

Data International Co., Ltd.



APPROVAL SHEET

Customer :

Part Name :

LCD MODULE

Model No. :

DG24064-2-S1RB

Drawing No. :

Approved By :

Date :

**SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY MODULE
MODEL NO. DG24064-2-S1RB**

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Approved	Checked	Prepared	Sheet Code
		Jai-Huei Liu	35000387

**SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY MODULE
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1. SCOPE

This specification covers the engineering requirements for the DG-24064-2-S1RB liquid crystal module.

2. PRODUCT SPECIFICATIONS

2.1 General

- 240 x 64 dot matrix LCD
- STN, Reflective
- 6 o'clock view
- Multiplexing : 1/64th duty, 1/8th bias

2.2 Mechanical Characteristics

Item	Characteristic
Dot Matrix Configuration	240 x 64
Pixel Dimensions (mm)	0.49 x 0.49
Pixel Pitch (mm)	0.04 (h) x 0.04 (w)
Active Area (mm)	127.16 x 33.88
View Area (mm)	132.00 x 39.00
Module Dimensions (mm)	180.0 x 65.0 x 10.0

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2.3 Electrical Absolute Maximum Ratings (excluding backlight)

Item	Symbol	Rating	Unit
Supply Voltage	V_{DD} (Note 1)	-0.3 to 7.0	V
Input Voltage	V_{IN} (Note 1)	-0.3 to $V_{DD} + 0.3$	V
Operating Temperature	T_{opr}	-20 to 70	°C
Storage Temperature	T_{stg}	-55 to 125	°C

Note 1 : Referenced to $V_{SS} = 0V @ 25^{\circ}C$

2.4 Electrical Characteristics (excluding backlight)

ITEM	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	PIN NAME	
Operating Voltage	V_{DD}	---	4.5	5.0	5.5	V	V_{DD}	
Input	H Level	V_{IH}	---	$V_{DD} - 2.2$	---	V_{DD}	V	Input Pins
	L Level	V_{IL}	---	0	---	0.8	V	Input Pins
Output Voltage	H Level	V_{OH}	---	$V_{DD} - 0.3$	---	V_{DD}	V	Output Pins
	L Level	V_{OL}	---	0	---	0.3	V	Output Pins
Output Resistance	H Level	R_{OH}	$V_{OUT} = V_{DD} - 0.5 V$	---	---	400	Ω	Output Pins
	L Level	R_{OL}	$V_{OUT} = 0.5 V$	---	---	400	Ω	Output Pins
Input Pull-up Resistance	RPU	---	50	100	200	k Ω	(Note 2)	
Operating Frequency	f_{OSC}	---	0.4	---	5.5	MHz	---	
Current Consumption (Operating)	$I_{DD(1)}$	$V_{DD} = 5.0 V$ (Note 3) $f_{OSC} = 3.0 MHz$	---	3.3	6	mA	V_{DD}	
Current Consumption (Halt)	$I_{DD(2)}$	$V_{DD} = 5.0 V$	---	---	3	μA	V_{DD}	

Note 2 : Applied /T1, /T2, /RESET

Note 3 : MDS = L , MD0 = L , MD2 = H , MD3 = H , FS0 = L ,
/SDSEL = L , /DUAL = H , D7 to D0 = LHLHLHLH

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2.5 Optical Characteristics Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Applied Voltage (AC)	V_{AC}	20	V
Operating Temperature Range	T_{OP}	0 ~ 50	°C
Storage Temperature Range	T_{ST}	-20 ~ 60	°C

