# SPECIFICATION

| | |
|---|---|
| MODULE NO | NB12864A-series |
| VERSION | |
| CUSTOMER | |
| APPROVE by | |

| Sale by | Check by | Prepare by |
|---|---|---|
| | | |


## 科創光電股份有限公司

台中市北屯區路 360 號 9 樓之一

## NewTec Display Co., Ltd.

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# INDEX

# ISSUE RECORD

| Module NO. | | |
|---|---|---|
| DATE | Version | Description |
| 2005/03/01 | 0 | Published |
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# 1.Numbering system

N B 12864 A – Y H Y – N

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

1 .Brand Name

| | |
|---|---|
| N | NEWTEC Display Co., LTD |

2. Display Type

| | |
|---|---|
| T | TAB |
| B | Graphic |
| C | Character |
| O | COG |
| P | PLED |
| R | Color-STN |
| S | Seven-Segment |
| F | TFT |

3. Number of Pixels

| | |
|---|---|
| Character Module | Characters per line ㄨ Lines |
| Graphic Module | Row Dots ㄨ Column Dots |

4. Series number

| | |
|---|---|
| A~Z | Series Number |

5. LCD Mode:

| | TN | STN | | FSTN | Color-STN | TFT |
|---|---|---|---|---|---|---|
| Positive | T | G | Gary | F | R | T (Black) |
| | | Y | Yellow/Green | | | |
| Negative | N | B | Blue | M | | |

6. LCD Polarize

| | Normal Temperature | | Wide Temperature | |
|---|---|---|---|---|
| | 6:00 | 12:00 | 6:00 | 12:00 |
| Reflective | A | D | G | J |

| | | | | |
|---|---|---|---|---|
| Transflective | B | E | H | K |
| Transmissive | C | F | I | L |

7. Backlight

| | | |
|---|---|---|
| None | N | None |
| EL | H | White |
| | U | Blue Green |
| LED | A | Amber |
| | B | Blue |
| | E | Yellow/Green, edge |
| | G | Green |
| | R | Red |
| | W | White |
| | Y | Yellow/Green |
| CCFL | C | White |

8. IC font (Character)

| | |
|---|---|
| Cyrillic/English | TS |
| Chinese/English | C(BIG 5), S(GB) |
| Japanese/English | PN,PS,PM |
| European/English | RN,RS |

9. Special code

| | |
|---|---|
| A | Anti-glare |
| H | Touch panel |
| M | Negative voltage output and temperature compensation on board |
| N | With negative voltage output on board |
| X | Without negative voltage output on board |
| B | Positive voltage (TAB and PLED only) |
| W | Without positive voltage (TAB and PLED only) |

10. Others

| |
|---|
| |

# 2. Precaution in use of LCD Module

(1) Avoid applying excessive shocks to the module or making any alterations or modifications to it.
(2) Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD module.
(3) Don't disassemble the LCM.
(4) Don't operate it above the absolute maximum rating.
(5) Don't drop, bend or twist LCM.
(6) Soldering: only to the I/O terminals.
(7) Storage: please storage in anti-static electricity container and clean environment.
(8) Don't touch the elastomer connecter, especially insert a backlight panel (EL or CCFL)

# 3. General Specification

## 3.1 Mechanical Dimension

| Item | Dimension | Unit |
|---|---|---|
| Number of Dots | 128 x 64 | dots |
| Module dimension (L x W x H) | 93.0 x 70.0 x 9.7(MAX)-EL B/L or NO B/L<br>93.0 x 70.0 x 13.6(MAX)-LED B/L | mm |
| View area | 72.0 x 40.0 | mm |
| Active area | 66.52 x 33.24 | mm |
| Dot size | 0.48x 0.48 | mm |
| Dot pitch | 0.52 x 0.52 | Mm |

## 3.2 Controller IC: **KS107 / KS108** controller or equivalent

## 3.3 Temperature Range

| | Normal | Wide temperature |
|---|---|---|
| Operating | 0 ~+50℃ | -20℃ ~ +70℃ |
| Storage | -10 ~ +60℃ | -30℃ ~ + 80℃ |

