JEWEL HILL ELECTRONIC CO.,LTD.

SPECIFICATIONS FOR
LCD MODULE

Module No.   GG2033

Office Address: Rm. 518,5/F., 101 Shangbu Industrial District,
HuaqiangNorthRoad, Shenzhen, China

TEL :   (86)-755-83362489   83617492

FAX: (86)-755-83286396   83365871

E-mail: sales@jewelhillelectronic.com
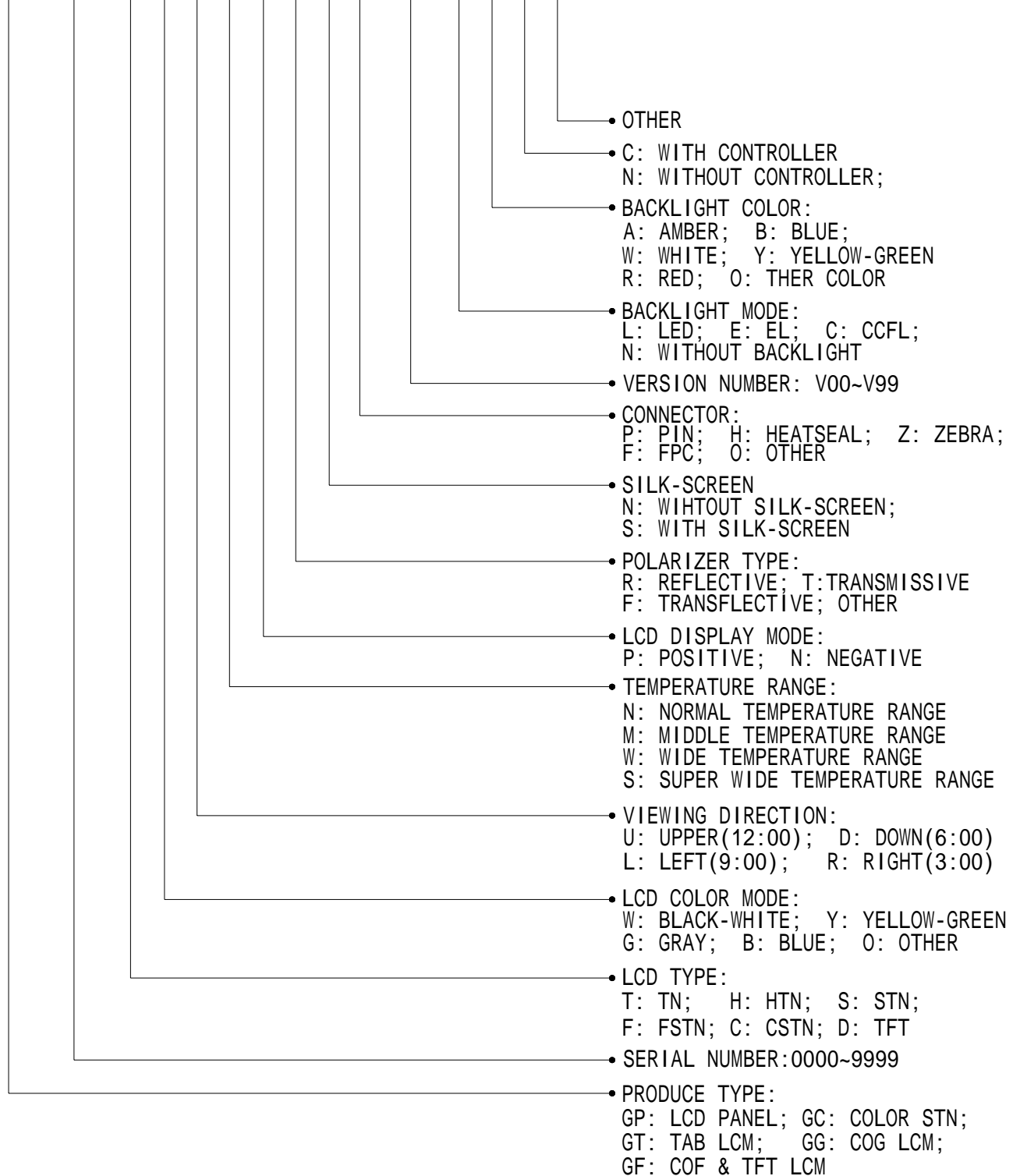jhlcd@21cn.com

Website: www.jewelhillelectronic.com

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TABLE OF CONTENTS

LCM Number System

GG 2033 S W U S N T S P-V00-N O C X

- OTHER

- C: WITH CONTROLLER
  N: WITHOUT CONTROLLER;

- BACKLIGHT COLOR:
  A: AMBER;   B: BLUE;
  W: WHITE;   Y: YELLOW-GREEN
  R: RED;   O: THER COLOR

- BACKLIGHT MODE:
  L: LED;   E: EL;   C: CCFL;
  N: WITHOUT BACKLIGHT

- VERSION NUMBER: V00~V99

- CONNECTOR:
  P: PIN;   H: HEATSEAL;   Z: ZEBRA;
  F: FPC;   O: OTHER

- SILK-SCREEN
  N: WIHTOUT SILK-SCREEN;
  S: WITH SILK-SCREEN

- POLARIZER TYPE:
  R: REFLECTIVE;   T: TRANSMISSIVE
  F: TRANSFLECTIVE;   OTHER

- LCD DISPLAY MODE:
  P: POSITIVE;   N: NEGATIVE

- TEMPERATURE RANGE:
  N: NORMAL TEMPERATURE RANGE
  M: MIDDLE TEMPERATURE RANGE
  W: WIDE TEMPERATURE RANGE
  S: SUPER WIDE TEMPERATURE RANGE

- VIEWING DIRECTION:
  U: UPPER(12:00);   D: DOWN(6:00)
  L: LEFT(9:00);   R: RIGHT(3:00)

- LCD COLOR MODE:
  W: BLACK-WHITE;   Y: YELLOW-GREEN
  G: GRAY;   B: BLUE;   O: OTHER

- LCD TYPE:
  T: TN;   H: HTN;   S: STN;
  F: FSTN;   C: CSTN;   D: TFT

- SERIAL NUMBER: 0000~9999

- PRODUCE TYPE:
  GP: LCD PANEL;   GC: COLOR STN;
  GT: TAB LCM;   GG: COG LCM;
  GF: COF & TFT LCM

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1. GENERAL DESCRIPTION

The GG2033 is a Dots+Icon LCD module. It has a STN panel composed of 120 segments and 16 commons. The LCM can be easily accessed by microcontroller via parallel or series interface.

