LCD MODULE

MODULE NO. :

KSEGB12864XXX-02 SERIES

Customer:	
Approved by:	

Approved by	Checked by	Prepared by

RECORDS OF REVISION

Part Number	Revision	Revision Content	Revised on
KSEGB12864XXX-02	1.0	First issue	Oct. 15th, 2022

CONTENTS

1. MODULE CLASSIFICATION INFORMATION

KSE G B 12864 - X X X - 02- X
　①　②　③　④　　⑤⑥⑦　⑧　⑨

① KSE: KEEN SIDE electronics

② C: Character Type,　G：Graphic Type

③ B: COB, G: COG

④ Display Font：128 * 64

⑤ LCD Mode：　　B→ STN-Blue Negative　　　　F→ FSTN Positive
　　　　　　　　　G→ STN Gray Positive　　　　Y→ STN Yellow Green Positive

⑥ Backlight Type：N→ Without backlight　　A→ Amber LED backlight
　　　　　　　　　B→ Blue LED backlight　　G→ Green LED backlight

　　　　　　　　　R→ Red LED backlight　　 W→ Withe LED backlight

　　　　　　　　　Y→ Yellow-Green LED backlight

⑦ LCD Polarizer Type/Temperature range/View direction :
　　　　　　　D→ Transflective, W.T, 12:00　　E→ Transmissive, W.T, 6:00
　　　　　　　P→ Reflective, W. T, 6:00　　　Q→ Transmissive, W.T, 12:00
　　　　　　　Z→ Transflective, W.T, 6:00

⑧ Model serials no. :

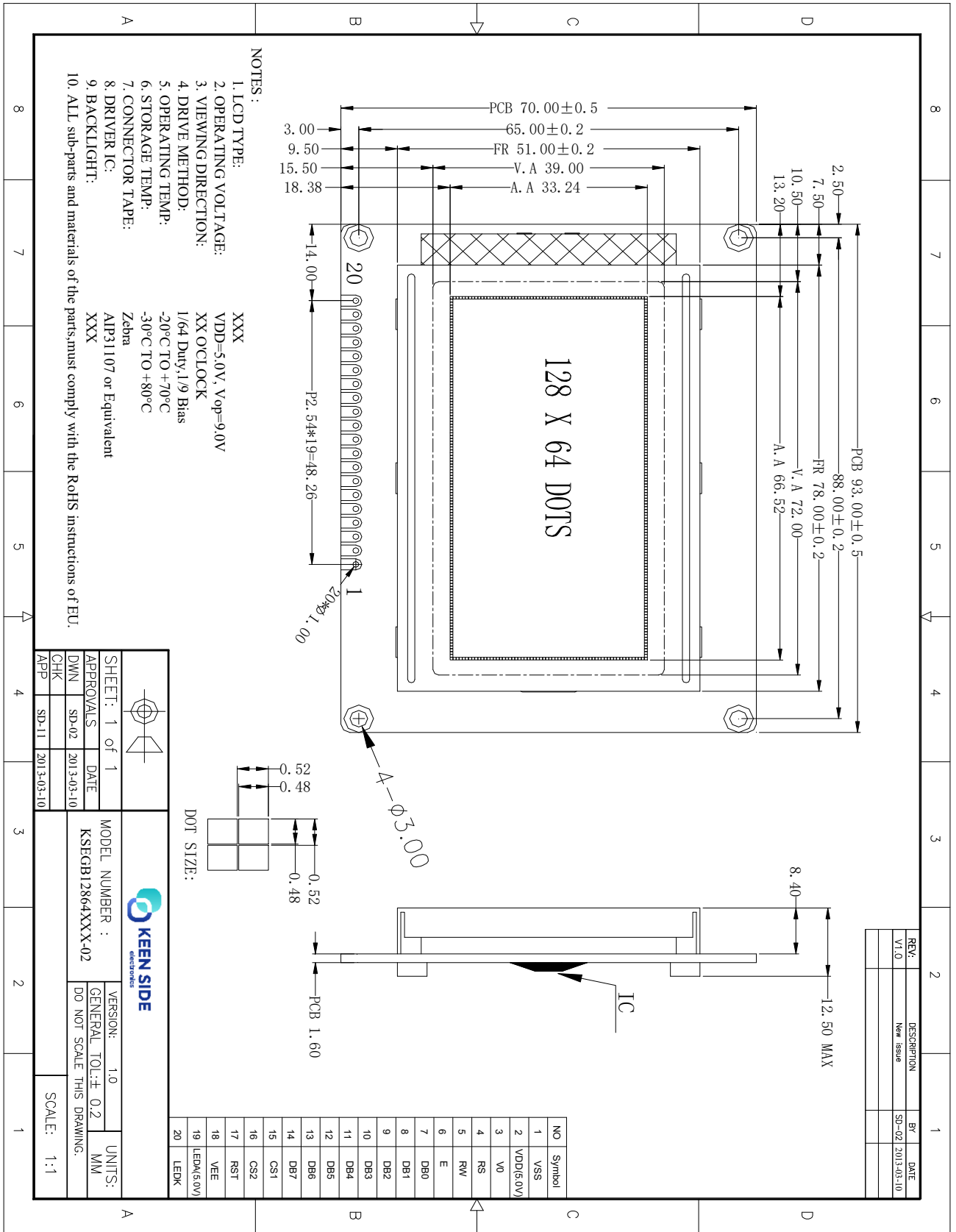⑨ Special Code:　V : Built in negative voltage& Temperature Compensation