# 4. Absolute Maximum Ratings

## 4.1 Electrical Absolute Maximum Ratings

| Item | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage (Logic) | Vdd- Vss | 0 | 6.7 | V |
| Supply Voltage (LCD driver) | Vdd-Vo | 0 | 16.7 | V |
| Input Voltage | VI | Vss | Vdd | V |

## 4.2 Environmental Absolute Maximum Ratings

| Item | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Normal Type | TOP | 0 | +50 | — | ℃ |
| | TSTG | -10 | +60 | — | ℃ |
| Wide Temperature Type | Top | -20 | +70 | — | ℃ |
| | Tstg | -30 | +80 | — | ℃ |

Note (1) Ta = 0℃ : 50Hr Max.

Note (2) Ta ≦40℃： 90% RH MAX

Ta > 40℃：Absolute humidity must be lower than the humidity of 90% at 40℃.

# 5. Electrical Characteristics

| Item | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Supply Voltage For Logic | Vdd-Vss | — | 4.5 | — | 5.5 | V |
| Supply Voltage For LCD | Vdd-Vo | Ta=-20℃<br>Ta=0℃<br>Ta=25℃<br>Ta=50℃<br>Ta=+70℃ | —<br>—<br>—<br>—<br>— | 10.0<br>9.4<br>8.9<br>8.4<br>7.9 | —<br>—<br>—<br>—<br>— | V<br>V<br>V<br>V<br>V |
| Input High Volt. | $V_{IH}$ | — | 0.7Vdd | — | Vdd | V |
| Input Low Volt. | $V_{IL}$ | — | 0 | — | 0.3Vdd | V |
| Output High Volt. | $V_{OH}$ | — | 2.4 | — | — | V |
| Output Low Volt. | $V_{OL}$ | — | 0 | — | 0.4 | V |
| Supply Current | Idd | Vdd=5V | — | 10 | — | mA |

# 6. Optical Characteristics

- STN

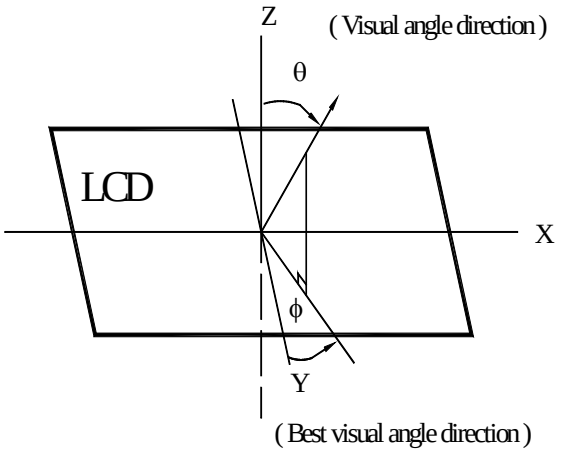
| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| View Angle | (V) θ | CR≧2 | 10 | | 45 | deg |
| | (H) ϕ | CR≧2 | -30 | | 30 | deg |
| Contrast Ratio | CR | — | | 3 | | — |
| Response Time 25℃ | T rise | — | | 100 | 150 | ms |
| | T fall | — | | 150 | 200 | ms |

- FSTN

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| View Angle | (V) θ | CR≧2 | 10 | | 50 | deg |
| | (H) ϕ | CR≧2 | -45 | | 45 | deg |
| Contrast Ratio | CR | — | | 5 | | — |
| Response Time 25℃ | T rise | — | | 100 | 150 | ms |
| | T fall | — | | 150 | 200 | ms |