2. FEATURES

Display Mode	Transflective and positive
	FSTN module
Display Format	dots+Icon
Input Data	Serial data input from MPU
Multiplexing Ratio	1/20 Duty
Bias	1/5 Bias
Viewing Direction	12 O'clock
Controller LSI	S1D15714D00B00
Backlight	None

3. MECHANICAL SPECIFICATION

Item	Specifications	Unit
Dimensional outline	88.6 x 33.0 x 2.85(max)	mm
Resolution	120segs x 16coms	---
Active area	82.6(W) x 19.5(H)	mm
Dots pitch	-----	mm
Dots size	-----	mm

4. MECHANICAL DIMENSION

5. MAXIMUM RATINGS

Item	Symbol	Min	Max	Unit	Note
Supply voltage	V_{DD} - V_{SS}	-0.3	6.0	V	
	V_{LCD}	-0.3	18.0	V	
Input Voltage	V_{IN}	-0.3	$V_{DD}+0.3$	V	
Operating temperature	T_{OPR}	-25	+70	℃	
Storage temperature	T_{STR}	-35	+80	℃	
Humidity	---	---	90	%RH	

6. ELECTRICAL CHARACTERISTICS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	Logic	V_{DD}	---	---	5.0	---	V
Input Voltage	H level	V_{IH}	---	$0.8V_{DD}$	---	V_{DD}	V
	L level	V_{IL}		V_{SS}	---	$0.2V_{DD}$	
Current Consumption (LCD DRIVER)		I_{DD}	$V_{DD}=5.0V$; $V_{LCD}=7.0V, T_{amb}=25℃$;	---	---	3.0	mA
LCD Driving Voltage		V_{LCD}	Bias=1/5 VLCD=V0-VSS	---	7.0	---	V

7. MODULE FUNCTION DESCRIPTION

7.1. PIN DESCRIPTION

Pin No.	Symbol	Description
1	/CS	Chip Select Signal, Low is Active
2	/RES	Reset Signal, Low is Active
3	A0	Data/Command Select Signal, "H":Data; "L":Command
4	SCL	Serial Colok Input
5	SDA	Serial Data Input
6	VDI	Power Supply Pin, Connect a Capacitor to VSS
7	VSS	Power Supply for Ground
8	VDD	Power Supply for Positive
9	VDD2	Power Supply for Boosting Circuit, Connect to VDD
10	VOUT	Output the Step-up, Connect a Capacitor to VDD or VDD2
11	V3	LCD Driving Voltage, the following order must be maintained: V3 V2 V1 VC MV1 MV2 MV3(=VSS) MV3 is Short Circuited with MV3 inside the IC Chip
12	V2	
13	V1	
14	VC	
15	MV1	
16	MV2	

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7.2 TIMING CHARACTERISTICS

1.SYSTEM BUS READ/WRITE CHARACTERISTIC

Serial interface
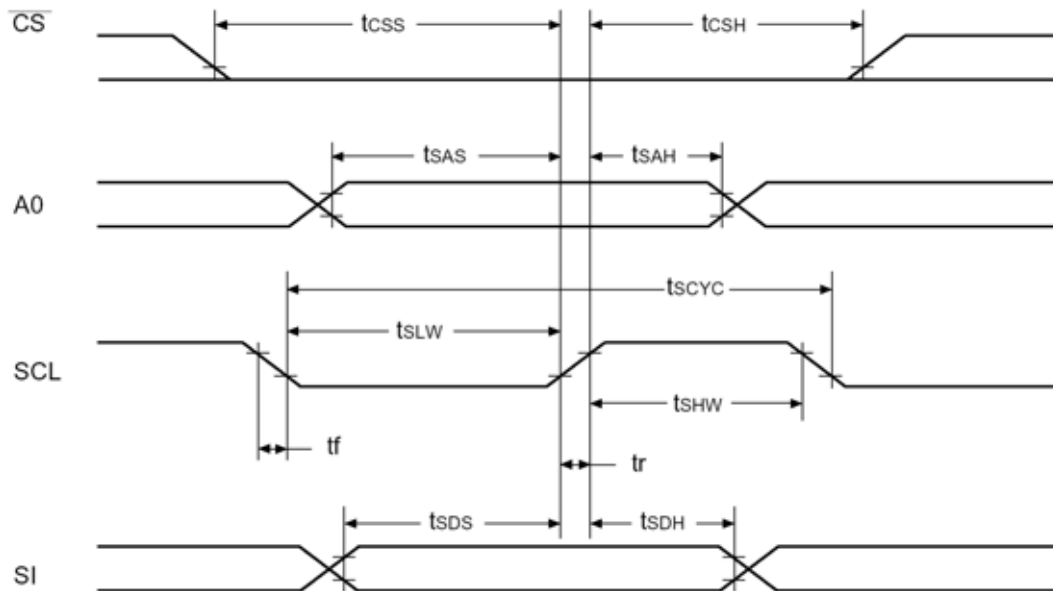
Figure 10.3

Table 10.3

[VDD = 2.7V to 5.5V, Ta = –40 to +85°C]

