DATA SHEET

KEEN SIDE
electronics

LCD MODULE

MODULE NO. :

KSECB4004GYZ-R02

Customer:
Approved by:

Approved by	Checked by	Prepared by

RECORDS OF REVISION

Part Number	Revision	Revision Content	Revised on
KSECB4004GYZ-R02	1.0	First issue	Sep. 15th, 2022

CONTENTS

1. MODULE CLASSIFICATION INFORMATION

KSE   C   B   4004 G Y Z - R 02

①   ②   ③   ④   ⑤ ⑥ ⑦   ⑧   ⑨

① KSE: COMPONET, Ltd

② C: Character Type,   G：Graphic Type

③ B: COB, G: COG

④ Display Font：40 * 4

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 Character Bank :

                  A→ English / Japan   B→ English / European

                  R→English / Cyrillic / Portuguese / Russian

                  T→ English / Russian   G→ Hebrew

⑨ Model serials no. :
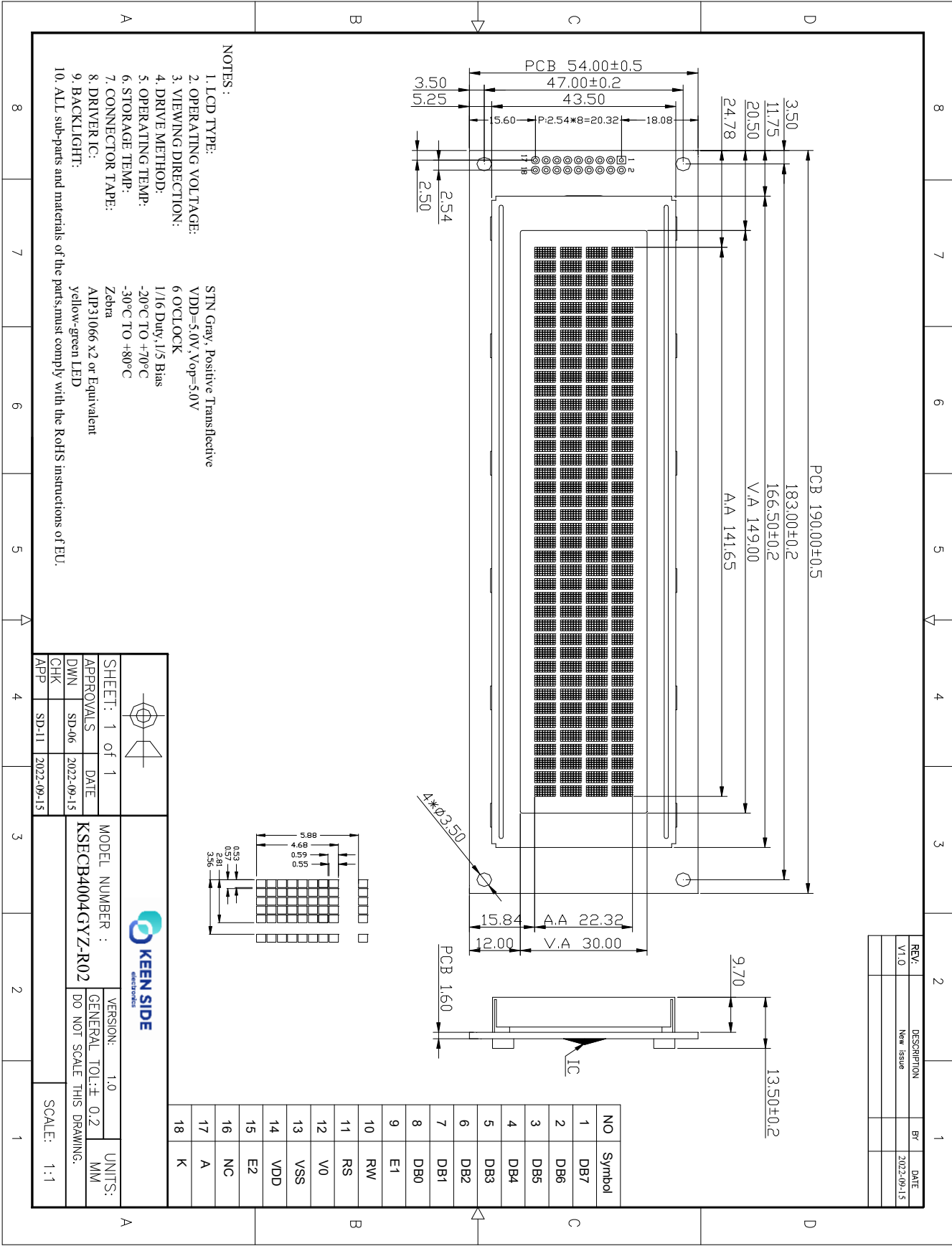
2.FUNCTIONS & FEATURES