2. FUNCTIONS & FEATURES

- KSEGB12864XXX-02 SERIES TYPE:
- Driving Scheme : 1/64Duty, 1/9 Bias
- Power Supply for logic : 5.0V
- Display Content : 128*64 Dots
- V_{LCD} : 9.0V
- Operation temperature : -20℃ to +70℃
- Storage temperature : -30℃ to +80℃

3. MODULE ARTWORK

- Module Size : 93.00(L)*70.00 (W)*12.50(H)mm
- Viewing Area : 72.00(L)mm*39.00 (W)mm
- Active Area : 66.52(L)mm*33.24(W)mm
- Dot Pitch : 0.52 (W)mm*0.52 (H)mm
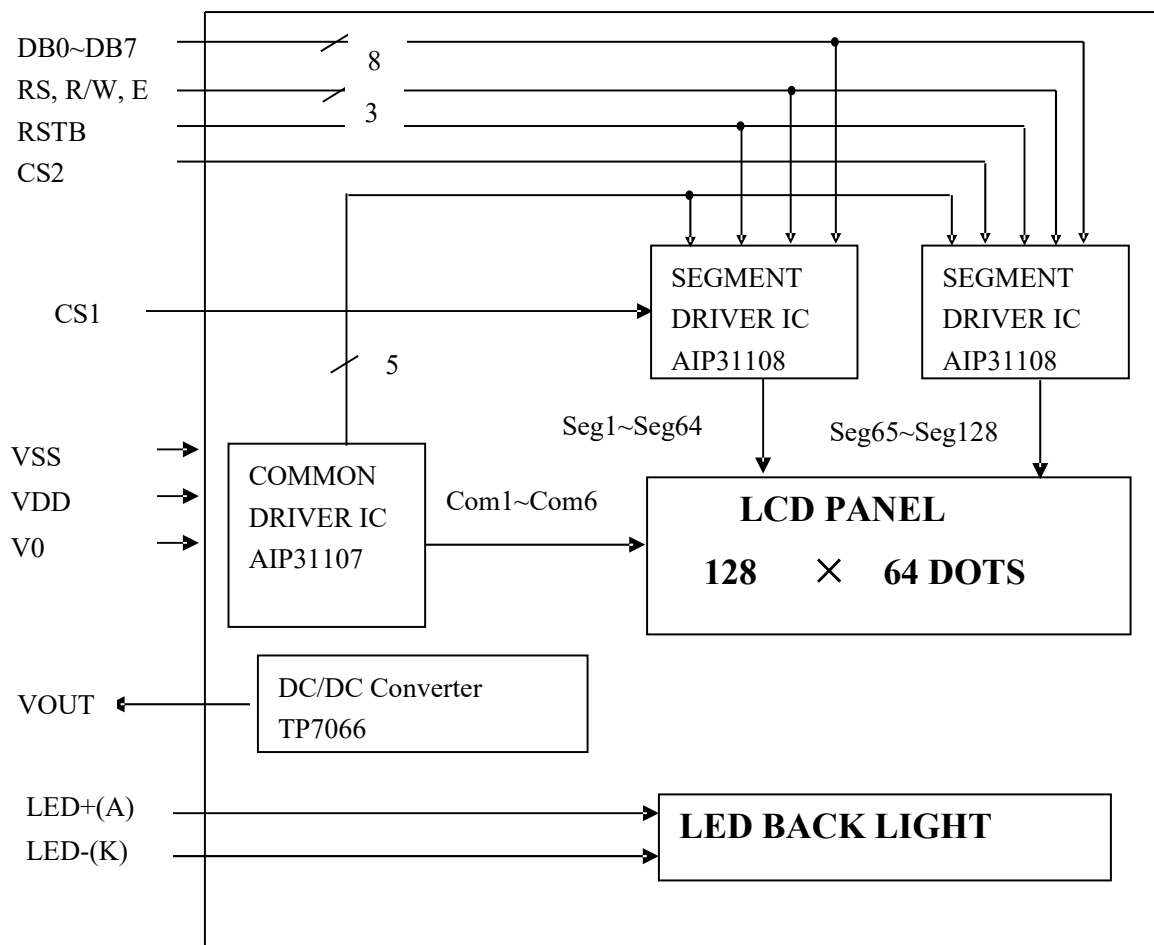- Dot Size : 0.48(W)mm*0.48 (H)mm
- Dot Gap : 0.04 mm

