DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 097032B SGH-PY

Product Specification   *Version: 1*

01.06.2017

GENERAL SPECIFICATION

MODULE NO. :

DEM 097032B SGH-PY

CUSTOMER   P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORGINAL VERSION	27.05.2017
1	Add Version	01.06.2017

PREPARED BY: GJJ   DATE: 01.06.2017

APPROVED BY: MH   DATE: 01.06.2017

CONTENTS

1. FUNCTIONS &FEATURES

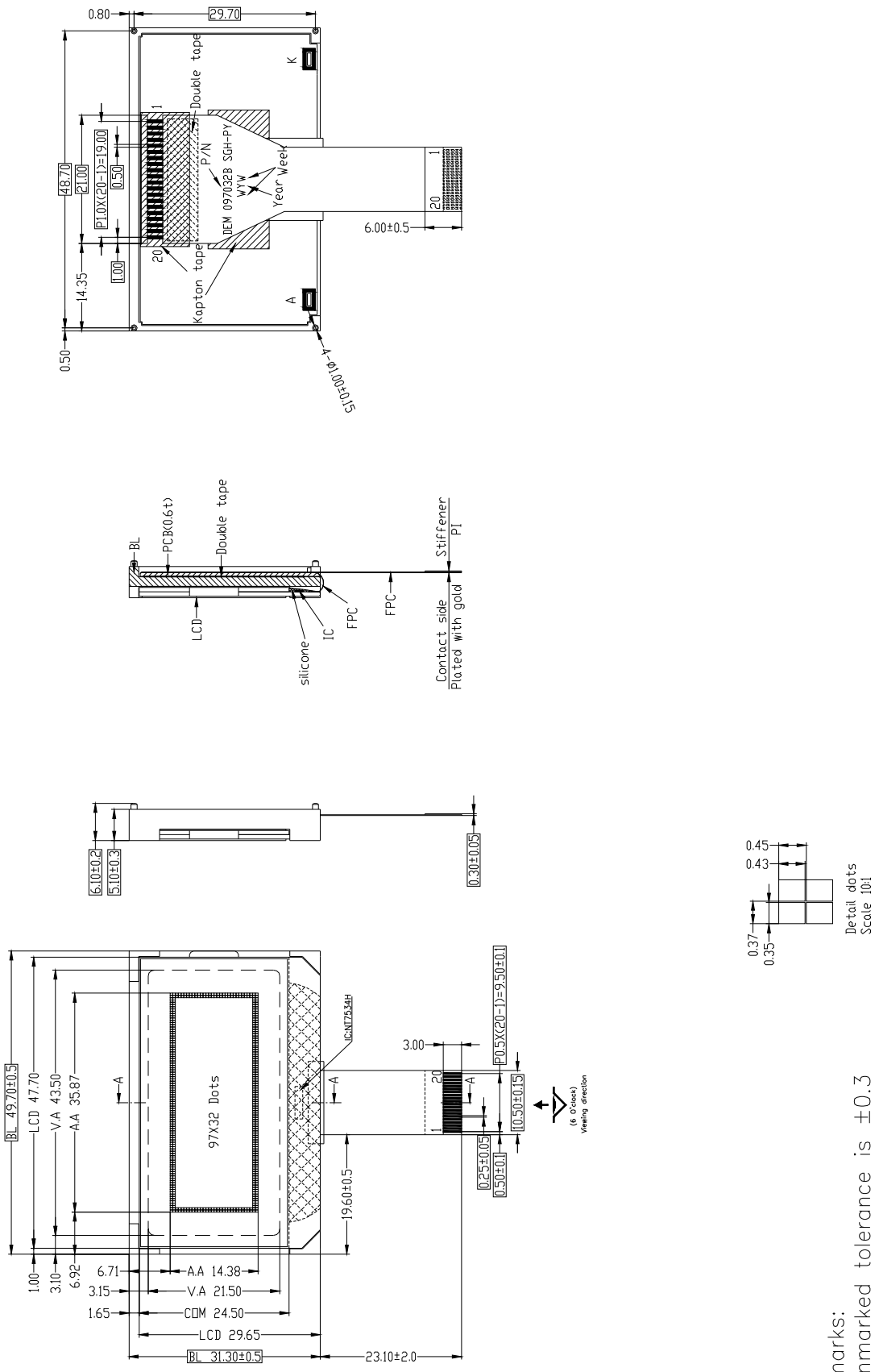| MODULE NAME	LCD TYPE	REMARK
DEM 097032B SGH-PY	STN-GRAY TRANSFLECTIVE POSITIVE	–

- Viewing Direction   : 6 O'clock
- Driving Scheme   : 1/33Duty, 1/6Bias
- Power Supply For Logic   : 3.0 Volt
- LCD voltage   : 6.2 Volt (typ.)
- Interface   : 8-Bit-Parallel-MCU Interface (8080)
- Driver IC   : NT7534H (Novatek COG-Driver IC)

