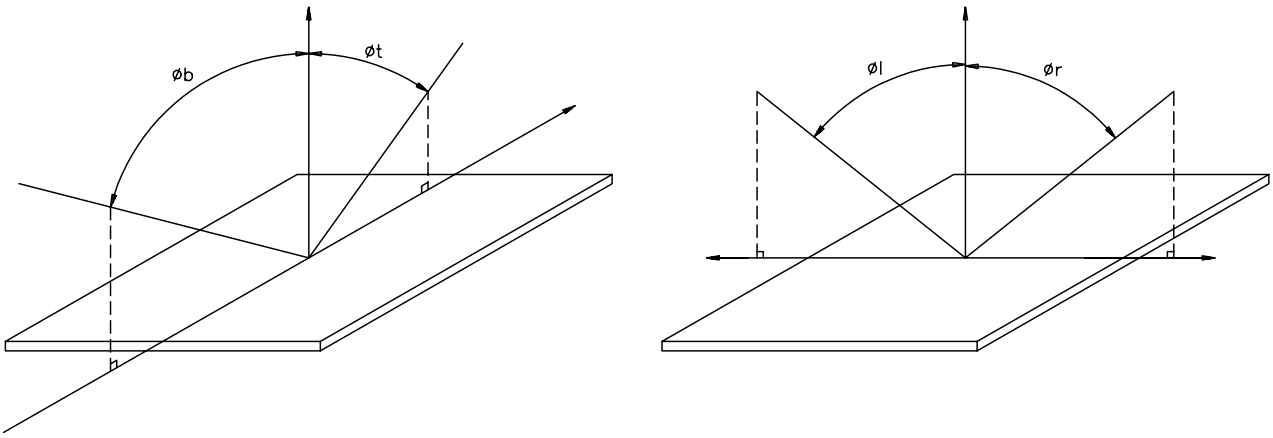
Operating Voltage : Vop **Viewing Angle(θ , ϕ): 0° , 0°**

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

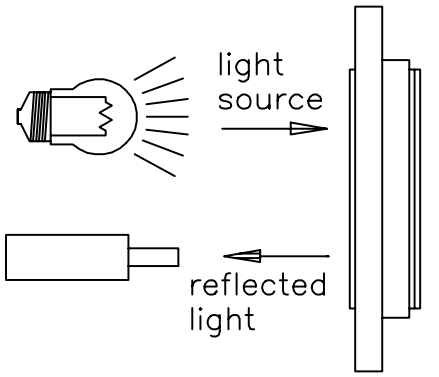
[Note 9] Definition of Viewing Direction