- KSECB4004GYZ-R02- Series LCD type:
- LCD Mode   : STN Gray Positive Transflective
- Display Contents   : 40* 4 Characters (5*8 dots)
- Driving Scheme   : 1/16 Duty; 1/5Bias
- Viewing Direction   : 6 0' clock
- Driver IC   : AIP31066-002
- Interface   : Parallel
- Backlight   : Yellow-Green
- Operating Temperature   : -20℃ ─ ＋70℃
- Storage Temperature   : -30℃ ─ ＋80℃
- RoHS Compliant
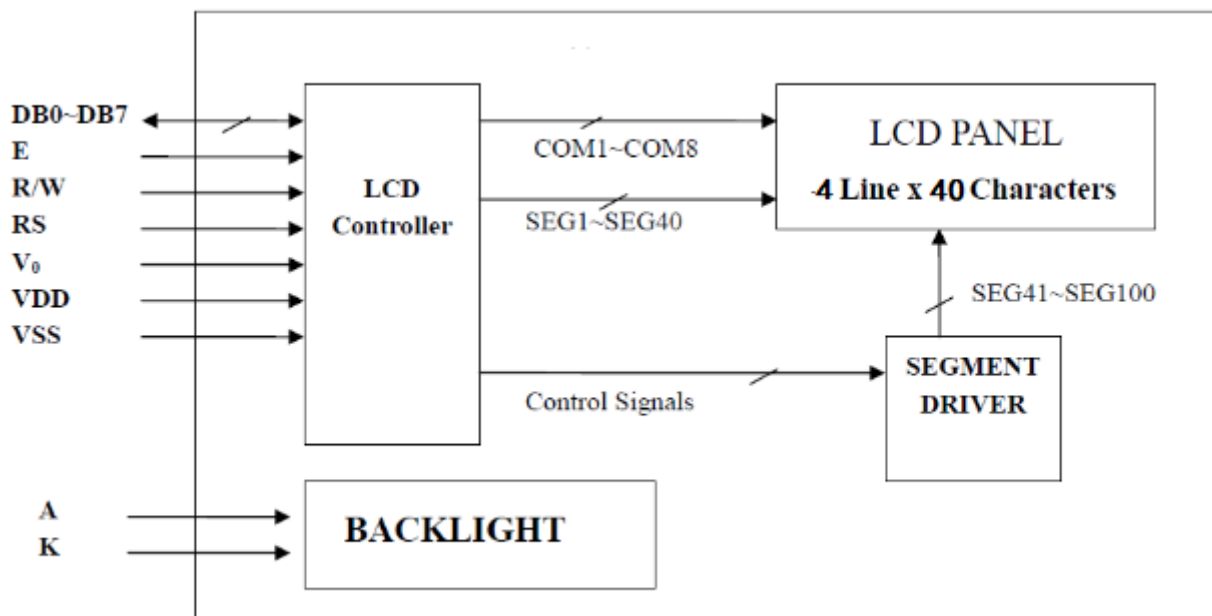
3. MECHANICAL SPECIFICATIONS

- Outline Dimensions   : 190.00(W) x 54.00(L) x 13.50(H)(mm)
- Viewing Area   : 149.00 (W) x 30.00(L)(mm)
- Active Area   : 141.65 (W) x 22.32 (L)(mm)
- Character Size   : 2.81 (W) x 4.68 (L)(mm)
- Character Pitch   : 3.56 (W) x 5.88 (L)(mm)
- Weight   : TBD

3. EXTERNAL DIMENSIONS

NOTES：
1. LCD TYPE:
2. OPERATING VOLTAGE:
3. VIEWING DIRECTION:
4. DRIVE METHOD:
5. OPERATING TEMP:
6. STORAGE TEMP:
7. CONNECTOR TAPE:
8. DRIVER IC:
9. BACKLIGHT:
10. ALL sub-parts and materials of the parts,must comply with the RoHS instructions of EU.