2. MODULE ARTWORK
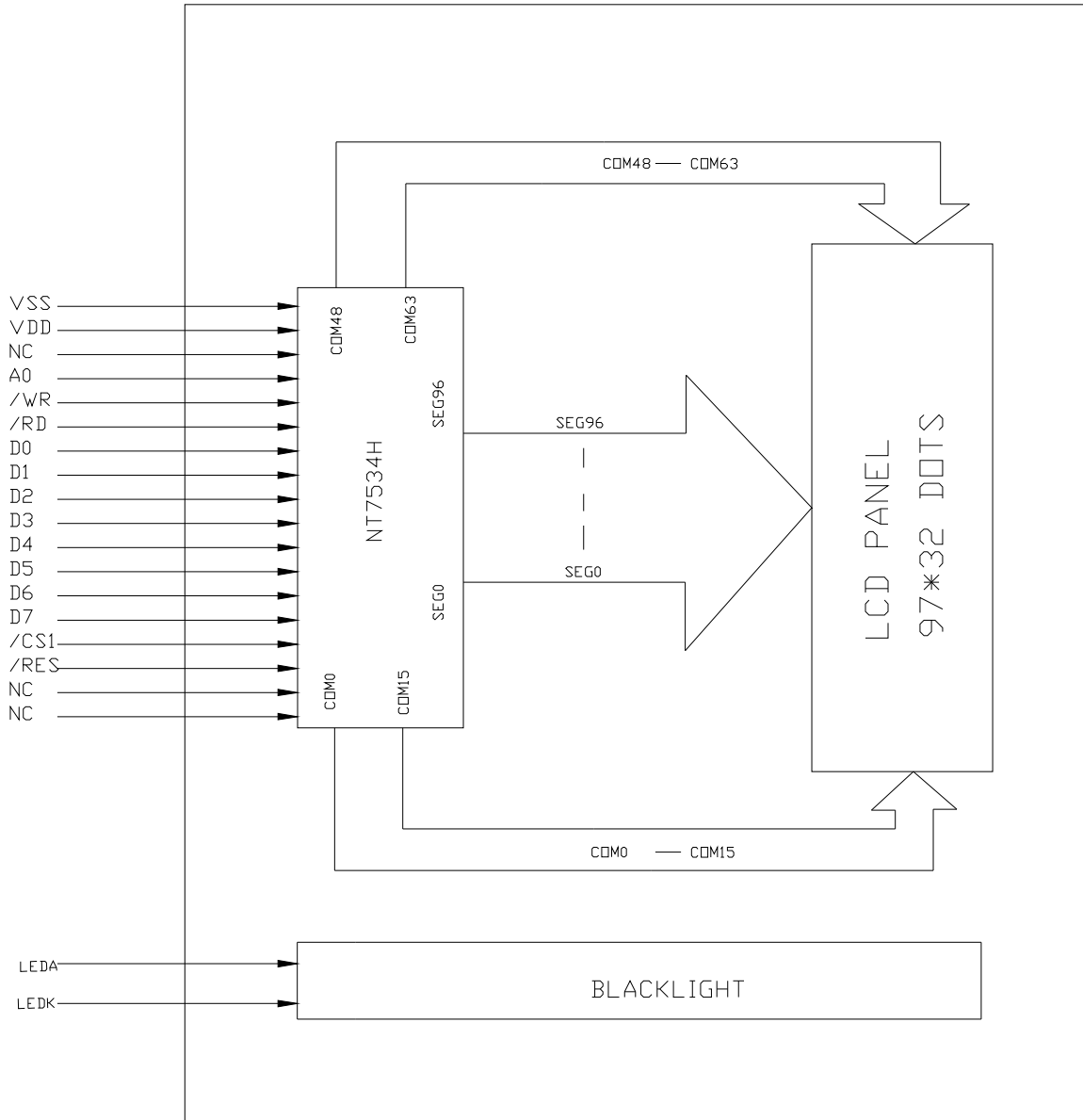
- Module Size   : 49.70 x 31.30 x 6.10 mm (max)
- Viewing Area   : 43.50 x 21.50 mm
- Active Area   : 35.87 x 14.38 mm
- Dot Size   : 0.35 x 0.43 mm
- Dot Gap   : 0.02 mm

3. EXTERNAL DIMENSIONS

4. BLOCK DIAGRAM

5. PIN ASSIGNMENT

N0.	SYMBOL	FUCTION
1	VSS	Ground output for pad option.
2	VDD	Power supply output for pad option
3	NC	No connection
4	A0	This is connected to the least significant bit of the normal MPU address bus, and it determines whether the data bits are data or a command. A0 = "H": Indicate that D0 to D7 are display data A0 = "L": Indicates that D0 to D7 are control data
5	/WR	When connected to an 8080 MPU, this is active LOW. This terminal connects to the 8080 MPU /WR signal. The signals on the data bus are latched at the rising edge of the /WR signal. When connected to a 6800 Series MPU, this is the read/write control signal input terminal. When R/W = "H": Read When R/W = "L": Write
6	/RD	When connected to an 8080 MPU, it is active LOW. This pad is connected to the /RD signal of the 8080MPU, and the NT7534 data bus is in an output status when this signal is "L". When connected to a 6800 Series MPU, this is active HIGH. This is used as an enable clock input of the 6800 series MPU
7	D0~D7	This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus. When the serial interface is selected (P/S="L"), then D7 serves as the serial data input terminal (SI) and D6 serves as the serial clock input terminal (SCL). When the serial interface is selected, fix D0~D5 pads to VDD or VSS level. When the chip select is inactive, D0 to D7 are set to high impedance.
8		
9		
10		
11		
12		
13		
14		
15	/CS1	Chip select signal.
16	/RES	When /RES is set to "L", the settings are initialized. The reset operation is performed by the /RES signal level.
17	NC	No connection
18	NC	No connection
19	A	LED A(+)
20	K	LED K(-)

6. PCB DRAWING

6.1 PCB DRAWING

TBD

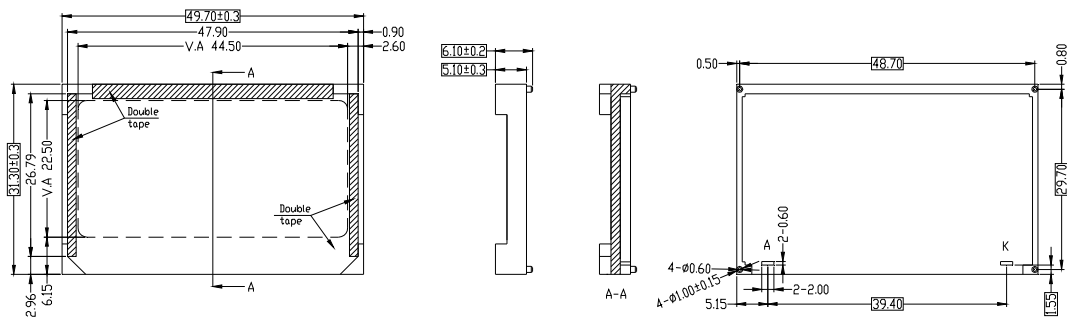Note: The PCB drawing is just for reference!!