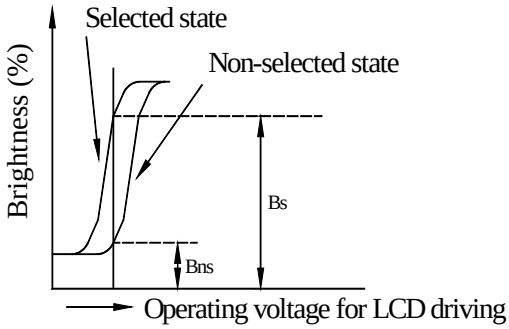
## 6.1 Definitions

■View Angles

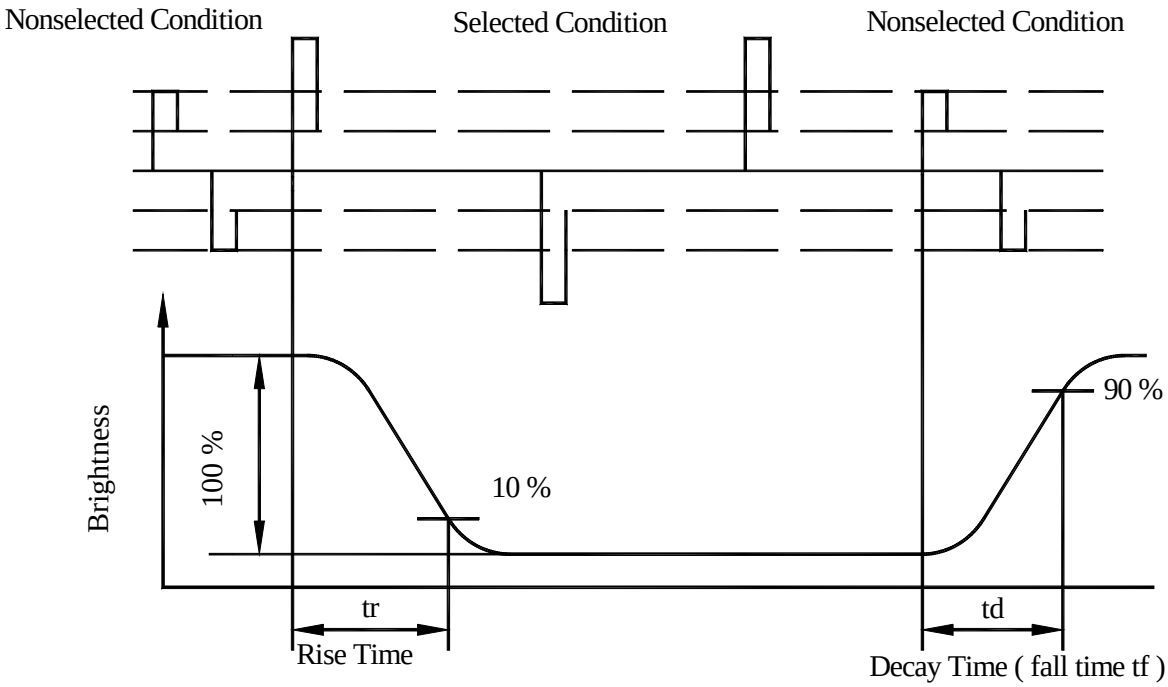



■Contrast Ratio

$$CR = \frac{\text{Brightness at selected state ( BS )}}{\text{Brightness at non-selected state ( Bns )}}$$