2.6 Optical Characteristics

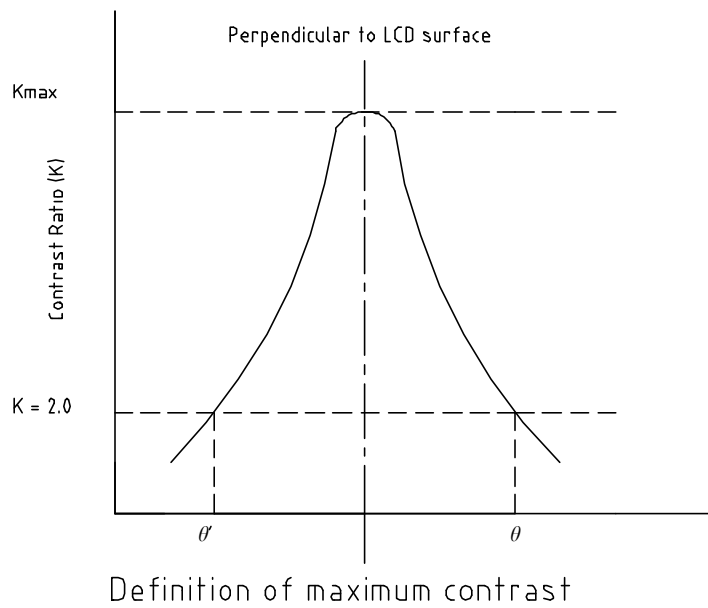
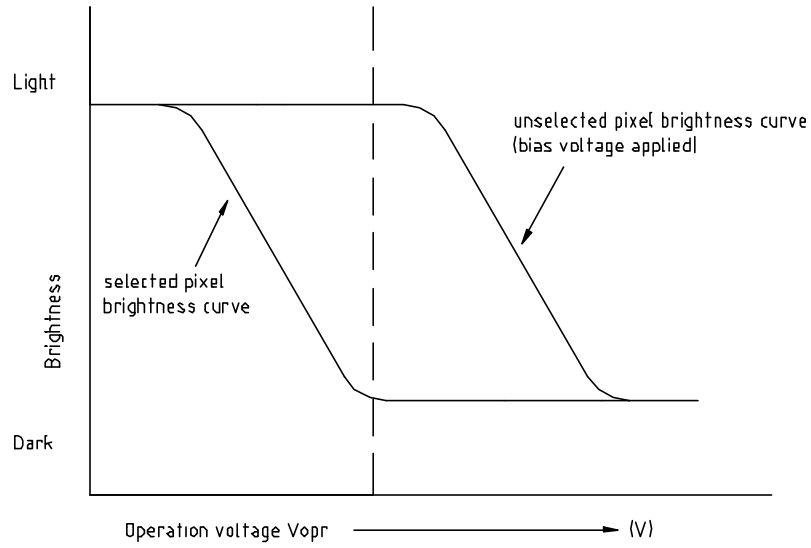
$1/64^{\text{th}}$ Duty , $1/8^{\text{th}}$ Bias, $V_{OP} = 9.3$ V

Item	Symbol	Temp.	Min.	Typ.	Max.	Unit
Driving Voltage	V_{OP}	0 °C	9.3	9.8	10.3	V
		25 °C	8.8	9.3	9.8	
		50 °C	7.8	8.2	8.6	
Contrast (Note 4)	K	$\theta = 0^\circ$ $\phi = 0^\circ$	3	4	---	---
Frame Freq.	fF	---	---	70	---	Hz
Viewing Angle (Note 5)	θ_1	25 °C $K \geq 1.5$	30	---	---	deg.
	θ_2		25	---	---	
Response Time (Note 6)	t_{on}	25 °C	---	160	240	ms
	t_{off}		---	290	440	

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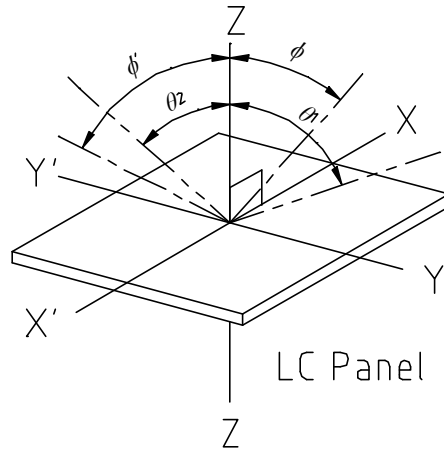
Note 4: Definition of Contrast K

$$K = \frac{B_1}{B_2} = \frac{\text{Brightness of selected pixel}}{\text{Brightness of unselected pixel}}$$