4. EXTERNAL DIMENSIONS

NOTES :
1. LCD TYPE: XXX
2. OPERATING VOLTAGE: VDD=5.0V, Vop=9.0V
3. VIEWING DIRECTION: XX O'CLOCK
4. DRIVE METHOD: 1/64 Duty,1/9 Bias
5. OPERATING TEMP: -20°C TO +70°C
6. STORAGE TEMP: -30°C TO +80°C
7. CONNECTOR TAPE: Zebra
8. DRIVER IC: AIP31107 or Equivalent
9. BACKLIGHT: XXX
10. ALL sub-parts and materials of the parts,must comply with the RoHS instructions of EU.

PCB 70.00±0.5
65.00±0.2
3.00
9.50   FR 51.00±0.2
15.50   V. A 39.00
18.38   A. A 33.24
7.50
2.50
10.50
13.20

PCB 93.00±0.5
88.00±0.2
FR 78.00±0.2
V. A 72.00
A. A 66.52

128 X 64 DOTS

14.00
20
P2.54*19=48.26
1
20*Φ1.00

A — Φ3.00

DOT SIZE:
0.52
0.48
0.52
0.48

8.40
12.50 MAX
PCB 1.60
IC

KEEN SIDE
electronics

MODEL NUMBER :
KSEGB12864XXX-02

VERSION: 1.0
GENERAL TOL:± 0.2
DO NOT SCALE THIS DRAWING.
UNITS:
MM
SCALE: 1:1

SHEET: 1 of 1
APPROVALS   DATE
DWN   SD-02   2013-03-10
CHK
APP   SD-11   2013-03-10

REV:
V1.0   DESCRIPTION   BY   DATE
New Issue   SD-02   2013-03-10

NO	Symbol
1	VSS
2	VDD(5.0V)
3	V0
4	RS
5	RW
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	CS1
16	CS2
17	RST
18	VEE
19	LEDA(5.0V)
20	LEDK

5. BLOCK DIAGRAM

6. PIN ASSIGNMENT

Pin No.	Symbol	Function
1	VSS	Ground
2	VDD	Power supply voltage for logic
3	V0	Input voltage for LCD
4	RS	Register select RS = 0···Instruction register RS = 1···Data register
5	R/W	Read /Write R/W = 1···Read R/W = 0···Write
6	E	Chip enable signal
7	DB0	Data bit 0
8	DB1	Data bit 1
9	DB2	Data bit 2
10	DB3	Data bit 3
11	DB4	Data bit 4
12	DB5	Data bit 5
13	DB6	Data bit 6
14	DB7	Data bit 7
15	CS1	Chip select signal for SBN0064(1)
16	CS2	Chip select signal for SBN0064(2)
17	RST	Reset signal
18	VEE	Output voltage for LCD,-9.0V
19	LED + (A)	Anode of LED backlight
20	LED – (K)	Cathode of LED backlight

7. BACKLIGHT ELECTRICAL/OPTICAL SPECIFICATIONS

Item	Symbol	MIN.	TYP.	MAX.	Unit	Conditions
Forward Voltage	Vf	4.8	5.0	5.2	V	If =15*4mA
Forward Current	If		60		mA	
Power Dissipation	Pd		0.30		W	If =15*4mA
Reverse Voltage	VR			5.0	V	
Reverse Current	IR			0.4	mA	
Luminous Intensity	Lv	100			cd/m^2	If =15*4mA
Luminous Uniformity	Δ Lv	70			%	If = 15*4mA
Emission Wavelength	x	0.27		0.30		If=15*4mA, Ta=25℃
	y	0.27		0.30		
Backlight Color	White					

8. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Standard value	Unit
Supply voltage for logic	V_{DD}	-0.3~+7.0	V
Supply voltage	V_0	V_{DD}-19.0~V_{DD}+0.3	V
Driver supply voltage	V_{DD} -V_0	V_0 -0.3~V_{DD}+0.3	V
Operating temperature	Topr	-20~+70	℃
Storage temperature	Tstg	-25~+75	℃