■Response Time

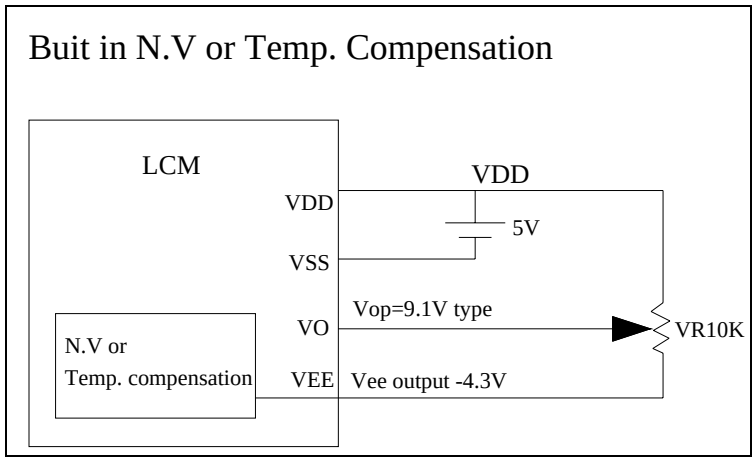


# 7. Interface Description

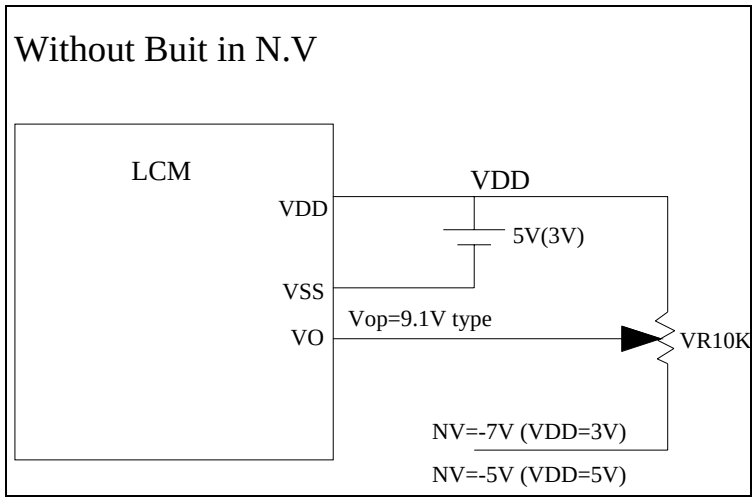
| Pin No. | Symbol | Level | Description |
|---|---|---|---|
| 1 | Vss | 0V | Ground |
| 2 | Vdd | 5.0V | Supply voltage for logic (option +3V) |
| 3 | $V_O$ | (Variable) | Operating voltage for LCD |
| 4 | D/I | H/L | H: Data , L: Instruction |
| 5 | R/W | H/L | H: Read(MPU←Module) , L :Write(MPU→Module) |
| 6 | E | H | Enable signal |
| 7 | DB0 | H/L | Data bus line |
| 8 | DB1 | H/L | Data bus line |
| 9 | DB2 | H/L | Data bus line |
| 10 | DB3 | H/L | Data bus line |
| 11 | DB4 | H/L | Data bus line |
| 12 | DB5 | H/L | Data bus line |
| 13 | DB6 | H/L | Data bus line |
| 14 | DB7 | H/L | Data bus line |
| 15 | CS1 | H | Chip Select for IC1 |
| 16 | CS2 | H | Chip Select for IC2 |
| 17 | /RST | L | Reset signal |
| 18 | Vee | | Negative Voltage output –4.3V |
| 19 | A | — | Power supply for B/L ( + ) |
| 20 | K | — | Power supply for B/L (GND) |

# 8. Power Supply for LCD Module and LCD Operating Voltage Adjustment

LCM operating with built-in negative voltage




LCM operating without negative voltage



# 9. Backlight Information

## 9. 1 Specification

- (1)LED Yellow/Green

| Parameter | Symbol | Min | Typical | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Supply Current | ILED | — | 330 | — | mA | VAK=4.2V |
| Supply Voltage | V | | 4.2 | | V | — |
| Reverse Voltage | VR | — | — | 8 | V | — |
| Luminous Intensity | IV | 80 | — | — | $cd/m^2$ | ILED=330mA |
| Wave Length | λp | — | 571 | — | nm | ILED=330mA |
| Life Time | — | — | 100,000 | — | Hr. | V≦4.4V |
| Color | Yellow/Green | | | | | |

(2) LED edge/white

| Parameter | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Supply Current | ILED | | 80 | 100 | mA | V=3.2V |
| Supply Voltage | V | | 3.2 | 3.4 | V | — |
| Reverse Voltage | VR | — | — | 4 | V | — |
| Luminous Intensity | IV | 80 | | — | $cd/m^2$ | ILED=80mA |
| **Chromaticity** | X | — | 0.30 | — | | ILED=80mA |
| | Y | | 0.31 | | | |
| Life Time | | — | 70000 | — | Hr. | V≦3.4V |
| Color | White | | | | | |

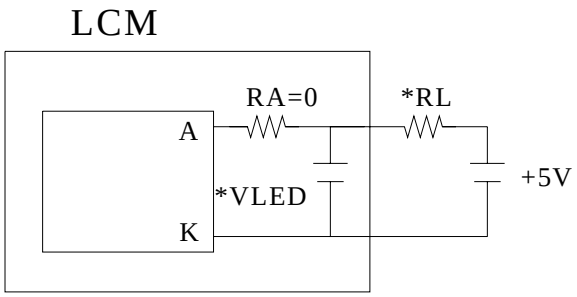
(3) EL white / blue

| Parameter | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Voltage | Vrms | -- | 110 (AC) | | -- | |
| Frequency | HZ | -- | 400 | | -- | |