Parameter	Signal	Symbol	Condition	Specified value		Unit
				Min.	Max.	
Serial clock period SCL HIGH pulse width SCL LOW pulse width	SCL	t_{SCYC} t_{SHW} t_{SLW}	—	250 100 100	— — —	ns
Address setup time Address hold time	A0	t_{SAS} t_{SAH}	—	150 150	— —	
Data setup time Data hold time	SI	t_{SDS} t_{SDH}	—	200 100	— —	
CS-SCL time	CS	t_{CSS} t_{CSH}	—	150 150	— —	

*1. Input signal rise and fall time (tr, tf) must not exceed 15 ns.
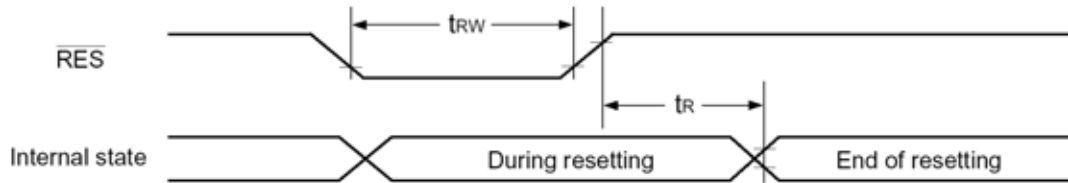*2. Timing is entirely specified with reference to 20% or 80% of VDD.

GG2033   VER: 2.0   - 7 -   Issue date: 2005/11/21

2. RESET TIMING

Fig. 10.5

Table 10.5

[VDD = 2.7V to 5.5V, Ta = −40 to +85°C]

Parameter	Signal	Symbol	Condition	Specified value			Unit
				Min.	Typ.	Max.	
Reset time	—	t_R	—	—	—	1000	μs
Reset LOW pulse width	$\overline{RES}$	t_{RW}		1000	—	—	

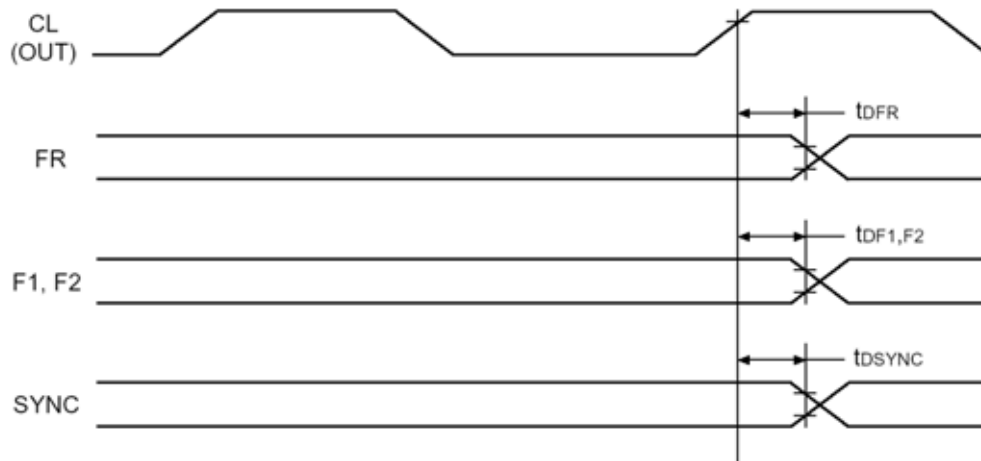*1. Timing is entirely specified with reference to 20% or 80% of VDD.

3. DISPLAY CONTROL TIMING

Fig. 10.4

Table 10.4 Output Timing

[V_{DD} = 2.7V to 5.5V, Ta = –40 to +85°C]

Parameter	Signal	Symbol	Condition	Specified value			Unit
				Min.	Typ.	Max.	
FR delay time	FR	t_{DFR}	C_L = 50pF	—	60	200	ns
F1, F2 delay time	F1, F2	t_{DF1}, t_{F2}		—	60	200	ns
SYNC delay time	SYNC	t_{DSYNC}		—	60	200	ns

Table 10.5 Input Timing

[V_{DD} = 2.7V to 5.5V, Ta = –40 to +85°C]

Parameter	Signal	Symbol	Condition	Specified value			Unit
				Min.	Typ.	Max.	
FR delay time	FR	t_{DFR}		–1.0	—	1.0	µs
F1, F2 delay time	F1, F2	t_{DF1}, t_{F2}		–1.0	—	1.0	µs
SYNC delay time	SYNC	t_{DSYNC}		–1.0	—	1.0	µs
Low-level pulse width	CL	t_{WLCL}		1.0	—	—	µs
High-level pulse width		t_{WHCL}		1.0	—	—	µs