STN Gray, Positive Transflective
VDD=5.0V,Vop=5.0V
6 O'CLOCK
1/16 Duty,1/5 Bias
-20°C TO +70°C
-30°C TO +80°C
Zebra
AIP31066 x2 or Equivalent
yellow-green LED

SHEET: 1 of 1		
APPROVALS		DATE
DWN	SD-06	2022-09-15
CHK	SD-11	2022-09-15
APP		

MODEL NUMBER :
KSECB4004GYZ-R02

KEEN SIDE electronics

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

REV:	DESCRIPTION	BY	DATE
V1.0	New issue		2022-09-15

PCB 54.00±0.5
47.00±0.2
43.50
3.50
5.25
15.60   P:2.54*8=20.32   18.08
2.54
2.50

3.50
11.75
20.50
24.78

PCB 190.00±0.5
183.00±0.2
166.50±0.2
V.A 149.00
A.A 141.65

4*Ø3.50
15.84   A.A 22.32
12.00   V.A 30.00

PCB 1.60
9.70
13.50±0.2
IC

5.88
4.68
0.59
0.55
0.53
0.57
2.81
3.56

NO	Symbol
1	DB7
2	DB6
3	DB5
4	DB4
5	DB3
6	DB2
7	DB1
8	DB0
9	E1
10	RW
11	RS
12	V0
13	VSS
14	VDD
15	E2
16	NC
17	A
18	K

4. BLOC`K DIAGRAM

5. PIN ASSIGNMENT

Pin No.	Symbol	Function
1-8	DB7-DB0	Bi-directional data bus, data transfer is performed once, thru DB0 to DB7, in the case of interface data. Length is 8-bits; and twice, thru DB4 to DB7 in the case of interface data length is 4-bits. Upper four bits first then lower four bits.
9	E1	Enable Signal
10	R/W	Read /Write R/W = 1···Read R/W = 0···Write
11	RS	Register select RS = 0···Instruction register RS = 1···Data register
12	V0	Power Supply for liquid crystal drive.
13	VSS	Ground terminal of module.
14	VDD	Power terminal of module
15	E2	Enable Signal
16	NC	No Connection
17	A	Anode of Backlight(+5.0v)
18	K	Cathode of Backlight

6. BACKLIGHT ELECTRICAL/OPTICAL SPECIFICATIONS

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Forward Voltage	Vf	4.8	5.0	5.2	V	If= 15x4 mA
Reverse Current	Ir			100	μA	Vr=5.0 V
Dominant wave length	λ D	569	572	575	nm	If= 15x4 mA
Spectral Line Half width	Δ λ		25		nm	If= 15x4 mA
Luminous	Lv	75	80		cd/m^2	If= 15x4 mA

7. DISPLAY DATA RAM (DDRAM)

```
Display
Position    1   2   3   4   5   6   7   8   9   10  11  12  13  14  15  16
DDRAM      00  01  02  03  04  05  06  07  08  09  0A  0B  0C  0D  0E  0F
Address    40  41  42  43  44  45  46  47  48  49  4A  4B  4C  4D  4E  4F
```

```
For        01  02  03  04  05  06  07  08  09  0A  0B  0C  0D  0E  0F  10
Shift
Left       41  42  43  44  45  46  47  48  49  4A  4B  4C  4D  4E  4F  50
```

```
For        27  00  01  02  03  04  05  06  07  08  09  0A  0B  0C  0D  0E
Shift
Right      67  40  41  42  43  44  45  46  47  48  49  4A  4B  4C  4D  4E
```

8. MAXIMUM ABSOLUTE POWER RATINGS

ITEM	SYMBOL	STANDARD VALUE	UNIT
Power supply voltage(1)	VDD	-0.3~+7.0	V
Power supply voltage(2)	VLCD	VDD-10.0~VDD+0.3	V
Input voltage	VIN	-0.3~VDD+0.3	V
Operating temperature	Topr	-20~+70	℃
Storage temperature	Tstg	-30~+80	℃

＊Voltage greater than above may damage to the Circuit.