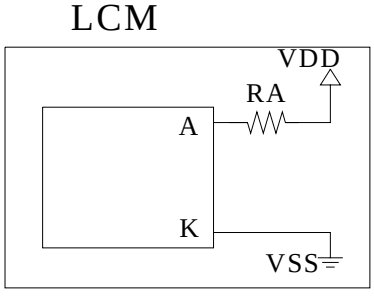
| | | | | | | |
|---|---|---|---|---|---|---|
| Brightness* | cd/m2 | 48 | 60 | | -- | 110Vrms 400Hz |
| CIE Chromaticity Diagram | X | -- | 0.3019(white) / 0.330 (blue) | | -- | |
| | Y | -- | 0.3929(white) / 0.365 (blue) | | -- | |
| Current Dissipation | mA/cm2 | -- | 3.63 | | -- | |
| Power Dissipation | mW/cm2 | -- | 71.71 | | -- | |
| Color | Blue , white | | | | | |

## 9.2 Backlight driving methods

a. LED B/L drive methods




LED B/L driver from A K directly

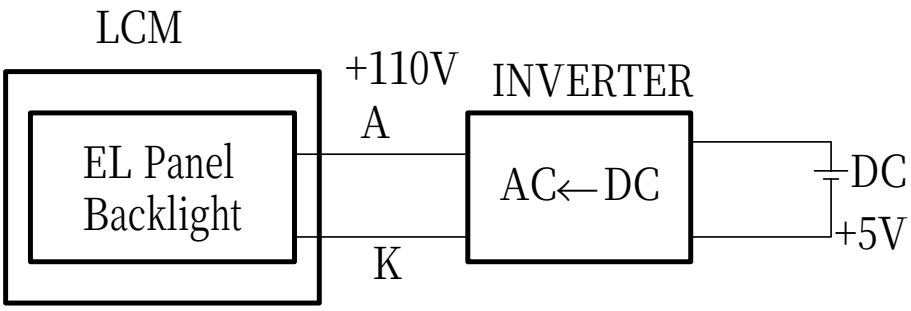



LED B/L Driver from VDD VSS

.＊ 1.array (yellow green) LED B/L driver : **VLED=4.2V RL=2.7Ω**

2. edge (white/blue) LED B/L driver : **VLED=3.2V RL=27Ω**

b. E/L B/L driven from A.K cable directly



# 10. Quality Assurance

◆ Screen Cosmetic Criteria

| No. | Defect | Judgment Criterion | Partition |
|---|---|---|---|
| 1 | Spots | A)Clear<br>Size: d mm — Acceptable Qty in active area<br>d ≦0.1 — Disregard<br>0.1<d≦0.2 — 6<br>0.2<d≦0.3 — 2<br>0.3<d — 0<br>Note:Including pin holes and defective dots which must be within one pixel size.<br>B)Unclear<br>Size: d mm — Acceptable Qty in active area<br>d ≦0.2 — Disregard<br>0.2<d≦0.5 — 6<br>0.5<d≦0.7 — 2<br>0.7<d — 0 | Minor |
| 2 | Bubbles in Polarizer | Size: d mm — Acceptable Qty in active area<br>d≦0.3 — Disregard<br>0.3<d≦1.0 — 3<br>1.0<d≦1.5 — 1<br>1.5<d — 0 | Minor |
| 3 | Scratch | In accordance with spots cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable. | Minor |
| 4 | Allowable Density | Above defects should be separated more than 30mm each other. | Minor |
| 5 | Coloration | Not to be noticeable coloration in the viewing area of the LCD panels.<br>Back-light type should be judged with back-light on state only. | Minor |