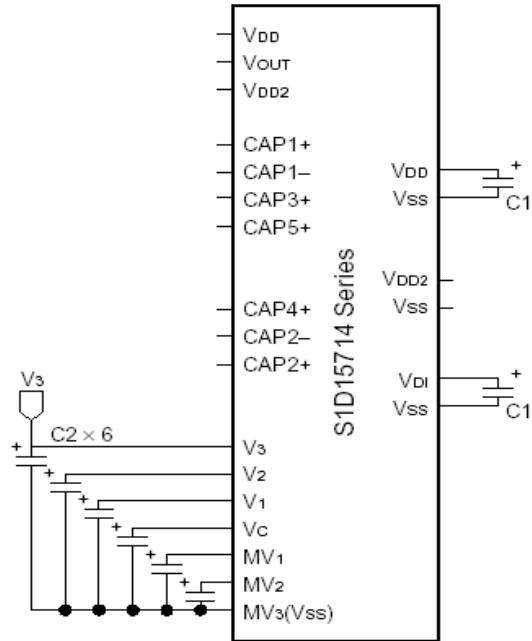*1. Timing is entirely specified with reference to 20% or 80% of V_{DD}.
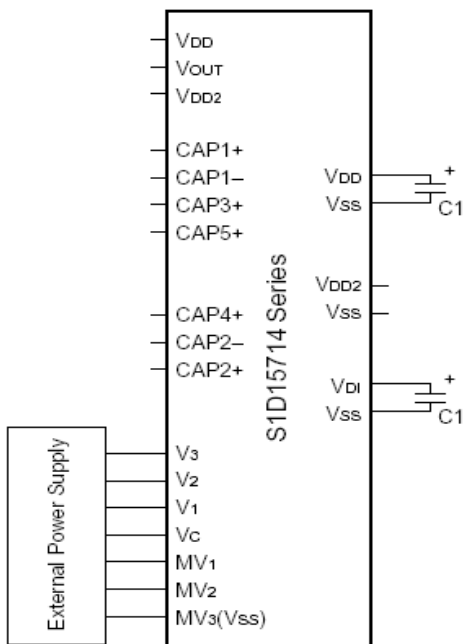
7.3 APPLICATION OF LCM

■Reference circuit

V3 adjusting circuit and LCDV circuit
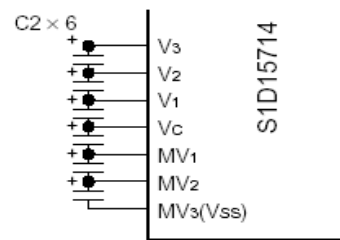VOUT external input (C: 9 units)
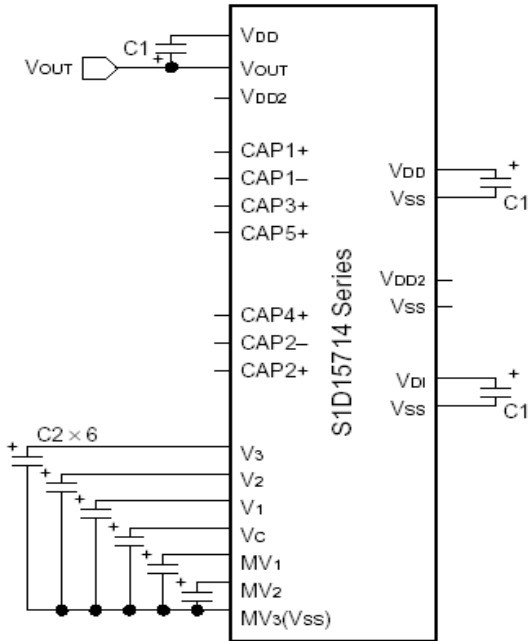
LCDV circuit only
V3 external input (C: 8 units)

External power supply only
External input (C: 2 unit)

Connection Example of Smoothing Capacitor for
Liquid Crystal Drive Voltage
In addition to the connections shown in the above ①
to ③, the following connection is also possible.

7.4 TABLE OF COMMAND

Command	A0	$\overline{RD}$	$\overline{WR}$	D7	D6	D5	D4	D3	D2	D1	D0	Function
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 / 1	LCD display ON/OFF control. 0: OFF, 1: ON
(2) Display Normal /Reverse	0	1	0	1	0	1	0	0	1	1	0 / 1	LCD display normal/reverse 0: Normal, 1: Reverse
(3) Display All Lighting ON/OFF	0	1	0	1	0	1	0	0	1	0	0 / 1	Display All Lighting 0: Normal display, 1: All ON
(4) Common Output Status Select	0	1	0	1	1	0	0	0	1	0	0 / 1	Selects COM output scan direction. 0: Normal, 1: Reverse
(5) Display Start Line Set	0	1	0	1	0	0	0	1	0	1	0	Sets display start line.
	0	1	0	*	*	Display start line address						
(6) Page Address Set	0	1	0	1	0	1	1	0	0	0	1	Sets the display RAM page address.
	0	1	0	*	*	Page address						
(7) Column Address Set Higher bits	0	1	0	0	0	0	1	Higher column address				Higher 4 bits of column address in Display RAM are set.
Column Address Set Lower bits	0	1	0	0	0	0	0	Lower column address				Lower 4 bits of column address in Display RAM are set.
(8) Display Data Write	1	1	0	Writes data								Writes data to the display RAM.
(9) Display Data Read	1	0	1	Reads data								Reads data to the display RAM.
(10) Display Data Input Direction Select	0	1	0	1	0	0	0	0	1	0	0 / 1	Display RAM data input direction 0: Column direction 1: Page direction
(11) Column Address Set Direction	0	1	0	1	0	1	0	0	0	0	0 / 1	Compatible with display RAM address SEG output 0: Normal 1: Reverse
(12) n-line inversion Drive Register Set	0	1	0	0	0	1	1	Invert line count				Line invert drive. Sets the line count.
(13) n-line ON/OFF	0	1	0	1	1	1	0	0	1	0	0	Resets the line invert drive. 0: n-line OFF 1: n-line ON
(14) Duty Set Command	0	1	0	0	1	1	0	1	1	0	1	2 byte command
Duty Set Static spot set	0	1	0	*	*	Static spot (block)						
(15) Read Modify Write	0	1	0	1	1	1	0	0	0	0	0	Increments the column address. Increments +1 in the write mode. Does not increment in the read mode.
(16) End	0	1	0	1	1	1	0	1	1	1	0	Resets read modify write functions.
(17) Built-in Oscillator Circuit ON/OFF	0	1	0	1	0	1	0	1	0	1	0 / 1	Built-in oscillator circuit operation 0: OFF, 1: ON
(18) Built-in Oscillator Circuit Frequency Select	0	1	0	0	1	1	1	Frequency				
(19) Power Control Set	0	1	0	0	0	1	0	1	Operation state			Selects built-in power supply operation state.
(20) Liquid Crystal Drive Voltage Select	0	1	0	0	0	1	0	0	V3 range			
(21) LCD bias change	0	1	0	1	0	1	0	0	0	bias		Bias ratio select
(22) Electronic Volume Mode Set	0	1	0	1	0	0	0	0	0	0	1	
Electronic Volume Register Set	0	1	0	*	Electronic volume							V3 output voltage is set to the electronic volume register. 128 states
(23) Discharge ON/OFF	0	1	0	1	1	1	0	1	0	1	0 / 1	Discharges Power supply circuit connection capacitor. 0: OFF (normal), 1: ON
(24) Power Save ON/OFF	0	1	0	1	0	1	0	1	0	0	0 / 1	Power Save 0: OFF, 1: ON
(25) Temperature Gradient Select	0	1	0	0	1	0	0	1	Temperature gradient			Sets to 8 steps.
(26) Stator Read	0	1	0	1	0	0	0	1	1	1	0	Issues the temperature gradient select bit. * : denote invalid bits.
	0	0	1	*	*	*	*	*Temperature gradient				
(27) Reset	0	1	0	1	1	1	0	0	0	1	0	Resets the column, page and address registers. Resets the read modify write function.
(28) Temperature Sensor ON/OFF	0	1	0	0	1	1	0	1	0	0	0	Temperature sensor 0 : OFF (normal), 1 : ON
(29) MLS Drive Select (2-byte command)	0	1	0	1	1	1	0	0	1	1	1	Mode Set
	0	1	0	*	*	*	0	MLS	0	1	1	MLS 0 : Dispersion, 1: Non-dispersion
(30) NOP	0	1	0	1	1	1	0	0	0	1	1	Non-operation command

8. ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Temp	Min	Typ.	Max	Units	Note
LCD driving voltage	V_{LCD}	$\theta = \phi = 0$	0℃	---	7.3	---	V	NOTE1
			25℃	6.5	7.0	7.5		
			50℃	---	6.7	---		
Response Time	Rise Time (Tr)	$\theta = \phi = 0$	0℃	---	---	--	msec	NOTE2
	Decay Time (Tf)			---	----	---		
	Rise Time (Tr)		25℃	---	225	340		
	Decay Time (Tf)			---	240	360		
	Rise Time (Tr)		50℃	---	---	--		
	Decay Time (Tf)			---	---	--		
Contrast Ratio	Cr	$\theta = \phi = 0$	25℃	5	10	---	---	NOTE4

Viewing Angle Range	θ ($\phi = 0°$) (6")	$\phi = 90°$ (3")	$\phi = 180°$ (12")	$\phi = 270°$ (9")	備註
θ (25℃) CR≥2	15	35	45	30	Deg NOTE3

● For panel only

- **Electro-Optical Characteristics Measuring Equipment(DMS501)**

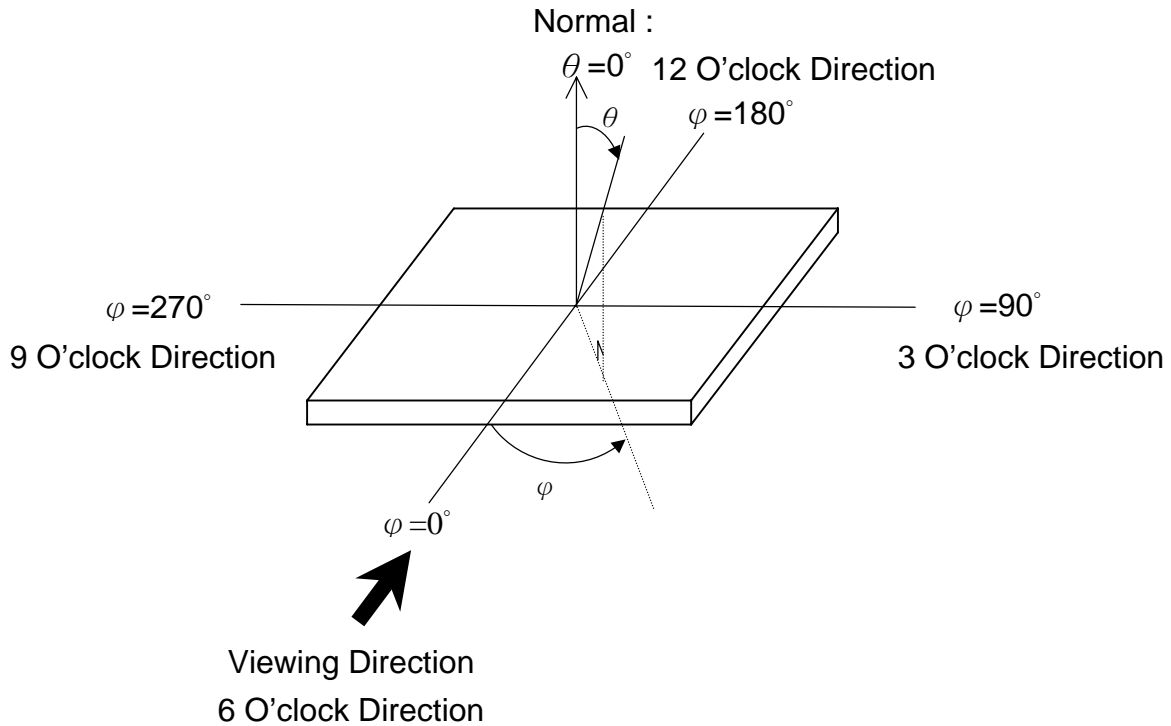System   Illumination (D65)
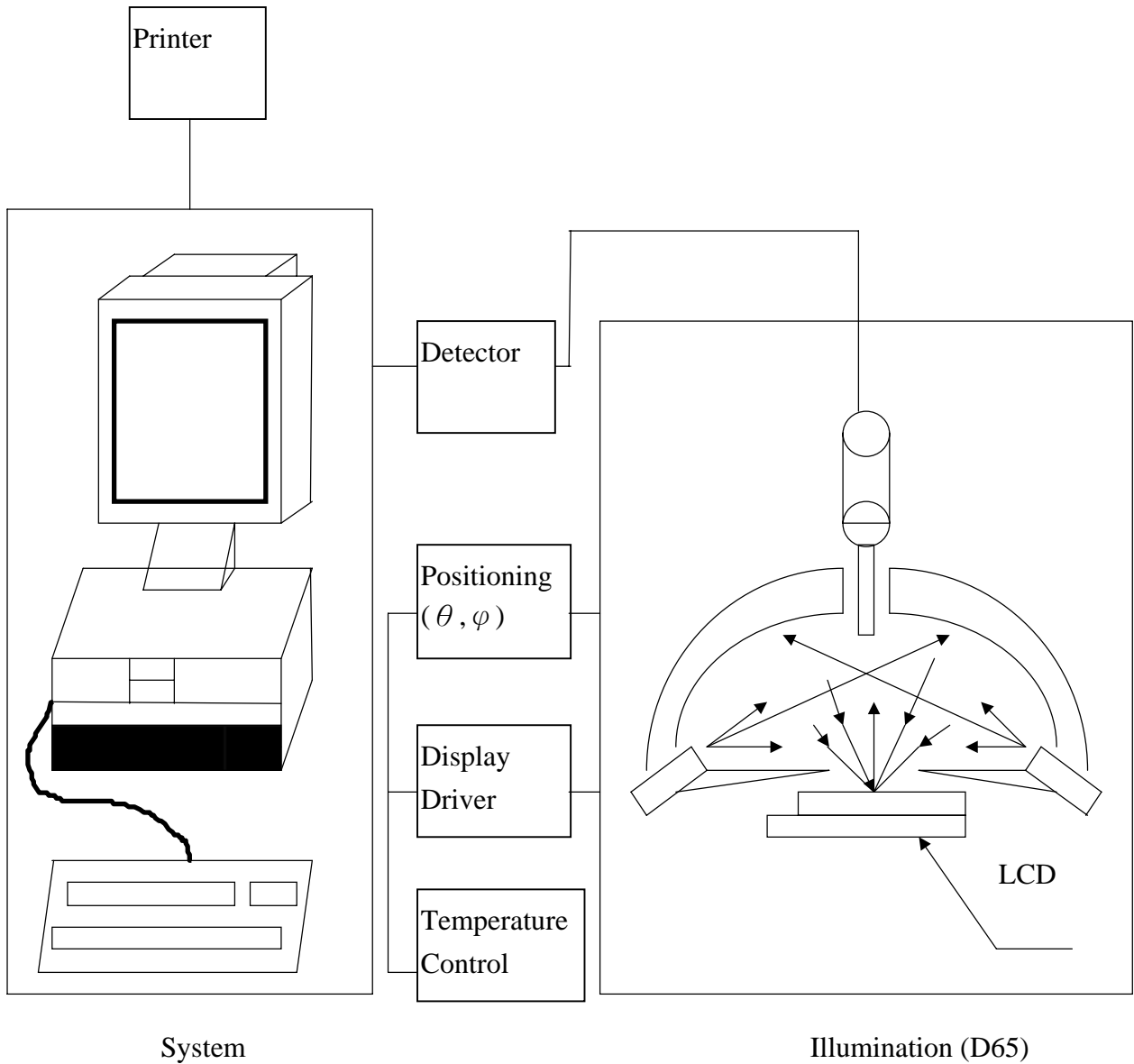
● **Note 1.   Definition of Driving Voltage(Vlcd) :**
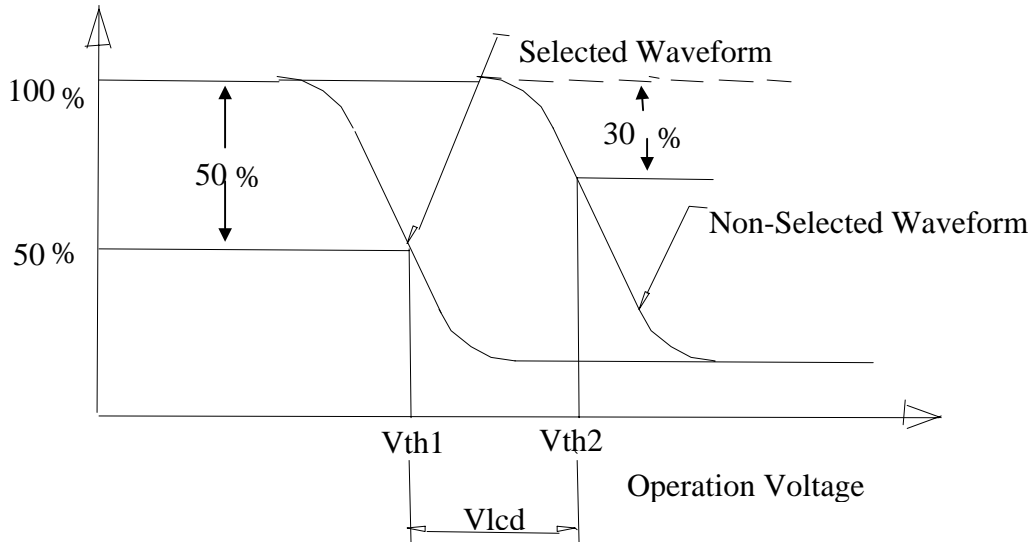
● **Note 2.   Definition of Optical Response Time :**
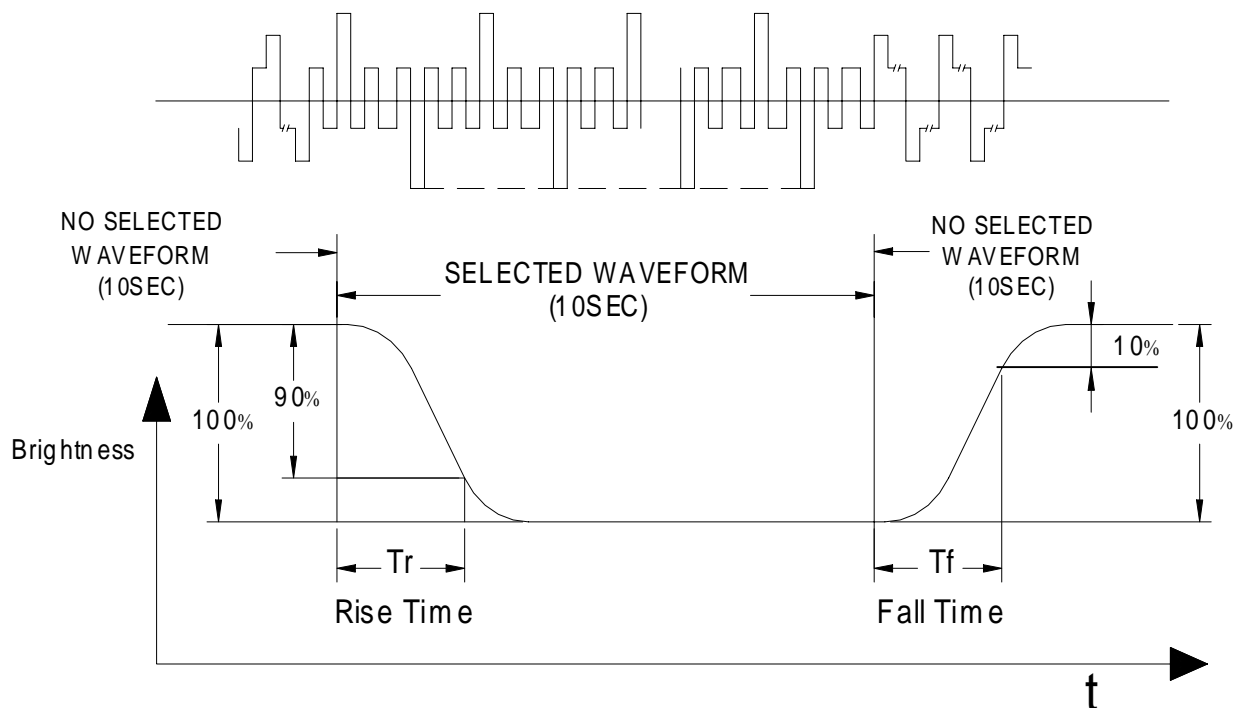
• **Note 3.   Definition of Viewing Angle θ and ϕ :**