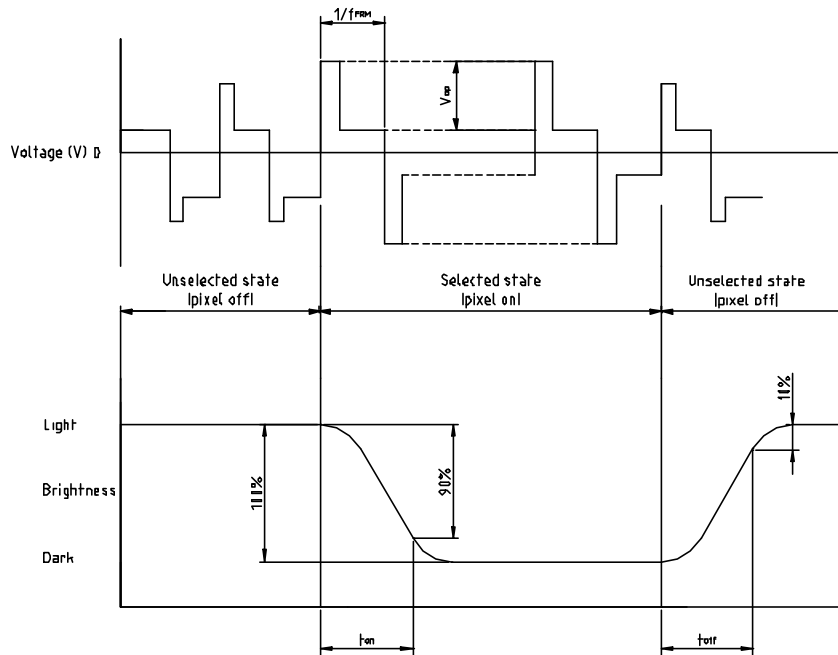


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Note 5: Definition of angles ϕ and θ .



Note 6: Definition of response time.



V_{op} : Operating voltage (V)
 f_{FRM} : Frame frequency (Hz)

t_{on} : Response time (rise) (ms)
 t_{off} : Response time (fall) (ms)

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3. RELIABILITY

Test Item	Test Condition	Evaluation and Assessment
Operation at high temperature and humidity	40°C ± 2°C 90%RH for 500 hours	No abnormalities in functions* and appearance**
Operation at high temperature	60°C ± 2°C for 500 hours	No abnormalities in functions* and appearance**
Heat shock		No abnormalities in functions* and appearance**
Low temperature	-20°C ± 2°C for 500 hours	No abnormalities in functions* and appearance**
Vibration	Sweep for 1 min at 10 Hz, 55 Hz, 10 Hz with amplitude of 1.5mm for 2 hrs in X, Y, Z directions	No abnormalities in functions* and appearance**
Drop shock	Dropped onto a board from a height of 10cm	No abnormalities in functions* and appearance**

* dissipation current, contrast and display functions

** polarizer deterioration or other appearance defects

Expected Liquid Crystal panel service life 100,000 hours minimum at 25°C ± 10°C.

Definition of end of LC panel service life:

- contrast less than 70% of initial value
- current consumption 3 times initial value
- alignment deterioration occurs in LC cell layer
- unusual operation occurs in display functions