# 11. Reliability

■Content of Reliability Test

| Environmental Test | | | | |
|---|---|---|---|---|
| No. | Test Item | Content of Test | Test Condition | Applicable Standard |
| 1 | High Temperature storage | Endurance test applying the high storage temperature for a long time. | 60℃<br>200hrs | —— |
| 2 | Low Temperature storage | Endurance test applying the high storage temperature for a long time. | -10℃<br>200hrs | —— |
| 3 | High Temperature Operation | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time. | 50℃<br>200hrs | —— |
| 4 | Low Temperature Operation | Endurance test applying the electric stress under low temperature for a long time. | 0℃<br>200hrs | —— |
| 5 | High Temperature/ Humidity Storage | Endurance test applying the high temperature and high humidity storage for a long time. | 70℃,90%RH<br>96hrs | —— |
| 6 | High Temperature/ Humidity Operation | Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time. | 40℃,90%RH<br>96hrs | —— |
| 7 | Temperature Cycle | Endurance test applying the low and high temperature cycle.<br>-10℃ 25℃ 60℃<br>30min 5min 30min<br>1 cycle | -10℃/60℃<br>10 cycles | —— |
| Mechanical Test | | | | |
| 8 | Vibration test | Endurance test applying the vibration during transportation and using. | 10~22Hz→1.5mmp-p<br>22~500Hz→1.5G<br>Total 0.5hrs | —— |
| 9 | Shock test | Constructional and mechanical endurance test applying the shock during transportation. | 50G Half sign wave 11 msedc<br>3 times of each direction | —— |
| 10 | Atmospheric pressure test | Endurance test applying the atmospheric pressure during transportation by air. | 115mbar<br>40hrs | —— |
| Others | | | | |
| 11 | Static electricity test | Endurance test applying the electric stress to the terminal. | VS=800V,RS=1.5kΩ<br>CS=100pF<br>1 time | —— |

***Supply voltage for logic system=5V. Supply voltage for LCD system = Operating voltage at 25℃

# 12.KS0108 controller data

The display control instructions control the internal state of the KS0108B. Instruction is received from MPU to KS0108B for the display control. The following table shows various instructions.

| Instruction | D/I | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Function |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Display ON/OFF | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0/1 | Controls the display on or off. Internal status and display RAM data are not affected.<br>0:OFF, 1:ON |
| Set Address | 0 | 0 | 0 | 1 | Y address (0~63) | | | | | | Sets the Y address in the Y address counter. |
| Set Page<br>(X address) | 0 | 0 | 1 | 0 | 1 | 1 | 1 | Page (0 ~7) | | | Sets the X address at the X address register. |
| Display Start Line | 0 | 0 | 1 | 1 | Display start line(0~63) | | | | | | Indicates the display data RAM displayed at the top of the screen. |
| Status Read | 0 | 1 | B<br>U<br>S<br>Y | 0 | ON/<br>OFF | R<br>E<br>S<br>E<br>T | 0 | 0 | 0 | 0 | Read status.<br>BUSY 0:Ready<br>1:In operation<br>ON/OFF 0:Display ON<br>1:Display OFF<br>RESET 0:Normal<br>1:Reset |
| Write Display Data | 1 | 0 | Display Data | | | | | | | | Writes data (DB0:7)into display data RAM. After writing instruction, Y address is increased by 1 automatically. |
| Read Display Data | 1 | 1 | Display Data | | | | | | | | Reads data (DB0:7) from display data RAM to the data bus. |

## 12.1 Detailed Explanation

Display On/Off

| R/W | D/I | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | D |

The display data appears when D is and disappears when D is 0. Though the data is not on the screen with D = 0, it remains in the display data RAM. Therefore, you can make it appear by changing D = 0 into D = 1.

Display Start Line

| R/W | D/I | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 1 | 1 | A | A | A | A | A | A |

Z address AAAAAA ( binary ) of the display data RAM is set in the display start line register and displayed at the top of the screen. Figure 2. shows examples of display ( 1/64 duty cycle ) when the start line = 0-3. When the display duty cycle is 1/64 or more ( ex. 1/32, 1/24 etc. ), the data of total line number of LCD screen, from the line specified by display start line

Set Page ( X Address )

| R/W | D/I | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 1 | 0 | 1 | 1 | 1 | A | A | A |

X address AAA ( binary ) of the display data RAM is set in the X address register.After that, writing or reading to or from MPU is executed in this specified page until the next page is set. See Figure 1.