9. ELECTRICAL CHARACTERISTICS

1). DC Characteristics

Item	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Supply voltage for logic	V_{DD}	4.8	5.0	5.2	-------	V
Supply current for logic	I_{DD}	----	2.7	5	-------	mA
operating Voltage for LCD	V_{DD}-V_0	10.8	11.0	11.2	-20℃	V
		8.8	9.0	9.2	25℃	
		8.0	8.2	8.4	70℃	
Input voltage "H" level	VIH	0.7V_{DD}	---	V_{DD}	---	V
Input voltage "L" level	VIL	0	---	0.3V_{DD}	---	V

2). AC Characteristics

Characteristic	Symbol	Min	Typ	Max	Unit
E Cycle	t_C	1000	-	-	ns
E Rise	t_R	-	-	25	ns
E Fall	t_F	-	-	25	ns
E High Level Width	t_{WH}	450	-	-	ns
E-Low Level Width	t_{WL}	450	-	-	ns
Address Set –Up Time	t_{ASU}	140	-	-	ns
Address Hold Time	t_{AH}	10	-	-	ns
Data Delay Time	t_D	-	-	320	ns
Data Set –Up Time	t_{DSU}	200	-	-	ns
Data Hold Time (Write)	t_{DHW}	10	-	-	ns
Data Hold Time (Read)	t_{DHR}	20	-	-	ns
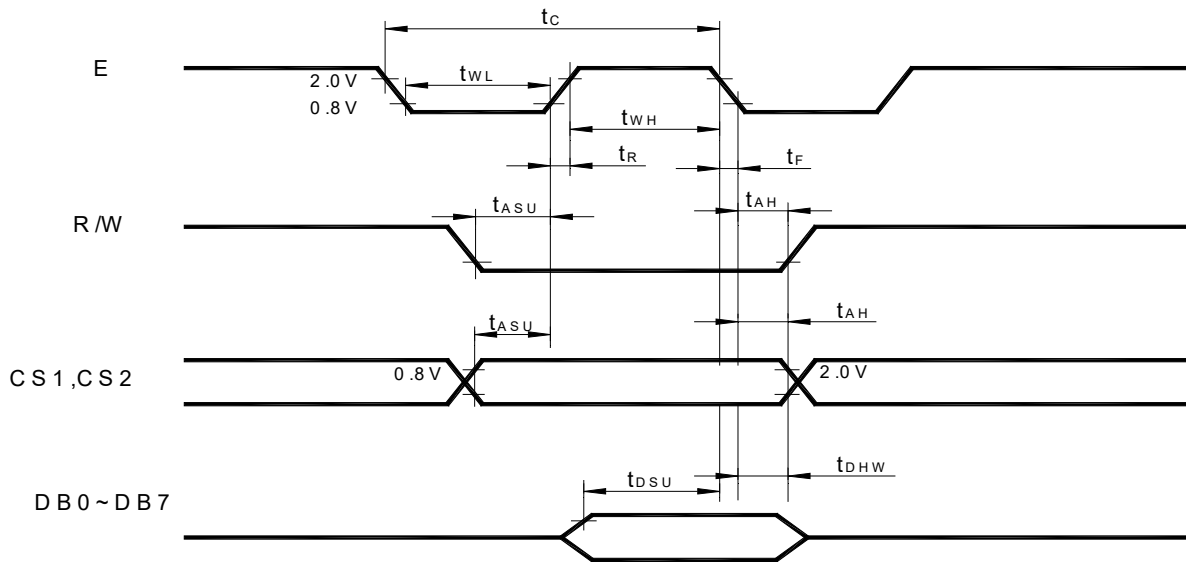
Figure 5.0 MPU write timing
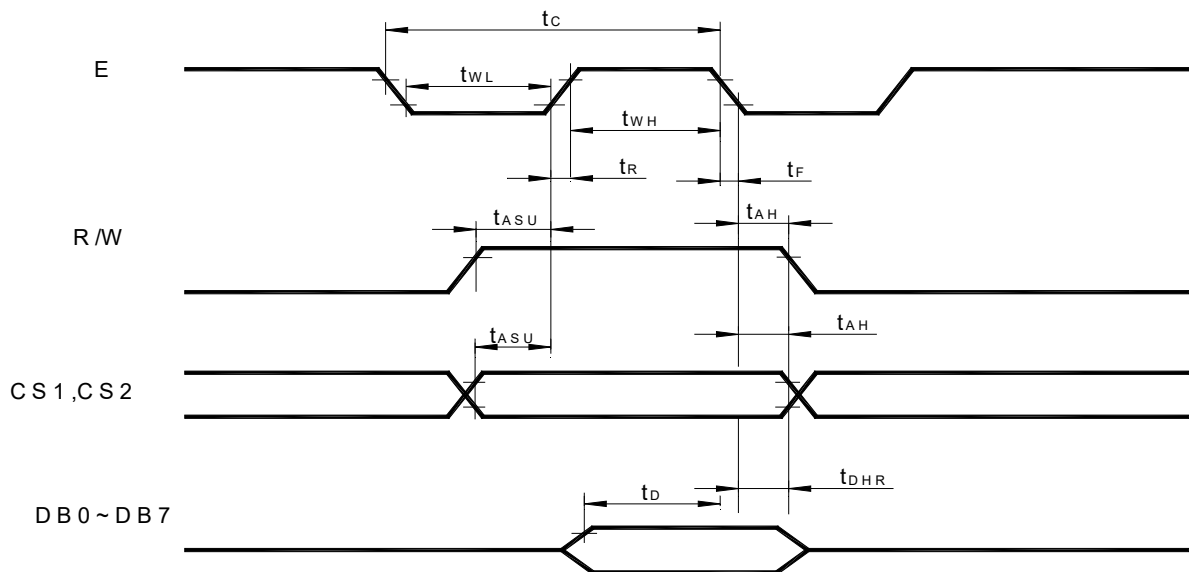
10. COMMAND DEFINTTIONS