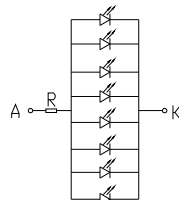**6.2 THE DESCRIPTION OF THE JUMPER**

TBD

7. BACKLIGHT CHARACTERISTICS

ELECTRICAL-OPTICAL CHARACTERISTICS:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forward Voltage	Vf	1.9	2.1	2.3	V	
Luminance	Lv	32	44	--	cd/m²	If= 80 mA
Uniformity	Avg	70			%	
Dominant Wave Length	λD	565	570	575	nm	

Electrical Circuit:

A ○—R—[8PCS Yellow-Green LED]—○K

8PCS Yellow-Green LED

REMARKS:
1.Unmarked tolerance is ±0.3,
2.All materials comply with RoHs.
3.▭...:critical dimension.

8. MAXIMUM ABSOLUTE POWER RATINGS.

Item	Symbol	Standard value	Unit
Power Supply Voltage(1)	V_{DD}	-0.3 ~ +4.0	V
Power Supply Voltage(2)	V_{LCD}	-0.3 ~ +15.0	V
Input Voltage	V_I	-0.3V ~ VDD+0.3	V
Operating Temperature	Topr	-20 ~ +70	°C
Storage Temperature	Tstg	-30 ~ +80	°C

9. ELECTRICAL CHARACTERISTICS

9.1 DC Characteristics

ITEM	symbol	STANDARD VALUE			TEST CONDITION	UNIT
		MIN	TYP	MAX		
Supply Voltage For Logic	V_{DD}	2.4	3.0	3.6	-	V
Supply Voltage For LCD	V_{LCD}	5.9	6.2	6.5	-	
Current Consumption	I_{DD}		t.b.d.		-	mA
High-Level Input Voltage	VIHC	0.8xVDD	-	VDD	-	V
Low-Level Input Voltage	VILC	VSS	-	0.2xVDD	-	
High-Level Output Voltage	VOHC	0.8xVDD	-	VDD	-	
Low -Level Output Voltage	VOLC	VSS	-	0.2xVSS	-	