Set Y Address

| R/W | D/I | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | A | A | A | A | A | A |

Y address AAAAAA ( binary ) of the display data RAM is set in the Y address counter. After that, Y address counter is increased by 1 every time the data is written or read to or from MPU.

Status Read

| R/W | D/I | 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 LSI is executing internal operations. No instruction are accepted while busy is 1, so you should make sure that busy is 0 before writing the next instruction.

∅ •ON/OFF

Shows the liquid crystal display condition: on condition or off condition.

When on/off is 1, the display is in off condition.

When on/off is 0, the display is in on condition.

∅ •RESET

RESET = 1 shows that the system system is being initialized. In this condition, no instructions except status read can be accepted.

RESET = 0 shows that initializing has system is in the usual operation condition.

Write Display Data

| R/W | D/I | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | D | D | D | D | D | D | D | D |

Writes 8-bit data DDDDDDDD ( binary ) into the display data RAM. The Y address is increased by 1 automatically.

Read Display Data

| R/W | D/I | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | D | D | D | D | 1 | D | D | D |

Reads out 8-bit data DDDDDDDD (binary) from the display data RAM. Then Y address is increased by 1 automatically.

One dummy read is necessary right after the address setting. For details, refer to the explanation of output register in “Function of Each Block”.

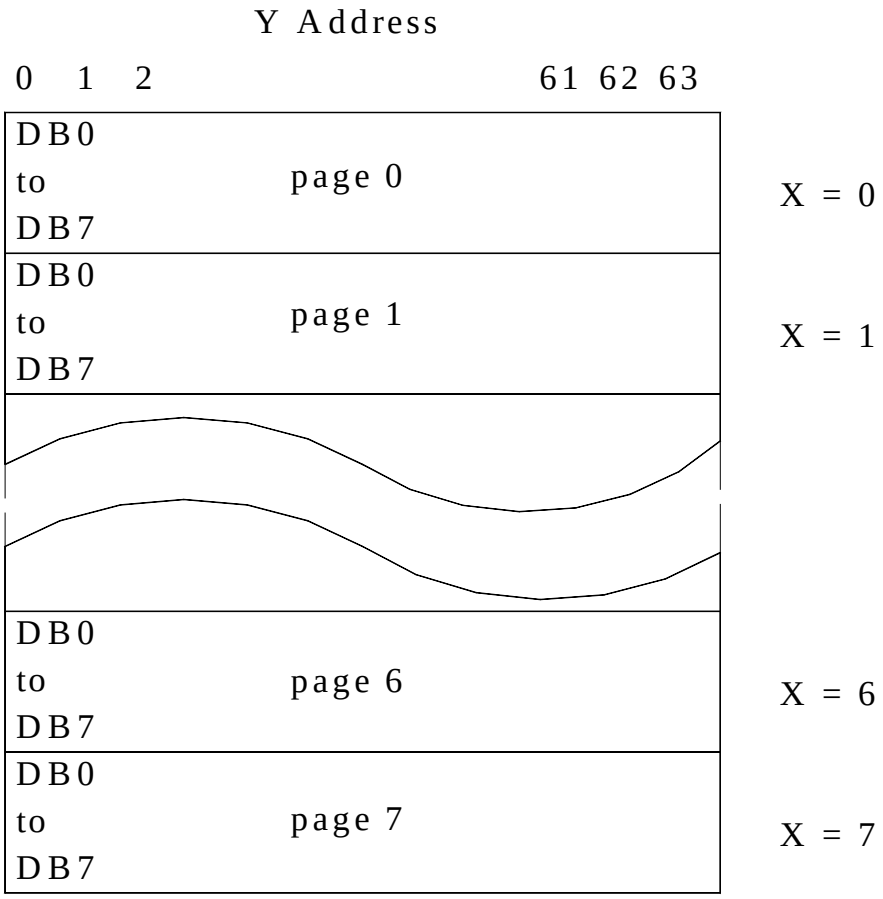
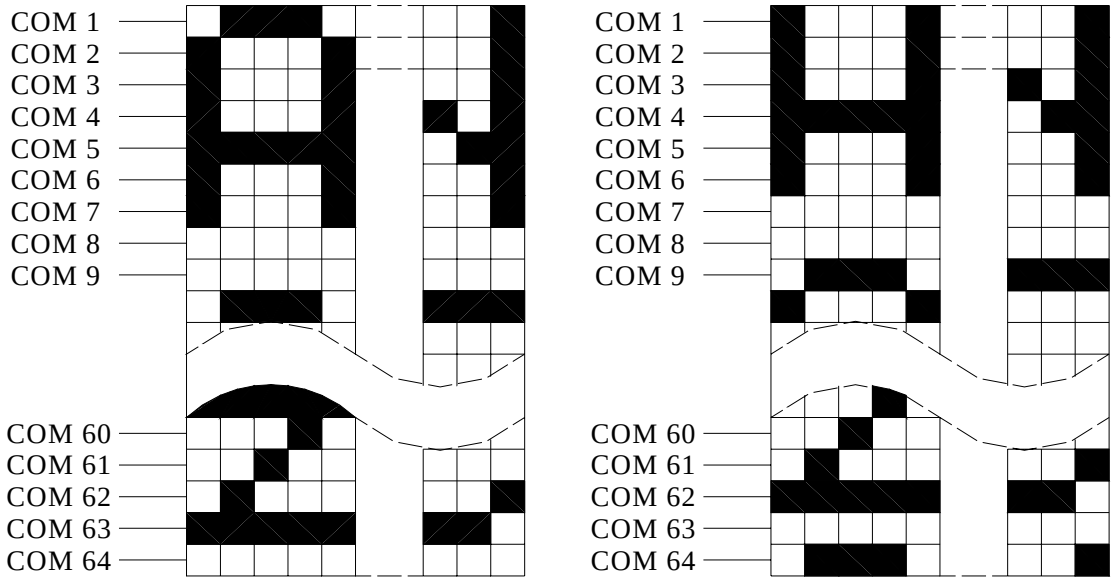