The display control instructions the internal state of the SBN0064. Instruction is received from MPU to AIP31070 for the display control. The following table shows various instructions.

| Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display ON/OFF	L	L	L	L	H	H		H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L: OFF, H: ON
Set Address (Y address)	L	L	L	H	Y address (0~63)						Sets the Y address in the Y address counter.
Set Page (X address)	L	L	H	L	H	H	H	Page (0~7)			Sets the X address At the X address counter
Display Start line (Z address)	L	L	H	H	Display start line (0~63)						Indicates the display data RAM displayed at the top of the screen.
Status Read	L	H	BUSY	L	ON/OFF	RESET	L	L	L	L	Read status BUSY L: Ready H: In operation On/Off L: display ON H: Display OFF RESET L: Normal H: Reset
Write Display Data	H	L	Write Date								Writes data (DB0:7) into display data RAM . After writing instruction, Y address is increased by 1 automatically.
Read Display data	H	H	Read Date								Reads data (DB0:7) From display data RAM to the data bus.

10-1. Display On/Off

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	1	1	1	D0

The display data appears when D is 1 and disappears when D is 0.

Though the data is not on the screen with D=0, it remains display data RAM.

Therefore, you can make it appear by changing D=0 into D=1.

10-2. Set Address (Y Address)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

Y address (AC0~AC5) of the display data RAM is set in the Y address counter.

An address is set by instruction and increased by 1 automatically by read or write operations of display data.

10-3. Set Page (X Address)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	0	1	1	1	AC2	AC1	AC0

X address (AC0~AC2) of the display data RAM is set in the X address register.

Writing or reading to or from MPU is executed in this specified page until the next page is set.

10-4. Display Start Line (Z Address)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	1	AC5	AC4	AC3	AC2	AC1	AC0

Z address (AC0~AC5) of the display data RAM is set in the display start line register and display at the top of the screen.

When the display duty cycle is 1/64 or others (1/32~1/64),   the data of total line number of LCD screen,   from the line

specified by display start line instruction, is displayed.

10-5. Status Read

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	BUSY	0	ON/OFF	RESET	0	0	0	0

■   BUSY

When BUSY is 1, the Chip is executing internal operation and no instructions are accepted.

When BUSY is 0, the Chip is ready to accept any instructions.

■   ON/OFF

When ON/OFF is 1, the display is on.

When ON/OFF is 0, the display is off.

■   RESET

When RESET is 1, the system is being initialized.

In this condition is 0, no instructions except status read can be accepted.

When RESET is 0, initialized has finished and the system is in the usual operation condition

10-6. Write Display data

R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	D7	D6	D5	D4	D3	D2	D1	D0

Writes data (D0~D7) into the display data RAM.

After writing instruction, Y addressed is increased 1 automatically.

10-7. Read Display data

R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	D7	D6	D5	D4	D3	D2	D1	D0

Reads data (D0~D7) from the display data RAM.

After reading instruction, Y addressed is increased 1 automatically.