VDD＞V1＞V2＞V3＞V4＞V5

9. ELECTRICAL CHARACTERISTICS

9-1 DC Characteristics

Item	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage	V_{DD}	4.8	5.0	5.2	-------	V
Supply Current	I_{DD2}	----	TBD	0.6	Resistor oscillation external clock operation fosc=270kHz	
LCD Driving Voltage	V_{LCD}	4.8	5.0	5.2	V_{DD}-V_0	V

9-2 AC Characteristics

9.2.1 Write mode

Characteristic	Symbol	Min	Type	Max	Unit	Test PIN
Enable Cycle Time	t_C	1200	---	---	ns	E
Enable Pulse Time	T_{PW}	460	---	---	ns	E
Enable Rise/Fall Time	T_R, T_F	---	---	25	ns	E
Address Set-up Time	T_{AS}	0	---	---	ns	R/W,RS,E
Address Hold Time	T_{AH}	10	---	---	ns	R/W,RS,E
Data Set-up Time	T_{DSW}	80	---	---	ns	DB0~DB7
Data Hold Time	T_H	10	---	---	ns	DB0~DB7
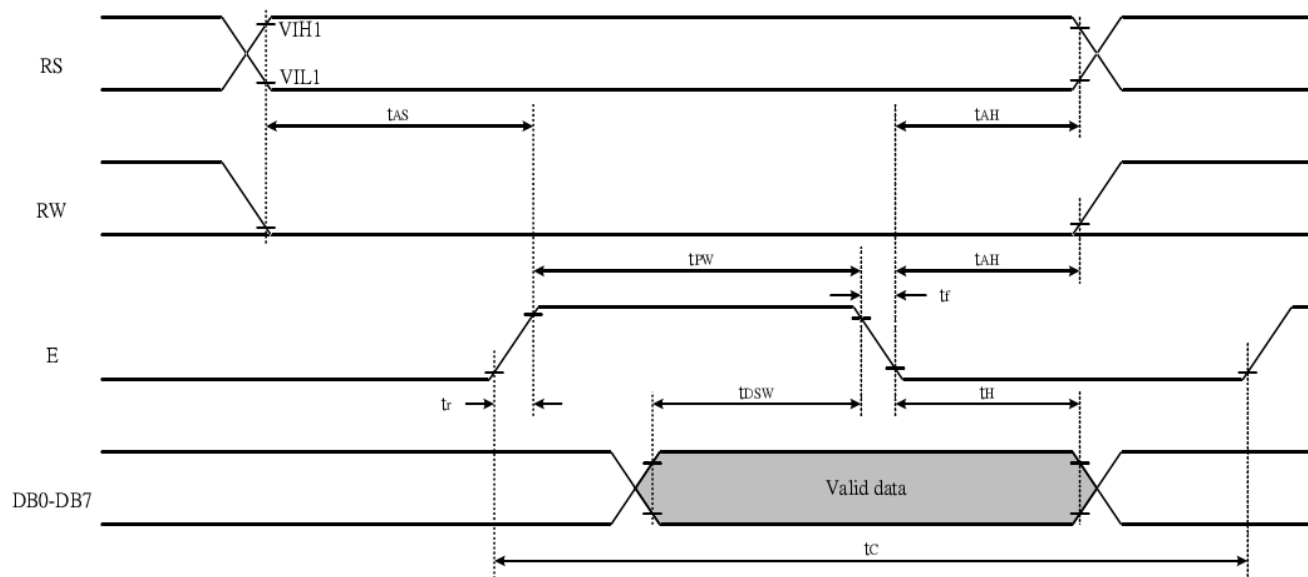
9.2.2 Read mode