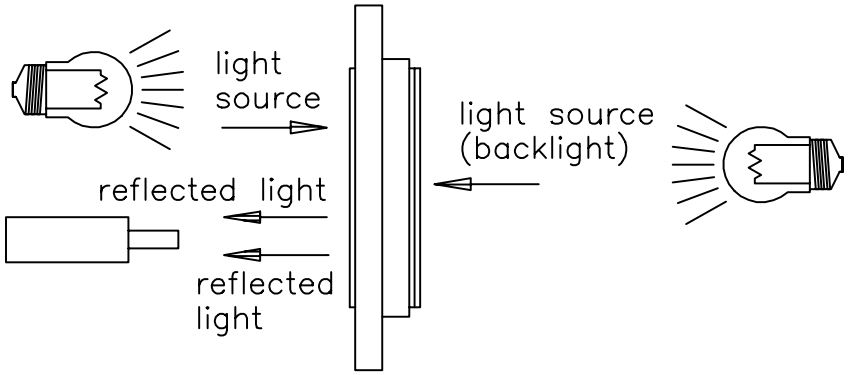
[Note 10] Definition of viewing angle



[Note 11] Description of Measuring Equipment



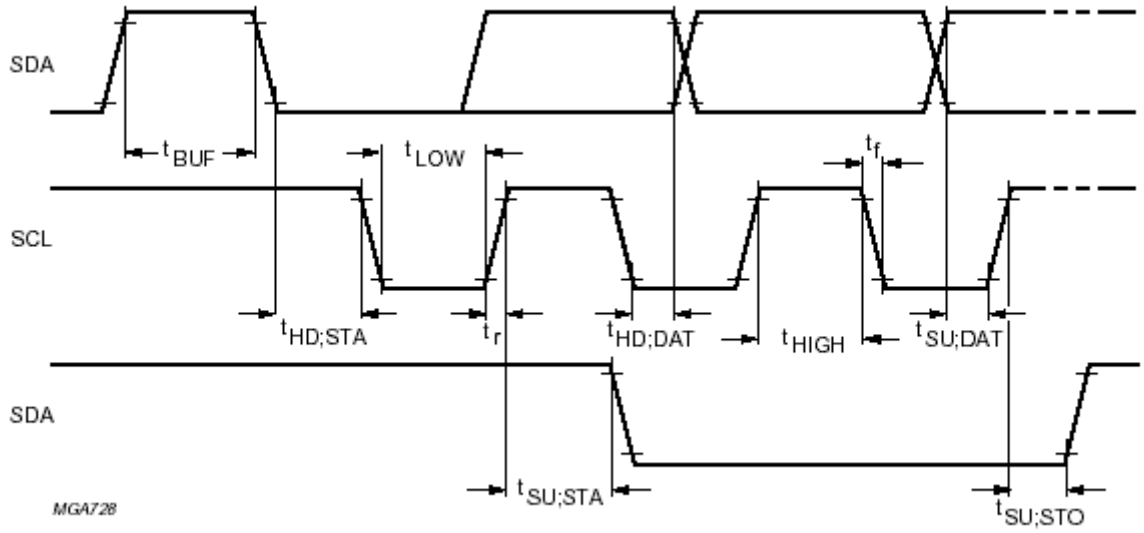
Reflective type



Transflective type

TIMING CHARACTERISTICS

f_{SCL}	SCL clock frequency		–	–	400	kHz
t_{LOW}	SCL clock low period		1.3	–	–	µs
t_{HIGH}	SCL clock high period		0.6	–	–	µs
$t_{SU;DAT}$	data set-up time		100	–	–	ns
$t_{HD;DAT}$	data hold time		0	–	–	ns
t_r	SCL, SDA rise time	notes 1 and 3	$15 + 0.1C_B$	–	300	ns
t_f	SCL, SDA fall time	notes 1 and 3	$15 + 0.1C_B$	–	300	ns
C_B	capacitive bus line load		–	–	400	pF
$t_{SU;STA}$	set-up time for a repeated START condition		0.6	–	–	µs
$t_{HD;STA}$	START condition hold time		0.6	–	–	µs
$t_{SU;STO}$	set-up time for STOP condition		0.6	–	–	µs
t_{SW}	tolerable spike width on bus		–	–	50	ns
t_{BUF}	bus free time between STOP and START condition		1.3	–	–	µs



COMMAND LIST

INSTRUCTION	RS	R/$\overline{W}$	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	DESCRIPTION	REQUIRED CLOCK CYCLES
H = 0 or 1												
NOP	0	0	0	0	0	0	0	0	0	0	no operation	3
Function set	0	0	0	0	1	DL	0	M	SL	H	sets interface Data Length (DL) and number of display lines (M); single line/MUX 1 : 9 (SL), extended instruction set control (H)	3
Read busy flag and address counter	0	1	BF	A_C							reads the Busy Flag (BF) indicating internal operating is being performed and reads address counter contents	0
Read data	1	1	read data								reads data from CGRAM or DDRAM	3
Write data	1	0	write data								writes data from CGRAM or DDRAM	3
H = 0												
Clear display	0	0	0	0	0	0	0	0	0	1	clears entire display and sets DDRAM address 0 in address counter	165
Return home	0	0	0	0	0	0	0	0	1	0	sets DDRAM address 0 in address counter; also returns shifted display to original position; DDRAM contents remain unchanged	3
Entry mode set	0	0	0	0	0	0	0	1	I/D	S	sets cursor move direction and specifies shift of display; these operations are performed during data write and read	3
Display control	0	0	0	0	0	0	1	D	C	B	sets entire display on/off (D), cursor on/off (C) and blink of cursor position character (B); D = 0 (display off) puts chip into the power-down mode	3
Cursor/display shift	0	0	0	0	0	1	S/C	R/L	0	0	moves cursor and shifts display without changing DDRAM contents	3
Set CGRAM address	0	0	0	1	A_{CG}						sets CGRAM address; bit 6 is to be set by the command 'set DDRAM address'; look at the description of the commands	3
Set DDRAM address	0	0	1	A_{DD}							sets DDRAM address	3
H = 1												
Reserved	0	0	0	0	0	0	0	0	0	1	do not use	–