Normal :
$\theta = 0°$ 12 O'clock Direction

θ

$\varphi = 180°$

$\varphi = 270°$

9 O'clock Direction

$\varphi = 90°$

3 O'clock Direction

φ

$\varphi = 0°$

Viewing Direction
6 O'clock Direction

• **Note 4.   Definition of Contrast ratio(CR) :**

$$CR = \frac{\text{Brightness of Non-selected Segment (B2)}}{\text{Brightness of Selected Segment (B1)}}$$

Brightness Curve for
Selected Segment

Brightness Curve for
Non-selected Segment

Contrast

Brightness (%)

100%

B2

CR,max

0%

B1

V,max

Driving Voltage
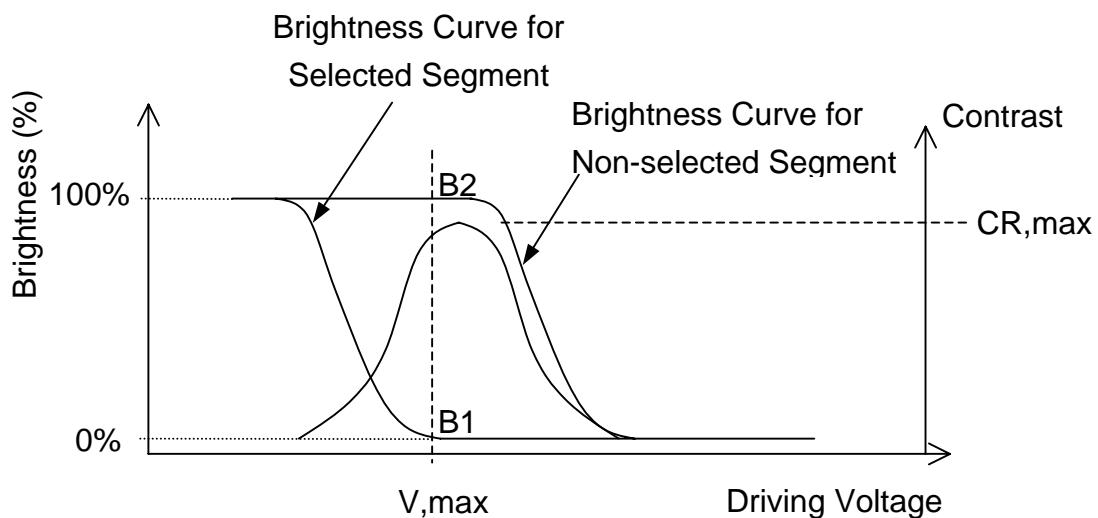
9. RELIABILITY

9.1. MTBF

The LCD module shall be designed to meet a minimum MTBF value of 50000 hours with normal. (25°C in the room without sunlight)

9.2. TESTS

NO.	ITEM	CONDITION	CRITERION
1	High Temperature Operating	70℃ 120Hrs	◦ No Defect Of Operational Function In Room Temperature Are Allowable.
2	Low Temperature Operating	-25℃ 120Hrs	
3	High Temperature/ Humidity Non-Operating	70℃ ,90%RH ,120 Hrs	◦ IDD of LCM in Pre-and post-test should follow specification
4	High Temperature Non-Operating	280℃ 120Hrs	
5	Low Temperature Non-Operating	-35℃ 120Hrs	
6	Temperature Cycling Non-Operating	-20℃(30Min)↔ 600℃(30Min) 10 CYCLES	

Notes: Judgments should be mode after exposure in room temperature for two hours.