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4. OPERATING INSTRUCTIONS

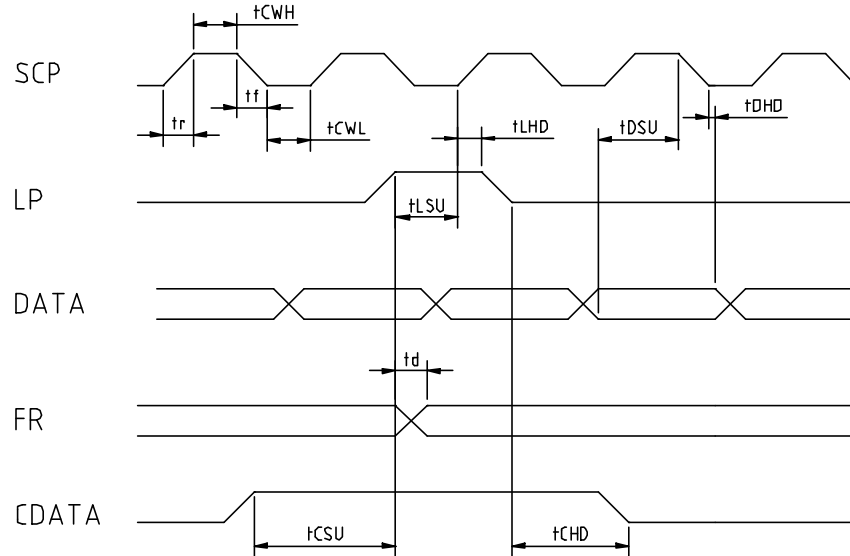
4.1 Input Signal Connections

Pin	Symbol	Function
1	FG	Frame ground
2	V _{SS}	Logic ground
3	V _{CC}	Logic power supply (5V)
4	V _{LCD}	LCD power supply
5	/WR	Write Data
6	/RD	Read Data
7	/CE	Chip enable
8	C/D	Command or Data select
9	NC	No connection
10	/RES	Reset
11-18	DB0~DB7	Data bus lines
19	FS	Font size select
20	NC	No connection

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4.2 Timing Characteristics

AC characteristics

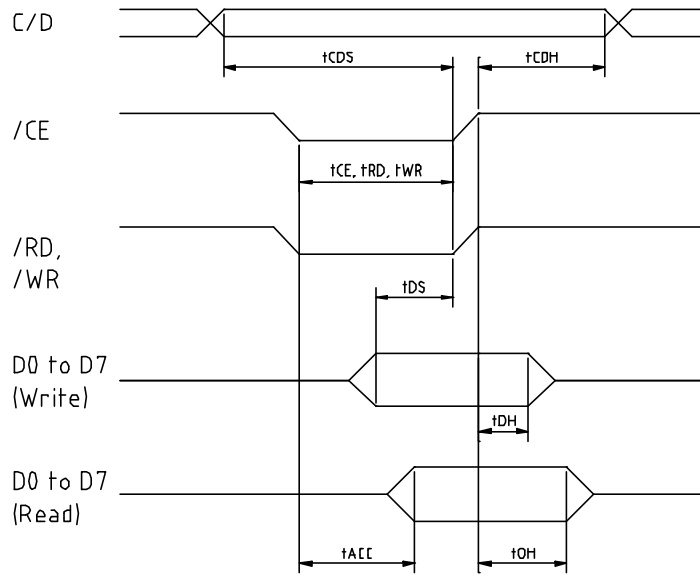


Test Conditions (Unless noted, $V_{DD} = 5.0V \pm 10\%$, $V_{SS} = 0V$, $T_a = -20$ to $70^\circ C$)

Item	Symbol	Conditions	Min	Max	Unit
Operating Frequency	f_{scp}	$T_a = -10$ to $70^\circ C$	---	2.75	MHz
SCP Pulse Width	t_{CWH}, t_{CWL}	---	150	---	ns
SCP Rise/Fall time	t_r, t_f	---	---	30	ns
LP Set-up time	t_{LSU}	---	150	290	ns
LP Hold time	t_{LHD}	---	5	40	ns
Data Set-up time	t_{DSU}	---	170	---	ns
Data Hold time	t_{DHD}	---	80	---	ns
FR Delay time	t_d	---	0	90	ns
CDATA Set-up time	t_{CSU}	---	450	850	ns
CDATA Hold time	t_{CHD}	---	450	950	ns