Characteristic	Symbol	Min	Type	Max	Unit	Test PIN
Enable Cycle Time	t_C	1200	---	---	ns	E
Enable Pulse Time	T_{PW}	480	---	---	ns	E
Enable Rise/Fall Time	T_R, T_F	---	---	25	ns	E
Address Set-up Time	T_{AS}	0	---	---	ns	R/W,RS,E
Address Hold Time	T_{AH}	10	---	---	ns	R/W,RS,E
Data Set-up Time	T_{DDR}	---	---	320	ns	DB0~DB7
Data Hold Time	T_H	10	---	---	ns	DB0~DB7
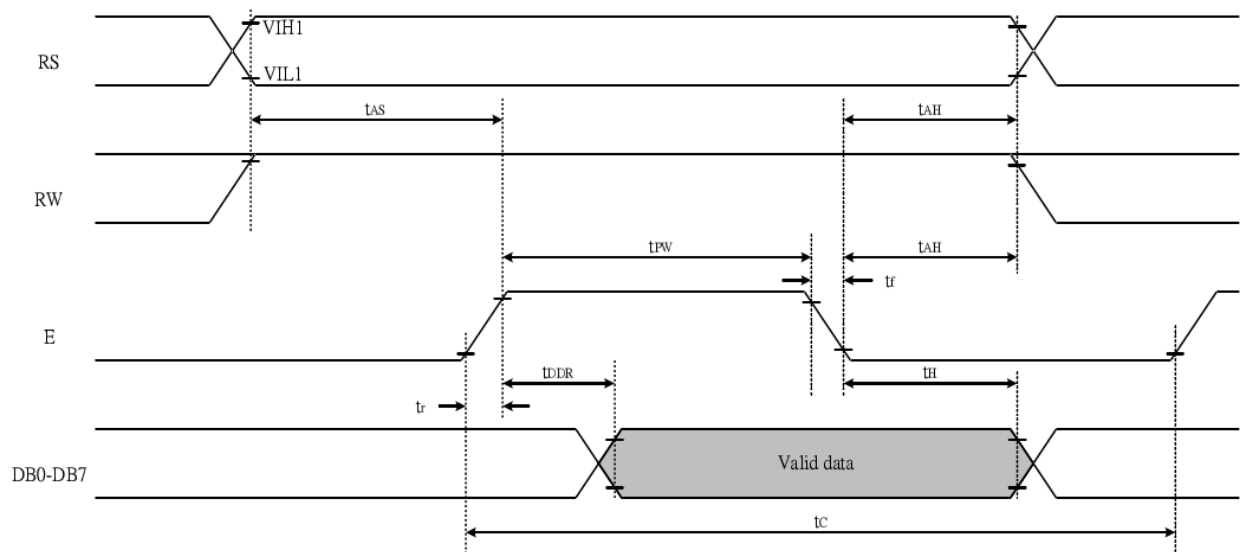
10. INSTRUCTION TABLE

Command	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Execution time (fosc=270KHz)	Remark
Clear Display	0	0	0	0	0	0	0	0	0	1	1.52ms	Write"20H" to DDRAM. And set DDRAM address to "00H" from AC
Return home	0	0	0	0	0	0	0	0	1	x	1.52ms	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.
Entry mode Set	0	0	0	0	0	0	0	1	I/D	S	37us	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.
Display on/off control	0	0	0	0	0	0	1	D	C	B	37us	D=1: entire display on C=1: cursor on B=1: cursor position on
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	37us	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.
function Set	0	0	0	0	1	DL	N	F	x	x	37us	DL: interface data is 8/4 bits N: number of line is 2/1 F: font size is 5x11/5x8
Set CGRAM address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	37us	Set CGRAM address in address counter
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	37us	Set DDRAM address in address counter
Read busy flag& address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	0us	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	37us	Write data into internal RAM (DDRAM/CGRAM)
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	37us	Read data from internal RAM (DDRAM / CGRAM)

Note:

Be sure the AIP31066 is not in the busy state (BF=00 before sending an instruction from the MPU to the AIP31066. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to instruction table for the list of each instruction execution time.