9.2 AC Characteristics

9.2.1 System Buses Read/Write Characteristics (for 8080 Series MPU)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
T_{AH8}	Address hold time	0	-	-	ns	A0
T_{AS8}	Address setup time	0	-	-	ns	
t_{CYC8}	System cycle time	240	-	-	ns	
t_{CCLW}	Control low pulse width (write)	90	-	-	ns	/WR
t_{CCLR}	Control low pulse width (read)	120	-	-	ns	/RD
t_{CCHW}	Control high pulse width (write)	100	-	-	ns	/WR
t_{CCHR}	Control high pulse width (read)	60	-	-	ns	/RD
T_{DS8}	Data setup time	40	-	-	ns	D0~D7
T_{DH8}	Data hold time	10	-	-	ns	
t_{ACC8}	/RD access time	-	-	140	ns	D0~D7,CL=100pF
T_{CH8}	Output disable time	5	-	50	ns	
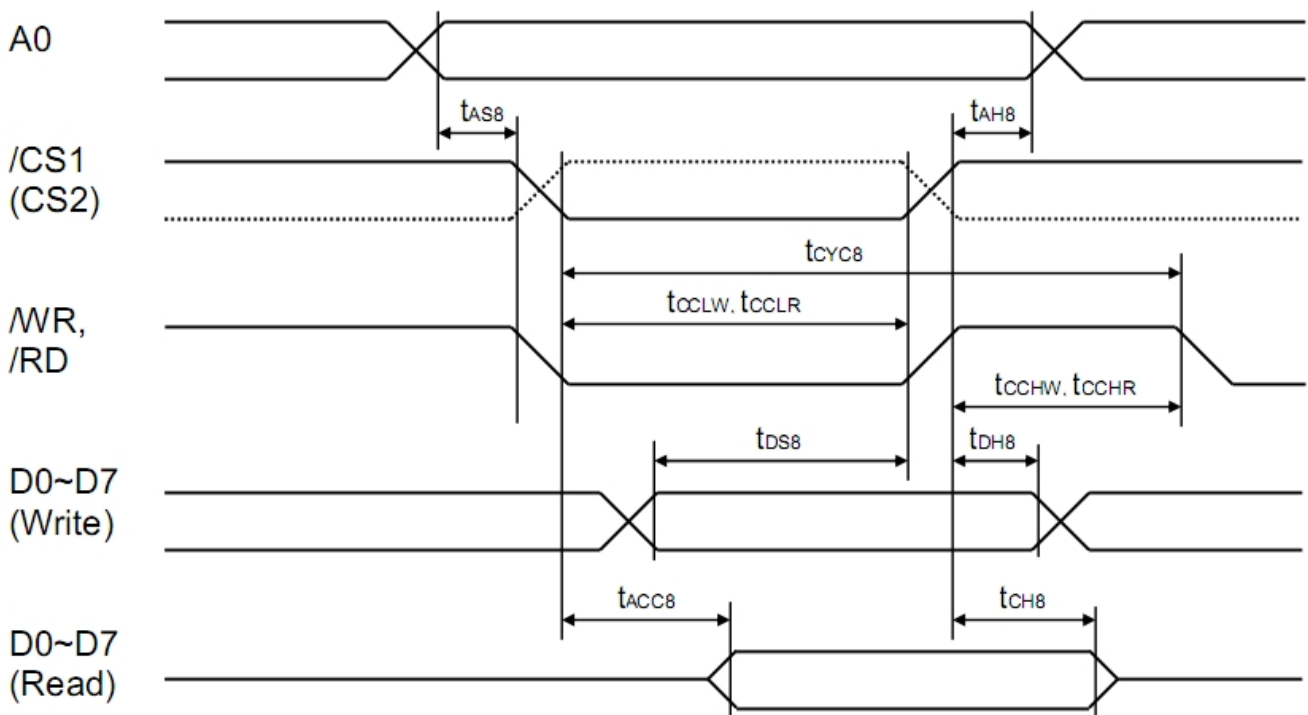
9.2.2 System Buses Read/Write Characteristics (for 6800 Series MPU)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{AH6}	Address hold time	0	-	-	ns	A0, R/W
t_{AS6}	Address setup time	0	-	-	ns	
t_{CYC6}	System cycle time	240	-	-	ns	
t_{EWHW}	Control high pulse width (write)	90	-	-	ns	E
t_{EWHR}	Control high pulse width (read)	120	-	-	ns	E
t_{EWLW}	Control low pulse width (write)	100	-	-	ns	E
t_{EWLR}	Control low pulse width (read)	60	-	-	ns	E
t_{DS6}	Data setup time	40	-	-	ns	D0~D7
t_{DH6}	Data hold time	10	-	-	ns	
t_{ACC6}	/RD access time	-	-	140	ns	D0~D7,CL=100pF
t_{OH6}	Output disable time	5	-	50	ns	
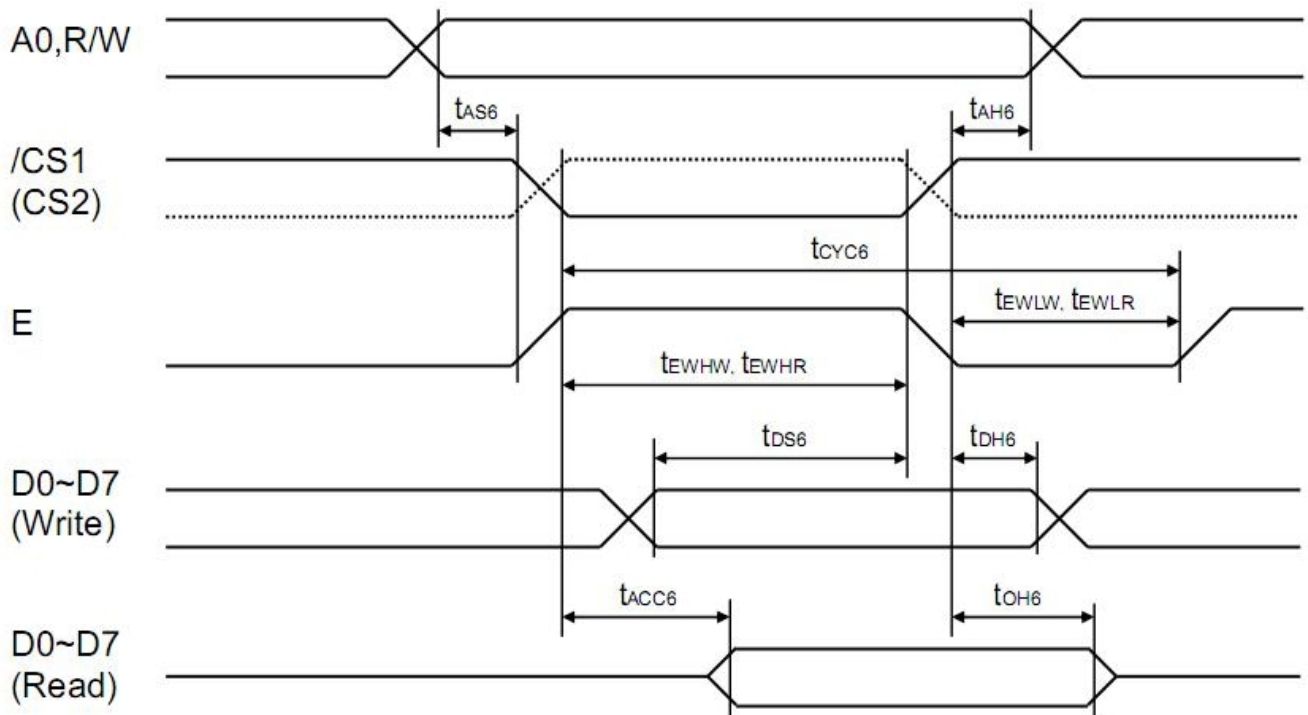
9.2.3 Serial Interface Timing

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{SCYC}	Serial clock cycle	120	-	-	ns	SCL
t_{SHW}	Serial clock H pulse width	60	-	-	ns	SCL
t_{SLW}	Serial clock L pulse width	60	-	-	ns	SCL
t_{SAS}	Address setup time	30	-	-	ns	A0
t_{SAH}	Address hold time	20	-	-	ns	A0
t_{SDS}	Data setup time	30	-	-	ns	SI
t_{SDH}	Data hold time	20	-	-	ns	SI
t_{CSS}	Chip select setup time	20	-	-	ns	/CS1, CS2
t_{CSH}	Chip select hold time	40	-	-	ns	/CS1, CS2
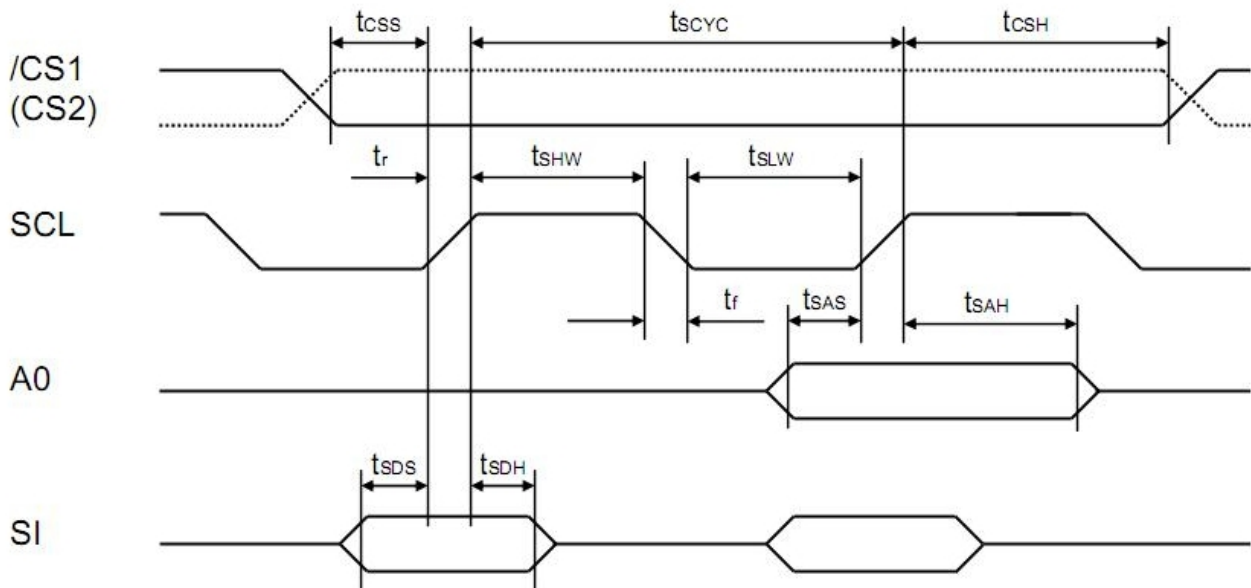
9.2.4 Reset Timing