INSTRUCTION	RS	R/$\overline{W}$	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	DESCRIPTION	REQUIRED CLOCK CYCLES
Screen configuration	0	0	0	0	0	0	0	0	1	L	set screen configuration	3
Display configuration	0	0	0	0	0	0	0	1	P	Q	set display configuration	3
Icon control	0	0	0	0	0	0	1	IM	IB	0	set icon mode (IM), icon blink (IB)	3
Temperature control	0	0	0	0	0	1	0	0	TC1	TC2	set temperature coefficient (TCx)	3
Set HVgen stages	0	0	0	1	0	0	0	0	S1	S0	set internal HVgen stages (S1 = 1 and S0 = 1 not allowed)	–
Set V_{LCD}	0	0	1	V	voltage						store V_{LCD} in register V_A or V_B (V)	3

Note

DISPLAY CONFIGURATION

CONTROL BYTE								COMMAND BYTE								I²C-BUS COMMANDS
Co	RS	0	0	0	0	0	0	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	note 1

Note

1. R/$\overline{W}$ is set together with the slave address.

COMMAND LIST(CONTINUED)

BIT	STATE	
	LOGIC 0	LOGIC 1
I/D	decrement	increment
S	display freeze	display shift
D	display off	display on
C	cursor off	cursor on
B	cursor character blink off: character at cursor position does not blink	cursor character blink on: character at cursor position blinks
S/C	cursor move	display shift
R/L	left shift	right shift
DL	4 bits	8 bits
H	use basic instruction set	use extended instruction set
L (no impact, if M = 1 or SL = 1)	left/right screen: standard connection (as in PCF2114)	left/right screen: mirrored connection (as in PCF2116)
	1st 16 characters of 32: columns are from 1 to 80	1st 16 characters of 32: columns are from 1 to 80
	2nd 16 characters of 32: columns are from 1 to 80	2nd 16 characters of 32: columns are from 80 to 1
P	column data: left to right (as in PCF2116); column data is displayed from 1 to 80	column data: right to left; column data is displayed from 80 to 1
Q	row data top to bottom (as in PCF2116): row data is displayed from 1 to 16 and icon row data in 17 and 18 in single line mode (SL = 1) row data is displayed from 1 to 8 and icon row data in 17	row data bottom to top: row data is displayed from 16 to 1 and icon row data in 18 and 17 in single line mode (SL = 1) row data is displayed from 8 to 1 and icon row data in 17
IM	character mode; full display	icon mode; only icons displayed
IB	icon blink disabled	icon blink enabled
DM	direct mode disable	direct mode enable
V	set V_A	set V_B
M (no impact, if SL = 1)	1-line by 32 display	2-line by 16 display
SL	MUX 1 : 18 (1 × 32 or 2 × 16 character display)	MUX 1 : 9 (1 × 16 character display)
C_0	last control byte; see Table 5	another control byte follows after data/command

FONT TABLE

lower 4 bits \ upper 4 bits	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx 0000	1															
xxxx 0001	2															
xxxx 0010	3															
xxxx 0011	4															
xxxx 0100	5															
xxxx 0101	6															
xxxx 0110	7															
xxxx 0111	8															
xxxx 1000	9															
xxxx 1001	10															
xxxx 1010	11															
xxxx 1011	12															
xxxx 1100	13															
xxxx 1101	14															
xxxx 1110	15															
xxxx 1111	16															

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.