Figure 1.



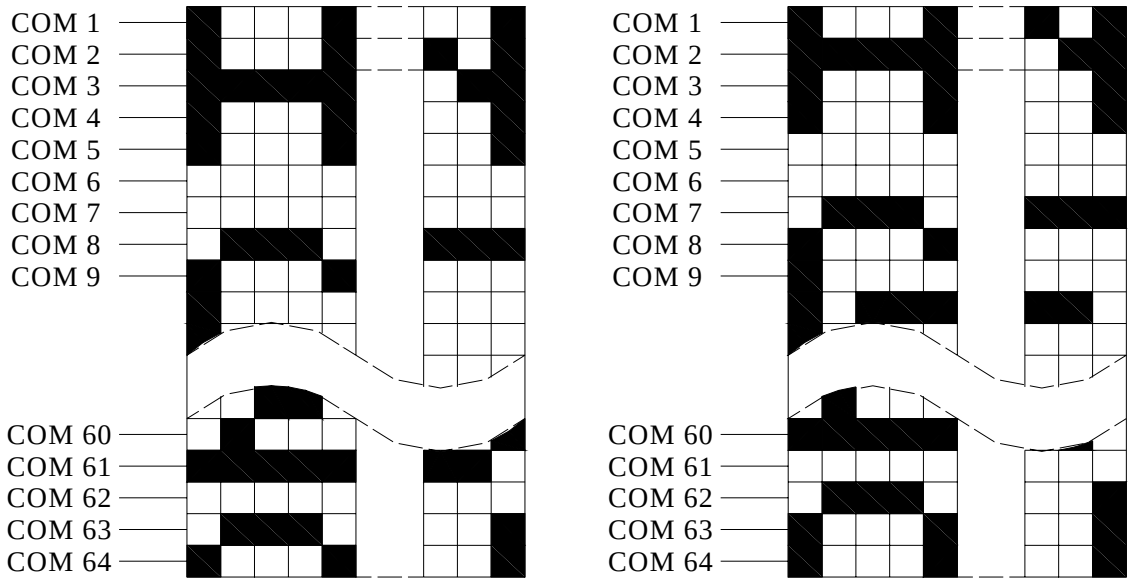




Figure 2

# 13. Outline drawing