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_R	Reset time	--	--	1.0	μs	
t_{RW}	Reset low pulse width	10	--	--	μs	/RES
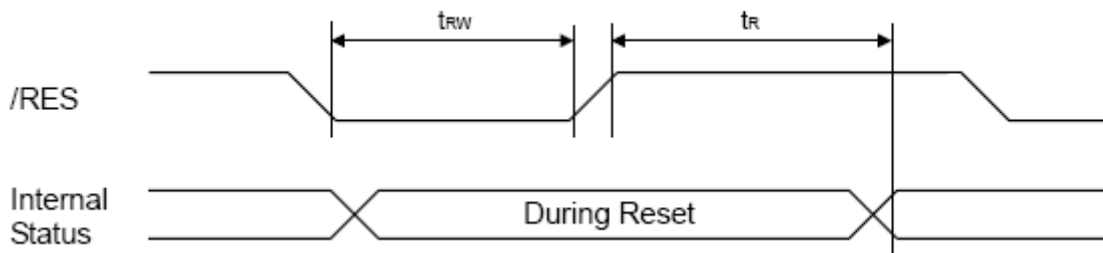
10. INSTRUCTION TABLE

Command	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Function
(1) Display OFF	0	1	0	1	0	1	0	1	1	1	0 / 1	AEh AFh	Turn on LCD panel when high, and turn off when low
(2) Display Start Line Set	0	1	0	0	1	Display Start Address						40h to 7Fh	Specifies RAM display line for COM0
(3) Page Address Set	0	1	0	1	0	1	1	Page Address				B0h to B8h	Set the display data RAM page in Page Address register
(4) Column Address Set	0	1	0	0	0	0	1	Higher Column Address				00h to 18h	Set 4 higher bits and 4 lower bits of column address of display data RAM in register
	0	1	0	0	0	0	0	Lower Column Address					
(5) Read Status	0	0	1	Status				0	0	0	0	XX	Reads the status information
(6) Write Display Data	1	1	0	Write Data								XX	Write data in display data RAM
(7) Read Display Data	1	0	1	Read Data								XX	Read data from display data RAM
(8) ADC Select	0	1	0	1	0	1	0	0	0	0	0 / 1	A0h A1h	Set the display data RAM address SEG output correspondence
(9) Normal/Reverse Display	0	1	0	1	0	1	0	0	1	1	0 / 1	A6h A7h	Normal indication when low, but full indication when high
(10) Entire Display ON/OFF	0	1	0	1	0	1	0	0	1	0	0 / 1	A4h A5h	Select normal display (0) or entire display on
(11) LCD Bias Set	0	1	0	1	0	1	0	0	0	1	0 / 1	A2h A3h	Sets LCD driving voltage bias ratio
(12) Read-Modify-Write	0	1	0	1	1	1	0	0	0	0	0	E0h	Increments column address counter during each write
(13) End	0	1	0	1	1	1	0	1	1	1	0	EEh	Releases the Read-Modify-Write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	E2h	Resets internal functions
(15) Common Output Mode Select	0	1	0	1	1	0	0	0 / 1	x	x	x	C0h to CFh	Select COM output scan direction *: invalid data
(16) Power Control Set	0	1	0	0	0	1	0	1	Operation Status			28h to 2Fh	Select the power circuit operation mode
(17) V0 Voltage Regulator Internal Resistor ratio Set	0	1	0	0	0	1	0	0	Resistor Ratio			20h to 27h	Select internal resistor ratio Rb/Ra mode
(18) Electronic Volume mode Set	0	1	0	1	0	0	0	0	0	0	1	81h	
Electronic Volume Register Set	0	1	0	x	x	Electronic Control Value					XX	Sets the V0 output voltage electronic volume register
(19) Set Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0 / 1	ACh ADh	Sets static indicator ON/OFF 0: OFF, 1: ON
Set Static Indicator Register	0	1	0	x	x	x	x	x	x	Mode		XX	Sets the flash mode
(20) Power Save	0	1	0	-	-	-	-	-	-	-	-	-	Compound command of Display OFF and Entire Display ON
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	E3h	Command for non-operation

Command Table (continue)