11. INITIALIZING BY INSTRUCTION

8-bit interface mode (fosc=270kHz)

```
                    ┌─────────────────┐
                    │    POWER ON      │
                    └─────────────────┘
                             │
                    ┌─────────────────┐
                    │ Wait time >40mS  │
                    │ After Vcc >4.5V  │
                    └─────────────────┘
                             │
```

Function set									
RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	N	F	X	X

← ⌐ BF cannot be checked before this instruction. ⌐

```
                    ┌─────────────────┐
                    │ Wait time >37uS  │
                    └─────────────────┘
                             │
```

Function set									
RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	N	F	X	X

← ⌐ BF cannot be checked before this instruction. ⌐

```
                    ┌─────────────────┐
                    │ Wait time >37uS  │
                    └─────────────────┘
                             │
```

Display ON/OFF control									
RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	1	D	C	B

```
                    ┌─────────────────┐
                    │ Wait time >37uS  │
                    └─────────────────┘
                             │
```

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

```
                    ┌─────────────────┐
                    │Wait time >1.52mS │
                    └─────────────────┘
                             │
```

Entry mode set									
RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	1	I/D	S

```
                    ┌─────────────────┐
                    │ Initialization end│
                    └─────────────────┘
```

12. CHARACTER GENERATOR ROM

13. Optical Characteristics

13.1 Definition of Viewing Angle
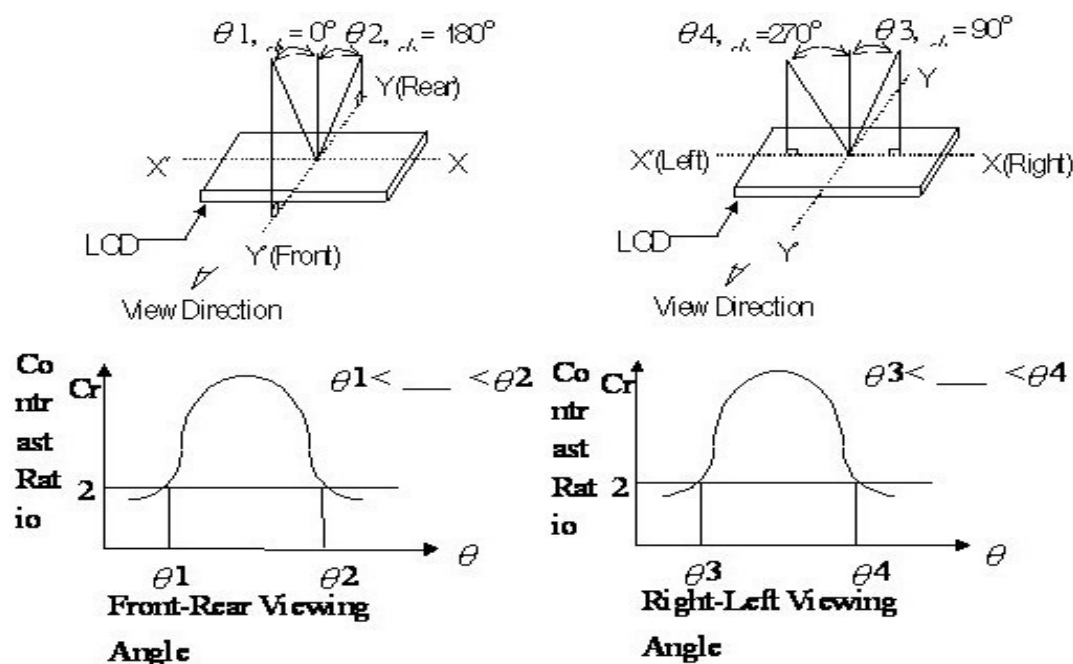
13.2 Definition of Contrast

$$C.R = \frac{\text{Brightness of nonselected segment (B2)}}{\text{Brightness of selected segment}}$$
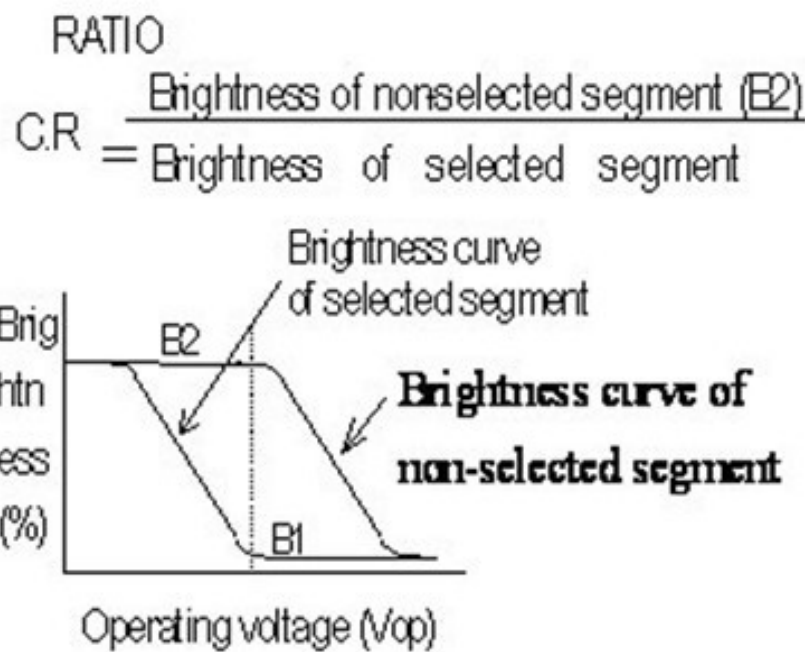
13.3 Definition of Response
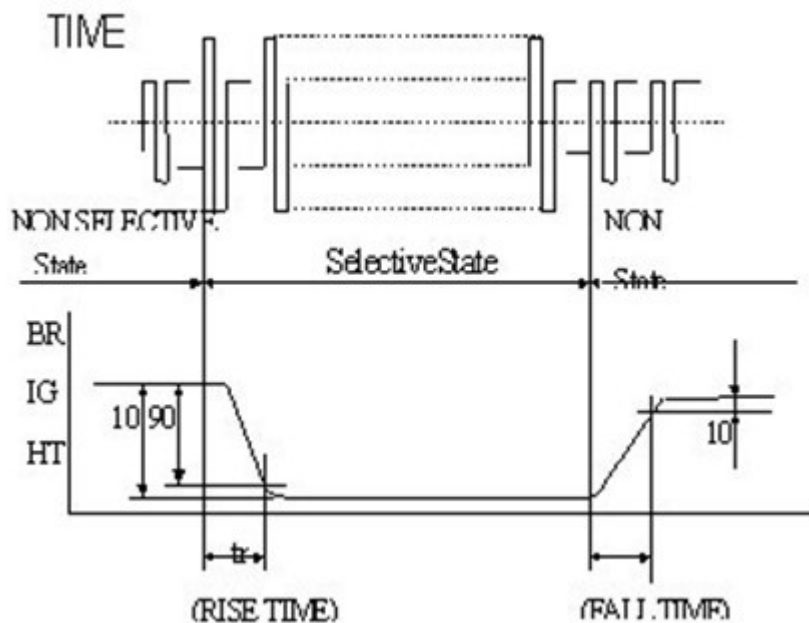
13.4 Measuring Instruments For Elector-optical Characteristics
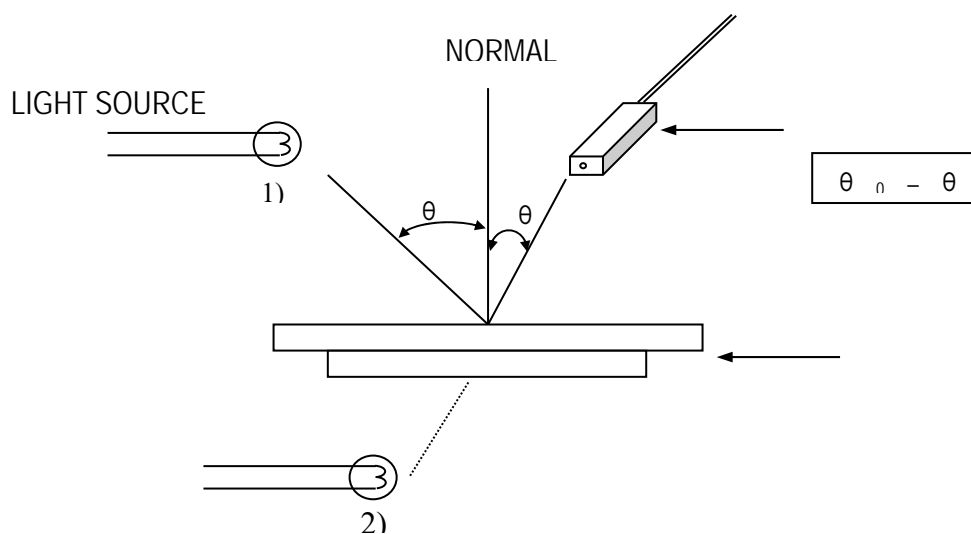
* Note:
1) Light source position for measuring the reflective type of LCD panel;
2) Light source position for measuring the transflective / transmissive types of LCD panel.