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Bus Timing

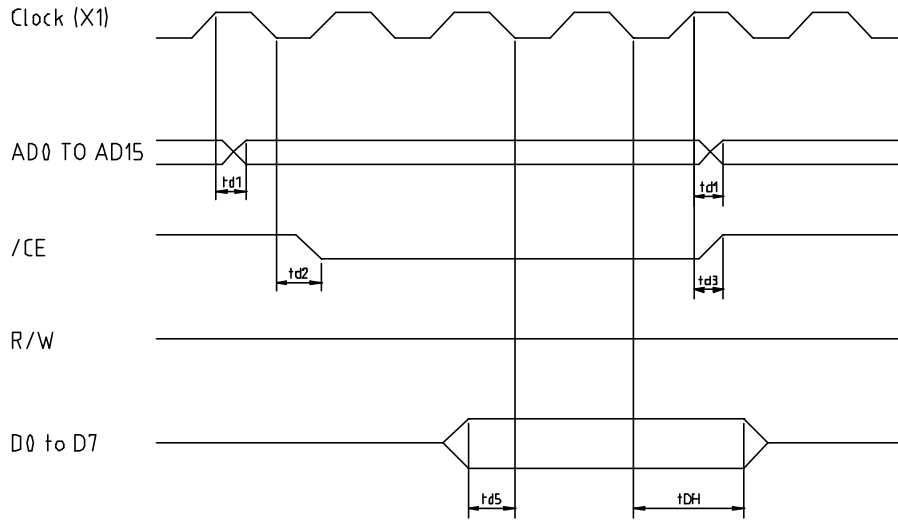


Test Conditions (Unless noted, $V_{DD} = 5.0V \pm 10\%$, $V_{SS} = 0V$, $T_a = -20$ to $70^\circ C$)

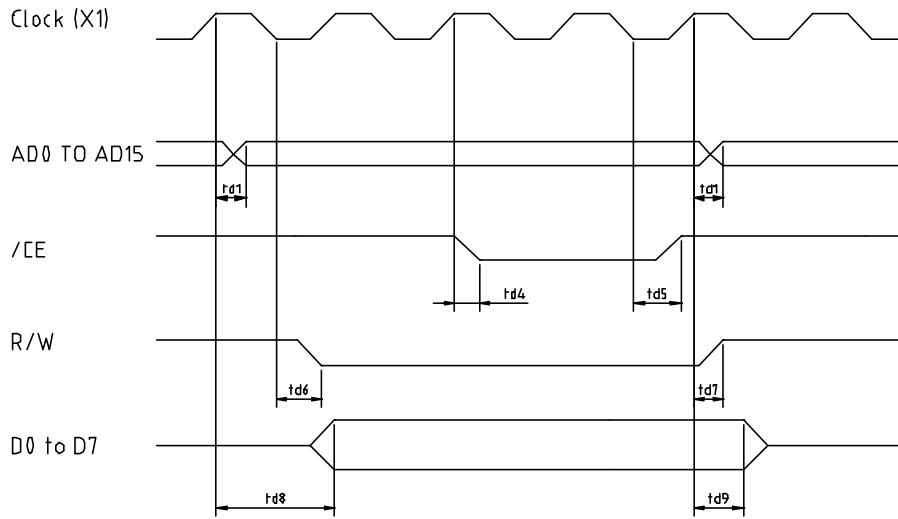
Item	Symbol	Test Conditions	Min	Max	Unit
C/D Set-up time	t_{CDS}	---	100	---	ns
C/D Hold time	t_{CDH}	---	10	---	ns
/CE, /RD, /WR Pulse width	t_{CE}, t_{RD}, t_{WR}	---	80	---	ns
Data Set-up time	t_{DS}	---	80	---	ns
Data Hold time	t_{DH}	---	40	---	ns
Access time	t_{ACC}	---	---	150	ns
Output Hold time	t_{OH}	---	10	50	ns

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External RAM Read Mode



External RAM Write Mode



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Test Conditions (Unless noted, $V_{DD} = 5.0V \pm 10\%$, $V_{SS} = 0V$, $T_a = -20$ to $70^\circ C$)

Item	Symbol	Test Conditions	Min	Max	Unit
Address Delay time	t_{d1}	---	---	250	ns
/CE Fall Delay time (Read)	t_{d2}	---	---	180	ns
/CE Rise Delay time (Read)	t_{d3}	---	---	180	ns
Data Set-up time	t_{DS}	---	0	---	ns
Data Hold time	t_{DH}	---	30	---	ns
/CE Fall Delay time (Write)	t_{d4}	---	---	200	ns
/CE Fall Delay time (Write)	t_{d5}	---	---	200	ns
R/W Fall Delay time	t_{d6}	---	---	180	ns
R/W Rise Delay time	t_{d7}	---	---	180	ns
Data Stable time	t_{d8}	---	---	450	ns
Data Hold time	t_{d9}	---	---	200	ns