Command	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Function
(22)Oscillation Frequency Select	0	1	0	1	1	1	0	0	1	0	0 1	E4h E5h	Select the oscillation frequency
(23)Partial Display mode Set	0	1	0	1	0	0	0	0	0	1	0 1	82h 83h	Enter/Release the partial display mode
(24)Partial Display Duty Set	0	1	0	0	0	1	1	0	Duty Ratio			30h 37h	Sets the LCD duty ratio for partial display mode
(25)Partial Display Bias Set	0	1	0	0	0	1	1	1	Bias Ratio			38h 3Fh	Sets the LCD bias ratio for partial display mode
(26)Partial Start Line Set	0	1	0	1	1	0	1	0	0	1	1	D3h	Enter Partial Start Line Set
Partial Start Line Set	0	1	0	1	1	Partial Start Line						XX	Sets the LCD Number of partial display start line
(27)N-Line Inversion Set	0	1	0	1	0	0	0	0	1	0	1	85h	Enter N-Line inversion
Number of Line Set	0	1	0	ˣ	ˣ	ˣ	Number of Line					XX	Sets the number of line used for N-Line inversion
(28)N-Line Inversion Release	0	1	0	1	0	0	0	0	1	0	0	84h	Exit N-Line Inversion
(29)DC/DC Clock Set	0	1	0	1	1	1	0	0	1	1	0	E6h	Set DC/DC Clock Frequency
DC/DC Clock Division Set	0	1	0	1	1	0	0	Clock Division				XX	Set the Division of DC/DC Clock Frequency
(30)Test Command	0	1	0	1	1	1	1	ˣ	ˣ	ˣ	ˣ	F1h to FFh	IC test command. Do not use!
(31)Test Mode Reset	0	1	0	1	1	1	1	0	0	0	0	F0h	Command of test mode reset

Note: Do not use any other command, or system malfunction may result.

11. LCD ELECTRICAL& OPTICAL CHARACTERISTICS

Item	Symbol	Description	Condition	Temp.	Min.	Typ.	Max.	Unit
Contrast	Cr		$\theta=10°$, $\Phi=0°$ $V_{CC}=3.0V\pm3\%$	25°C	-	4	-	-
Viewing angle	θ	6 o'clock axis	Cr≥2.0 $V_{CC}=3.0V\pm3\%$	25°C	35	40	-	°
		12 o'clock axis			30	35	-	
		3 o'clock axis			30	35	-	
		9 o'clock axis			30	35	-	
Response time	T_r	Rise	$V_{CC}=3.0V\pm3\%$	25°C	-	200	300	ms
	T_f	Fall	$V_{CC}=3.0V\pm3\%$	25°C	-	200	300	