14. MODULE ACCEPT QUALITY LEVEL (AQL)

14.1 AQL Standard Value: Critical Defect =0.1, Major Defect=0.65; Minor Defect =2.5.
14.2 Inspection Standard: MIL-STD-105E Table Normal Inspection Single Sampling Level II

15. 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
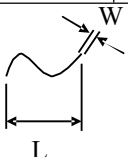
16. Inspection specification
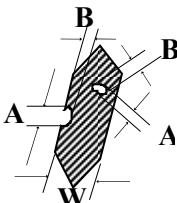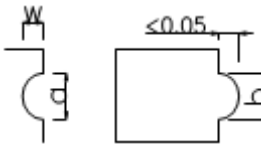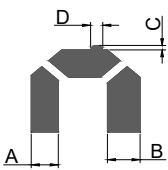
16.1 Visual Inspection
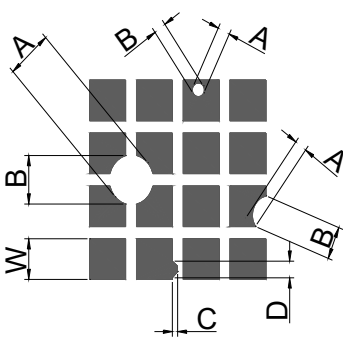
1) Inspect under 2x20W or 40W fluorescent lamp (approximately 3000 lux) leaving 25 to 30 cm between the module and the lamp and 30 cm between the module and the eye (measuring position).

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.
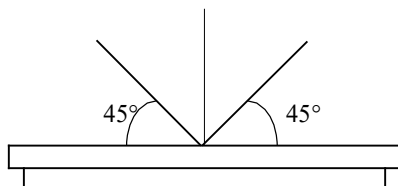
16.2 Standard of Appearance Inspection

No.	Item	Criteria			
1	Black spot White spot Dust	Round type: as per following drawing $\Phi = (X+Y)/2$			

Round type table (Acceptable quantity):

Size	Zone A	Zone B
$\Phi < 0.1$	Any number	Any number
$0.1 < \Phi < 0.2$	2	
$0.2 < \Phi < 0.25$	1	
$0.25 < \Phi$	0	

Line type: as per following drawing

Line type table (Acceptable quantity):

Length	Width	Zone A	Zone B
—	W≤0.02	Any number	Any number
L≤3.0	0.02<W≤0.03	2	
L≤2.5	0.03<W≤0.05		
—	0.05<W	As round type	

Total acceptable quantity: 3

No.	Item	Criteria
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
Φ <0.2	Any number	
0.2< Φ <0.5	2	
0.5< Φ <1.0	1	Any number
1.0< Φ	0	

Total acceptable quantity: 3

4.1 Pin hole on segmented display

W: segment width

$\Phi = (A+B)/2$

Acceptable quantity	
Width	Quantity
W≤0.4	Φ ≤0.2 and Φ ≤1/2W
W>0.4	Φ ≤0.25 and Φ ≤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< Φ <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

$\Phi = (A+B)/2$

4	Segment deformation	

Acceptable quantity	
Size	
Φ ≤0.4	Any number
0.4< Φ ≤1.0	5
1.0< Φ ≤1.5	3
1.5< Φ ≤2.0	2

Total acceptable quantity: 7

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	

Acceptable quantity		
	Size	Quantity
On tray	Φ <0.2	Any number
	Φ >0.25	4
On display	Φ ≥0.25	2
	L = 3	1

17. 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.

18. 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