10. PRECAUTIONS FOR USING LCD MODULES

10.1. HANDLING PRECAUTIONS

(1) The display panel is made of glass. Do not subject it to a mechanical shock or impact by dropping it.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten a cloth with one of the following solvents:
    - Isopropyl alcohol
    - Ethyl alcohol

(6) Solvents other than those above mentioned may damage the polarizer.
    Especially, do not use the following:
    - Water
    - Ketone
    - Aromatic solvents

(7) Extra care to minimize corrosion of the electrode. Water droplets, moisture condensation or a current flow in a high-humidity environment accelerates corrosion of the electrode.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD Module, make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD Module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Be sure to ground the body when handling he LCD Module.
- Tools required for assembling, such as soldering irons, must be properly grounded.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.

-The LCD Module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

10.2.　STORAGE CONDITIONS

When storing, avoid the LCD module to be exposed to direct sunlight of fluorescent lamps. For stability, to keep it away form high temperature and high humidity environment (The best condition is : 23±5°C, 45±20%RH). ESD protection is necessary for long-term storage also.

10.3.　OTHERS

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD Module have been operating for a long time showing the same display patterns the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be recovered by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD Module resulting from destruction caused by static electricity etc. exercise care to avoid holding the following sections when handling the modules.

- Exposed area of the printed circuit board.
- Terminal electrode sections.

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11. Using LCD modules

11.1 LIQUID CRYSTAL DISPLAY MODULES

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

(1) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

(2) Do not touch, push or rub the exposed polarizers with anything harder than a HB pencil lead (glass, tweezers, etc).

(3) N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances, which will be damaged by chemicals such as acetone, toluene, toluene, ethanol and isopropyl alcohol.

(4) When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum ether. Do not scrub hard to avoid damaging the display surface.

(5) Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.

(6) Avoid contacting oil and fats.

(7) Condensation on the surface and contact with terminals due to cold will damage, stain or polarizers. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(8) Do not put or attach anything on the display area to avoid leaving marks on.

(9) Do not touch the display with bare hands. This will stain the display area and degrade insulation between terminals (some cosmetics are determinate to the polarizers).

(10)As glass is fragile, it tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring.

11.2 INSTALLING LCD MODULE

Attend to the following items when installing the LCM.

(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.

(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

11.3 ELECTRO-STATIC DISCHARGE CONTROL

Since this module uses a CMOS LSI, the same careful attention should be paid for electrostatic discharge as for an ordinary CMOS IC.

(1) Make certain that you are grounded when handing LCM.

(2) Before removing LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.

(3) When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.

(4) When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

(5) As far as possible, make the electric potential of your work clothes and that of the workbenches to the ground potential.

(6) To reduce the generation of electro-static discharge, be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.

11.4 PRECAUTIONS FOR OPERATION

(1) Viewing angle varies with the change of liquid crystal driving voltage (Vo). Adjust Vo to show the best contrast.

(2) Driving the LCD in the voltage above the limit will shorten its lifetime.

(3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.

(4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then on.

(5) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, this product must be used and stored within the specified condition of $23\pm5°C$, $45\pm20\%RH$.

(6) When turning the power on, input each signal after the positive/negative voltage becomes stable.

11.5 SAFETY

(1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

12. REVISION HISTORY

Version	Revise record	Date
1.0	Original version	05-01-01
2.0	Change specification format	05-11-21

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SAMPLE APPROVED REPORT
(   )

SAMPLE MODEL NO. ( )	GG2033
SAMPLE SERIES NUMBER NO. ( )	
SAMPLE QUANTITY ( )	
COLOR/TYPE (/)	STN/NEGATIVE
VIEWING DIRECTION ( )	6:00
DRIVING METHOD ( )	1/65Duty, 1/9Bias
LOGIC VOLTAGE (IC)	5.0V
LCD VOP (LCD)	7.0V
OPERATING TEMP. ( )	-25~70
STORAGE TEMP. ( )	-35~80
POLARIZER----FRONT ( )	TRANSMISSIVE
POLARIZER----BACK ( )	TRANSMISSIVE
CONTROLLER/DRIVER IC(/ IC)	S1D15714D00B00
BACKLIGHT COLOR/TYPE (/)	NONE
DRAWING REV/NO./QUANTITY (/)	
SPECIFICATION ( )	

REMARKS

(   )

WRIT BY _____ DATE _____ APROV BY _____ DATE _____

CUSTOMER'S APPROVAL (   )

1   FUNCTION   ☐ OK   ☐ N.G.

2   DRIVER CONDITION   ☐ OK   ☐ N.G.

3   DISPLAY MODE   ☐ OK   ☐ N.G.

4   VIEWING   ANGLE   ☐ OK   ☐ N.G.

5   BACKLIGHT   ☐ OK   ☐ N.G.

6   DISPLAYING   PATTERN   ☐ OK   ☐ N.G.

CUSTOMER'S CONCLUSIONS   (   ) _____

_____

_____

CUSTOMER'S   SIGNATURE   _____ DATE (   ) _____