11.1 Definition of Characteristics.
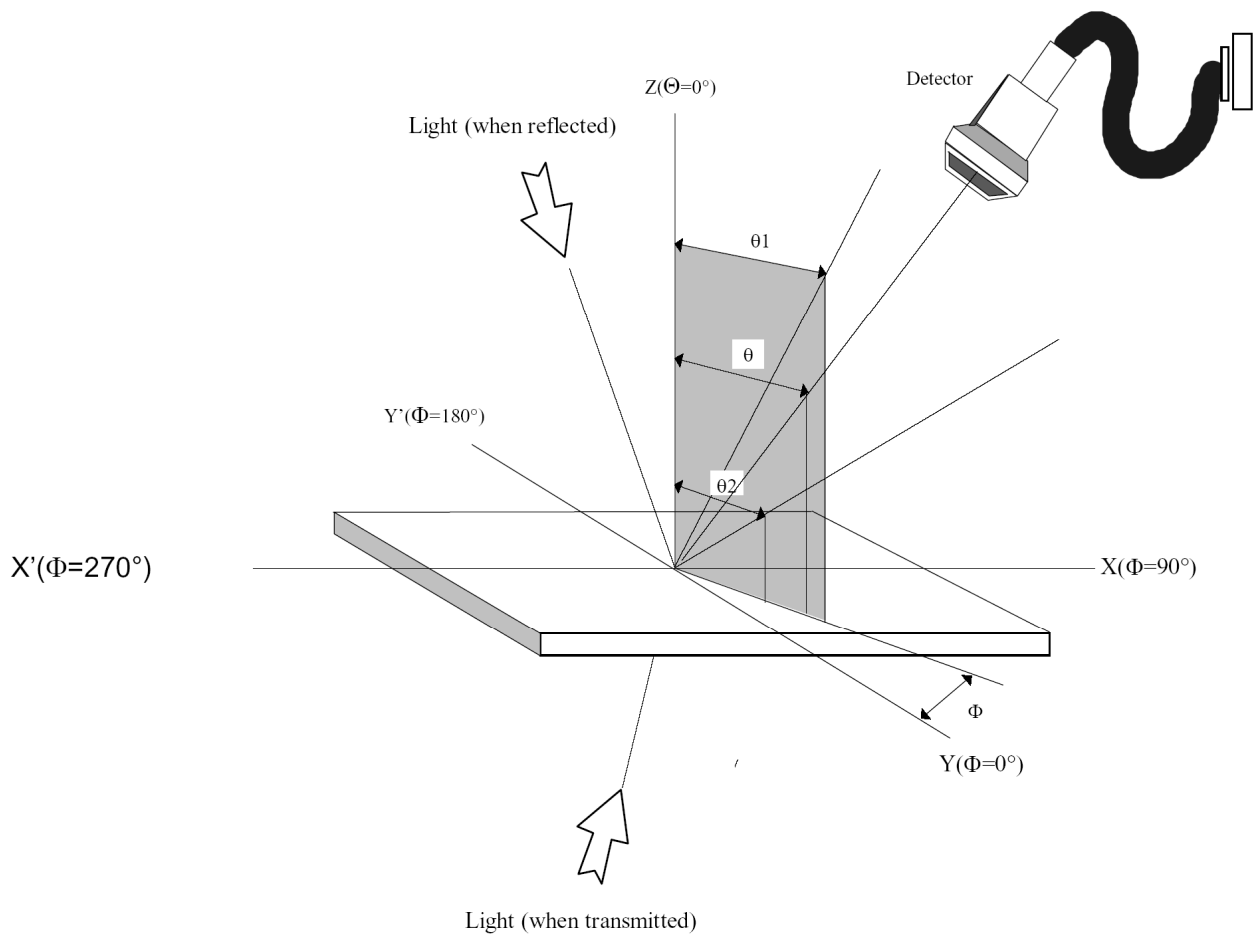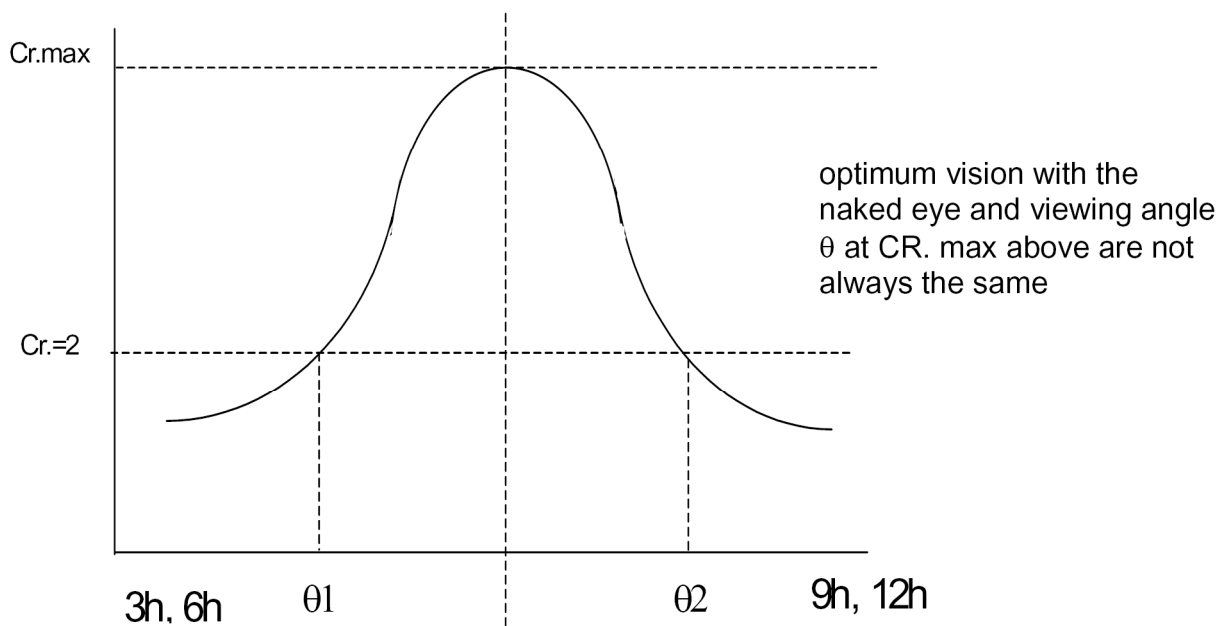
Definition of contrast $Cr. = \dfrac{B2}{B1} = \dfrac{\text{Bright curve of not selected segment}}{\text{Bright curve of selected segment}}$
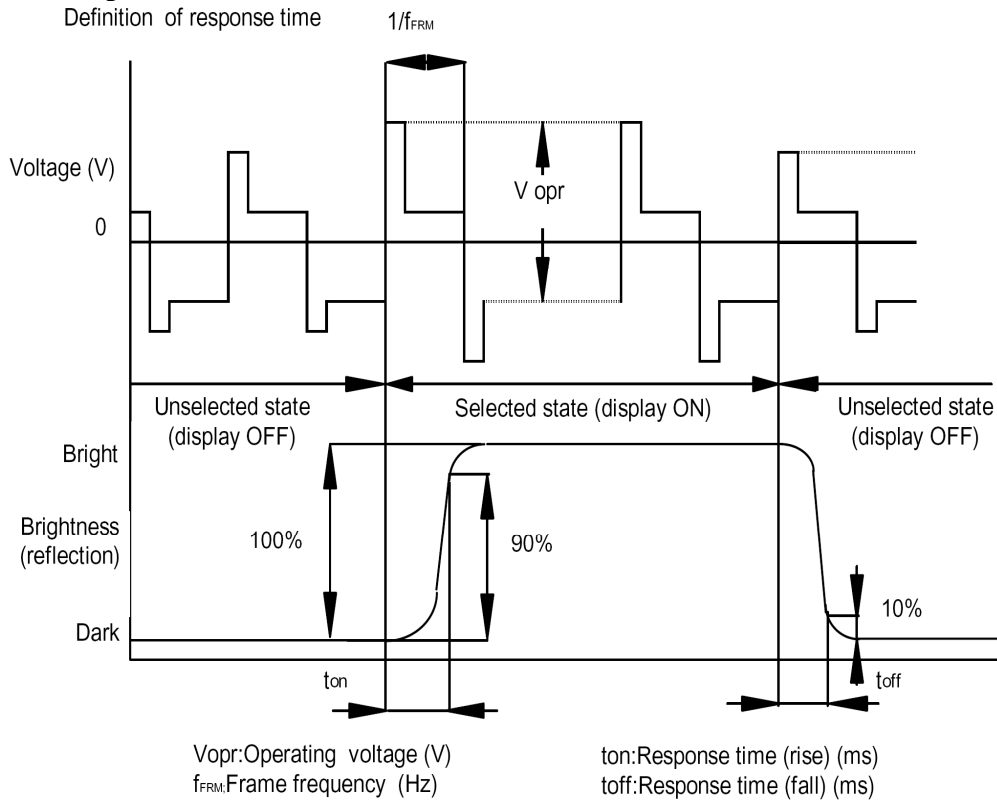
Bright (%)