11. OPTICAL CHARACTERISTICS

11.1 Definition of Viewing Angle
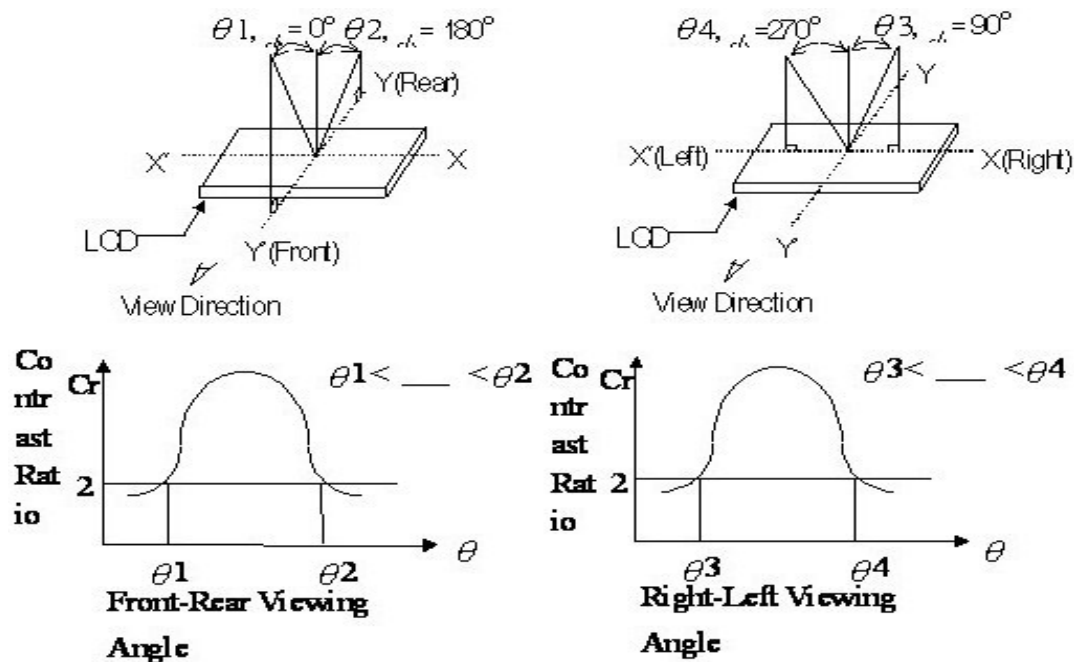
11.2 Definition of Contrast
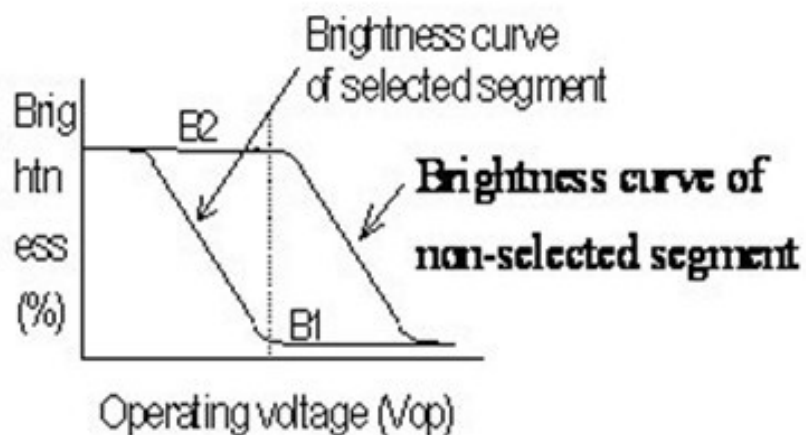
11.3 Definition of Response
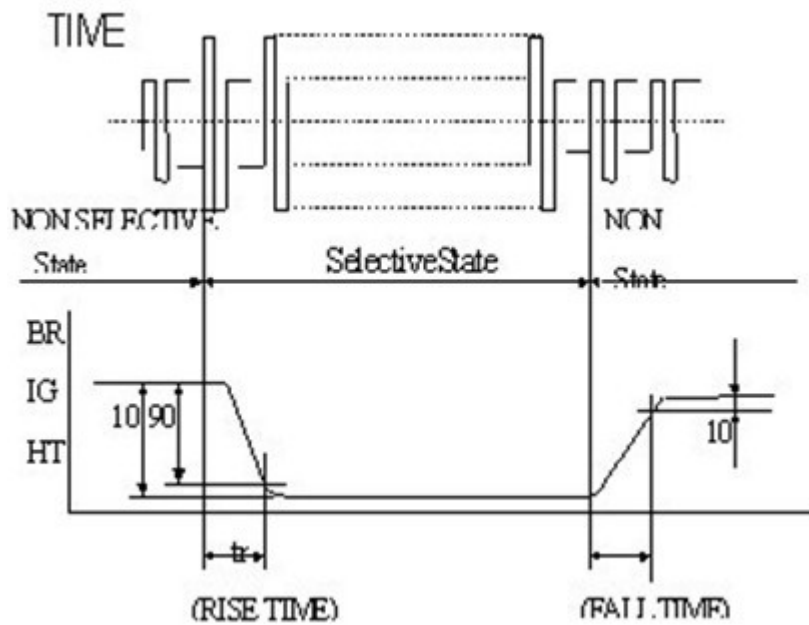
11.4 Measuring Instruments For Elector-optical Characteristics
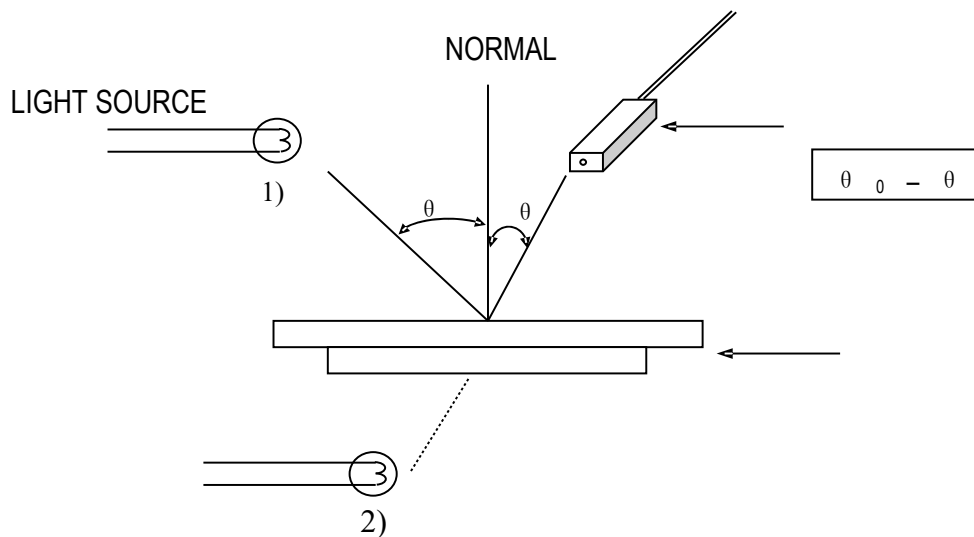
* Note:

1）Light source position for measuring the reflective type of LCD panel；
2）Light source position for measuring the transflective / transmissive types of LCD panel.

12. MODULE ACCEPT QUALITY LEVEL (AQL)

12.1 AQL Standard Value: Critical Defect =0.1, Major Defect=0.65; Minor Defect =2.5.

12.2 Inspection Standard: MIL-STD-105E Table Normal Inspection Single Sampling Level II

13. RELIABILITY TEST

Operating life time: Longer than 75,000 hours

(at room temperature without direct irradiation of sunlight)

Reliability characteristics shall meet following requirements.

No.	Test Item	Content of Test	Test Condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	+80°C 96H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	−30°C 96H
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time	+70°C 96H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	−20°C 96H
5	High Temperature/ Humidity Storage	Endurance test applying the high temperature and humidity storage for a long time	40°C 90%RH 96H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle −20°C ⟷ 25°C ⟷ 70°C ⟷ 25°C 30min 5min 30min 5min 1 cycle	−20°C/70°C 5 cycles
7	Vibration Test (Package State)	Endurance test applying the vibration during transportation	10Hz ~ 55Hz, 50m/s, 15min
8	Shock Test (Package State)	Endurance test applying the shock during transportation	Half-sinewave, 100m/s, 11ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	40 kPa 16 H
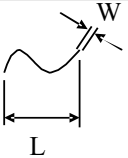
14. Inspection specification
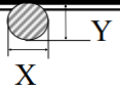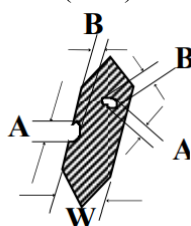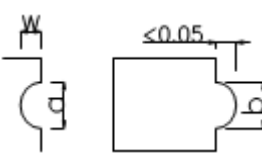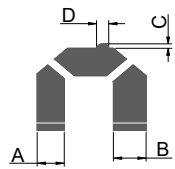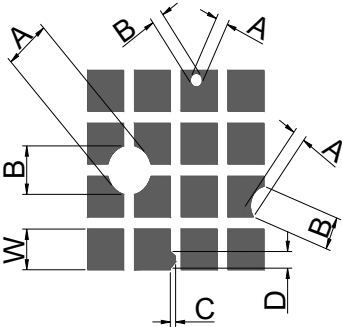
14.1 Visual Inspection

1) Inspect under 2x20W or 40W fluorescent lamp (approximately 3000 lux) leaving 25 to 30 cm between the module and the lamp and 30 cm between the module and the eye (measuring position).