4.3 Character Code Map (ROM Code 0101)

MSB \ LSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		!	"	#	\$	%	&	'	()	*	+	,	-	.	/
1	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
2	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
3	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_
4	'	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
5	p	q	r	s	t	u	v	w	x	y	z	{		}	~	
6	ç	ü	é	ä	ä	ä	ä	ç	è	ë	ë	ë	ï	ï	ï	ä
7	é	æ	æ	ö	ö	ö	ö	ü	ü	ü	ö	ü	ç	é	æ	æ

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4.4 Command Definitions

COMMAND	CODE	D1	D2	FUNCTION
REGISTERS SETTING	00100001 00100010 00100100	X address Data Low address	Y address Data High address	Set Cursor Pointer Set Offset Register Set Address Pointer
SET CONTROL WORD	01000000 01000001 01000010 01000011	Low address Columns Low address Columns	High address 00H High address 00H	Set Text Home Address Set Text Area Set Graphic Home Address Set Graphic Area
MODE SET	1000X000 1000X001 1000X011 1000X100 10000XXX 10001XXX	- - - - - -	- - - - - -	OR mode EXOR mode AND mode Text Attribute mode Internal CG ROM mode External CG RAM mode
DISPLAY MODE	10010000 1001XX10 1001XX11 100101XX 100110XX 100111XX	- - - - - -	- - - - - -	Display off Cursor on, blink off Cursor on, blink on Text on, graphic off Text off, graphic on Text on, graphic on
CURSOR PATTERN SELECT	10100000 10100001 10100010 10100011 10100100 10100101 10100110 10100111	- - - - - - - -	- - - - - - - -	1-line cursor 2-line cursor 3-line cursor 4-line cursor 5-line cursor 6-line cursor 7-line cursor 8-line cursor
DATA AUTO READ/WRITE	10110000 10110001 10110010	- - -	- - -	Set Data Auto Write Set Data Auto Read Auto Reset
DATA READ/WRITE	11000000 11000001 11000010 11000011 11000100 11000101	Data - Data - Data -	- - - - - -	Data Write and Increment ADP Data Read and Increment ADP Data Write and Decrement ADP Data Read and Decrement ADP Data Write and No change to ADP Data Read and No change to ADP
SCREEN PEEK	11100000	-	-	Screen Peek
SCREEN COPY	11101000	-	-	Screen Copy
BIT SET/RESET	11110XXX 11111XXX 1111X000 1111X001 1111X010 1111X011 1111X100 1111X101 1111X110 1111X111	- - - - - - - - - -	- - - - - - - - - -	Bit Reset Bit Set Bit 0 (LSB) Bit 1 Bit 2 Bit 3 Bit 4 Bit 5 Bit 6 Bit 7 (MSB)

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5. Notes

Safety

- If the LCD breaks, be careful not to get the liquid crystal in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

Handling

- Avoid static electricity as this can damage the CMOS LSI.
- The LCD panel is plate glass, do not hit or crush it.
- Do not remove the panel or frame from the module.
- The polarizing plate of the display is very fragile, handle it very carefully.

Mounting and Design

- Mount the module by using the specified mounting part and holes.
- To protect the module from external pressure, leave a small gap by placing transparent plates (e.g. acrylic or glass) on the display surface, frame and polarizing plate.
- Design the system so that no input signal is given unless the power supply voltage is applied.
- Keep the module dry. Avoid condensation; this can cause the transparent electrodes to fail.

Storage

- Store the module in a dark place where the temperature is $25^{\circ}\text{C}\pm 10^{\circ}\text{C}$ and the relative humidity is below 65%.
- Do not store the module near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module (including accessories).

Cleaning

- Do not wipe the polarizing plate with a dry cloth, it may scratch the surface.
- Do not use ketonic solvent (ketone and acetone) or aromatic solvents (tolulene and xylene); they may damage the polarizing plate.
- Wipe the module surface gently using a soft cloth soaked with petroleum benzene.