Brightbess

Dark

B2

B1

Bright curve of selected segment

Bright curve of non-selected segment

Operating voltage (V)
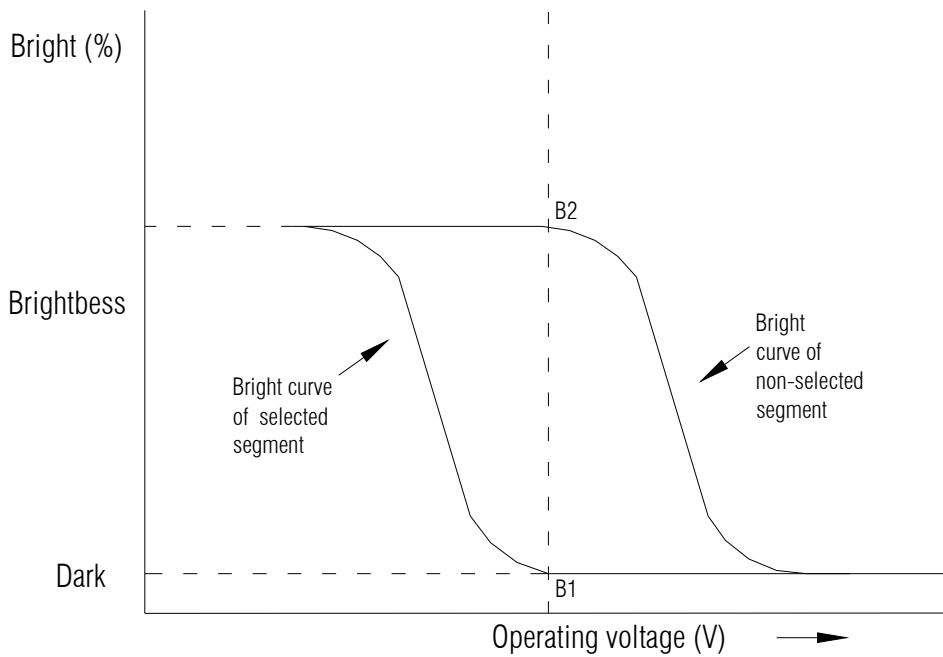
11.2. Definition of viewing angle

Definition of viewing angle $\theta1$ and $\theta2$

Cr.max

Cr.=2

3h, 6h $\theta1$ $\theta2$ 9h, 12h

optimum vision with the naked eye and viewing angle θ at CR. max above are not always the same

11.3 Definition of response time

Definition of response time

$1/f_{FRM}$

Voltage (V)

0

$V\ opr$

Unselected state (display OFF)   Selected state (display ON)   Unselected state (display OFF)

Bright

Brightness (reflection)

100%

90%

Dark

10%

t_{on}

t_{off}

Vopr:Operating voltage (V)   ton:Response time (rise) (ms)
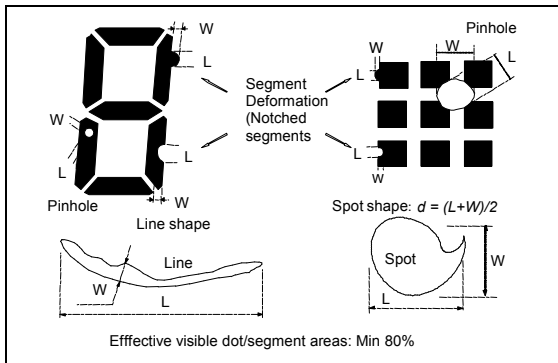$f_{FRM:}$Frame frequency (Hz)   toff:Response time (fall) (ms)

12. QUALITY DESCRIPTION

DEFECT SPECIFICATION:

Specific type-related items are covered in this sheet.

a: Table for Cosmetic defects
         (Note: nc = not counted).
         Sizes and number of defects
         (Max. Qty)

Efffective visible dot/segment areas: Min 80%

Examples/ Shapes

b: Glass defects
b1:Glass defects at contact ledge

b2:Glass chipping in other areas shall not be in conflict
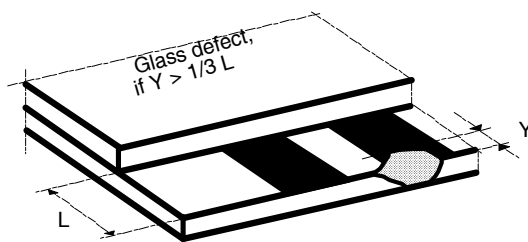
with the product's function.

Defect Type	Max. defect size [μm] d or L W	Max. Quantity.
Black or White Spots	d ≤ 150	nc
	150< d ≤ 300	5
Black or White Lines	-- W ≤ 10	nc
	L ≤ 5000 W ≤ 30	3
	L ≤ 2000 W ≤ 50	2
Pinhole	d ≤ 150 150< d ≤ 300	nc 1/segment
(Total defects)		(5)
Segment Deformation	W ≤ 100	nc
Bubble (e.g. under pola)	d ≤ 150	nc
	200< d ≤ 400	3
	400< d ≤ 600	1

13. RELIABILITY TEST

Operating life time: 50000 hours (at room temperature without direct irradiation of sunlight)
Reliability characteristics shall meet following requirements.

Test Item	Test Condition
High temperature storage	+80°C x 96hrs
Low temperature storage	-30°C x 96hrs
High temperature operation	+70°C x 96hrs
Low temperature operation	-20°C x 96hrs
High temperature, High humidity (storage)	+75°C x 90%RH x 96hrs
Thermal shock	-30°C x 30min ⟶ +25°C x 10s ⟶ +75°C x 30min 5Cycles
Vibration test	Frequency x Swing x Time 40Hz x 4mm x 4hrs
Drop test	Drop Height x No. of drops 1.0m x 6 drops

14. LCD MODULES HANDLING PRECATIONS

■ Please remove the protection foil of polarizer before using.

■ The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

■ If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.

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

■ The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.

■ 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 the LCD module.
  -Tools required for assembly, such as soldering irons, must be properly grounded.
  -To reduce the amount of static electricity generated, do not conduct assembly 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.

■ Storage precautions
  When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

15. OTHERS

■ Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.

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

■ To minimize the performance degradation of the LCD modules resulting from 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