2) Appearance is inspected at the best contrast voltage (best contrast is adjusted considering clearness and crosstalk on screen).

3) Inspect the module at 45° right and left, top and bottom.

4) Use the optimum viewing angle during the contrast inspection.
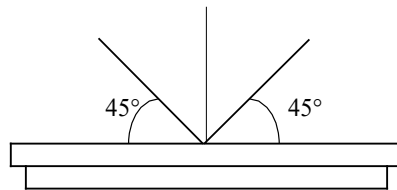
14.2 Standard of Appearance Inspection

No.	Item	Criteria
1	Black spot White spot Dust	Round type: as per following drawing $\Phi = (X+Y)/2$ <table><tr><td colspan="3">Acceptable quantity</td></tr><tr><td>Size</td><td>Zone A</td><td>Zone B</td></tr><tr><td>$\Phi <0.1$</td><td>Any number</td><td rowspan="4">Any number</td></tr><tr><td>$0.1< \Phi <0.2$</td><td>2</td></tr><tr><td>$0.2< \Phi <0.25$</td><td>1</td></tr><tr><td>$0.25< \Phi$</td><td>0</td></tr></table> Line type: as per following drawing <table><tr><td colspan="4">Acceptable quantity</td></tr><tr><td>Length</td><td>Width</td><td>Zone A</td><td>Zone B</td></tr><tr><td>—</td><td>$W\leq0.02$</td><td>Any number</td><td rowspan="4">Any number</td></tr><tr><td>$L\leq3.0$</td><td>$0.02<W\leq0.03$</td><td rowspan="2">2</td></tr><tr><td>$L\leq2.5$</td><td>$0.03<W\leq0.05$</td></tr><tr><td>—</td><td>$0.05<W$</td><td>As round type</td></tr></table> Total acceptable quantity: 3
2	Polariser scratch	Scratch on protective film is permitted Scratch on polariser: same as No. 1
3	Polariser bubble	$\Phi = (X+Y)/2$

			Acceptable quantity		
			Size	Zone A	Zone B
			$\Phi < 0.2$	Any number	
			$0.2 < \Phi < 0.5$	2	Any number
			$0.5 < \Phi < 1.0$	1	
			$1.0 < \Phi$	0	

Total acceptable quantity: 3

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4   **Segment deformation**

4.1 Pin hole on segmented display
W: segment width
$\Phi = (A+B)/2$

Acceptable quantity	
Width	Quantity
$W \leq 0.4$	$\Phi \leq 0.2$ and $\Phi \leq 1/2W$
$W > 0.4$	$\Phi \leq 0.25$ and $\Phi \leq 1/3W$
Total acceptable quantity: 1 defect per segment	
Pin holes with Φ under 0.10 mm are acceptable	

4.2 Pin hole on dot matrix display

Acceptable quantity	
Size	
a, b<0.1	Any number
(a+b)/2≤0.1	Any number
$0.5 < \Phi < 1.0$	3

Total acceptable quantity: 7

4.3 Segments / dots with different width

Acceptable	
a≥b	a/b≤4/3
a<b	a/b>4/3

4.4 Alignment layer defect
$\Phi = (A+B)/2$

Acceptable quantity	
Size	
$\Phi \leq 0.4$	Any number
$0.4 < \Phi \leq 1.0$	5
$1.0 < \Phi \leq 1.5$	3
$1.5 < \Phi \leq 2.0$	2

Total acceptable quantity: 7

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5   **Colour uniformity**   Level of sample for approval set as limit sample

6	Backlight	The backlight colour should correspond to the product specification Flashing and or unlit backlight is not allowed Dust larger than 0.25 mm is not allowed
7	COB	Exposed wire bond pad is not allowed Insufficient covering with resin is not allowed (wire bond line exposed) Dust or bubble on the resin are not allowed
8	PCB	No unmelted solder paste should be present on PCB Cold solder joints, missing solder connections, or oxidation are not allowed No residue or solder balls on PCB are allowed Short circuits on components are not allowed
9	Tray particles	<table><tr><td colspan="3">Acceptable quantity</td></tr><tr><td></td><td>Size</td><td>Quantity</td></tr><tr><td rowspan="2">On tray</td><td>Φ<0.2</td><td>Any number</td></tr><tr><td>Φ>0.25</td><td>4</td></tr><tr><td rowspan="2">On display</td><td>Φ≥0.25</td><td>2</td></tr><tr><td>L = 3</td><td>1</td></tr></table>

15. LCD MODULES HANDLING PRECAUTIONS

■ 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℃).Whenever possible,   the LCD modules should be stored in the same conditions in which they were shipped from our company.

16. 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