

PRODUCT SPECIFICATION

GS16032A-D-BSXTSWW-100

VI.1

September 9, 2006

REVISION RECORD

| REV | DESCRIPTION | DATA |
|------|--|-------------------|
| V1.0 | First Issue | September 7, 2006 |
| V1.1 | <ol style="list-style-type: none"> <li data-bbox="373 434 1054 555">1. Modify 4.2 “Electronic Block Diagram”, and indicate that the number of LED BackLight is only one. <li data-bbox="373 562 1054 640">2. Add 4.3 “Power Supply For LCD Module”. <li data-bbox="373 647 1054 768">3. Modify 6.1 “Electrical Characteristics”, and add Min and Max Supply Voltage of LED. | September 9, 2006 |

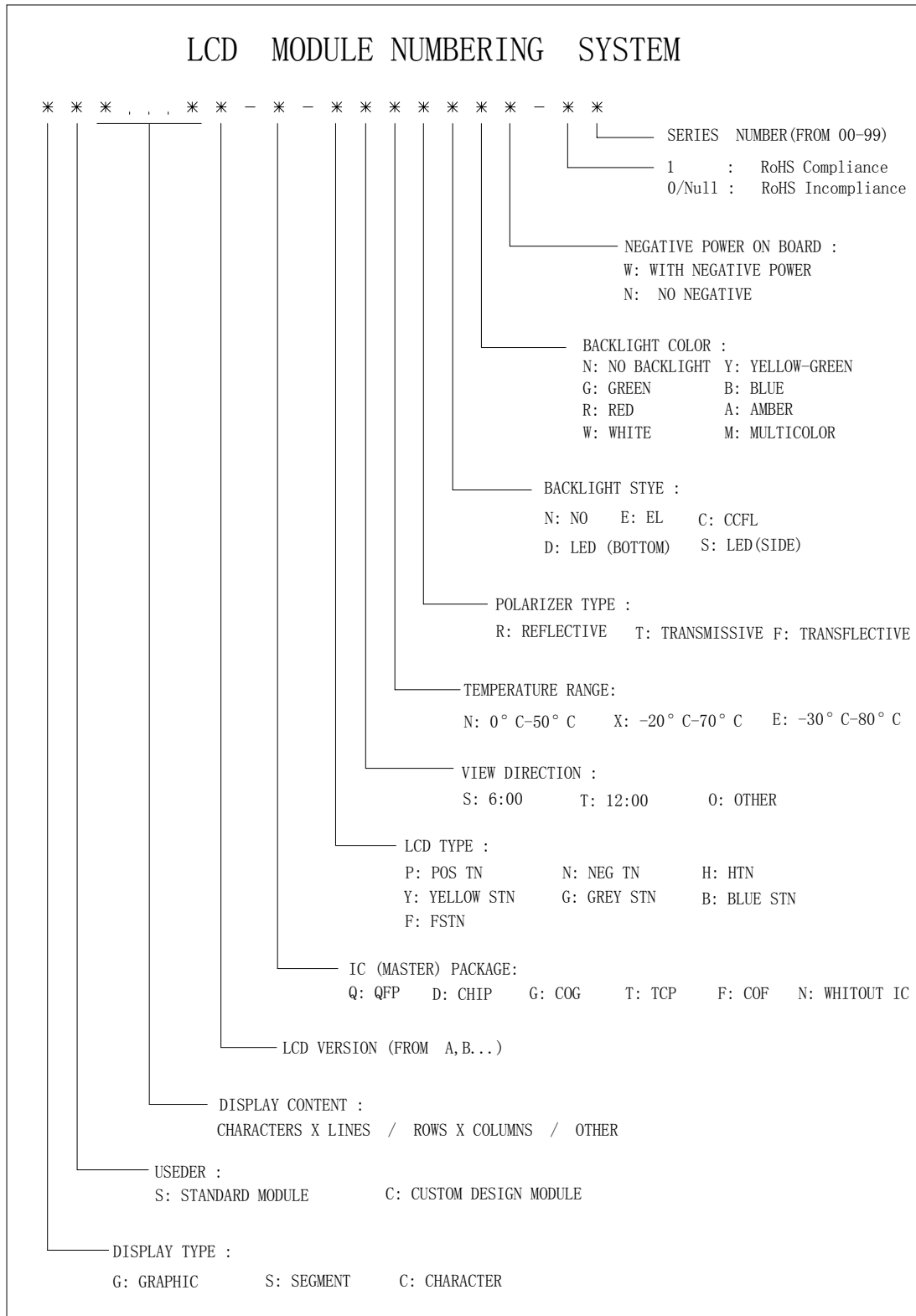
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Type Number and Description

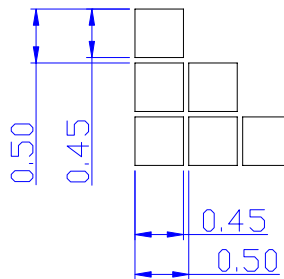
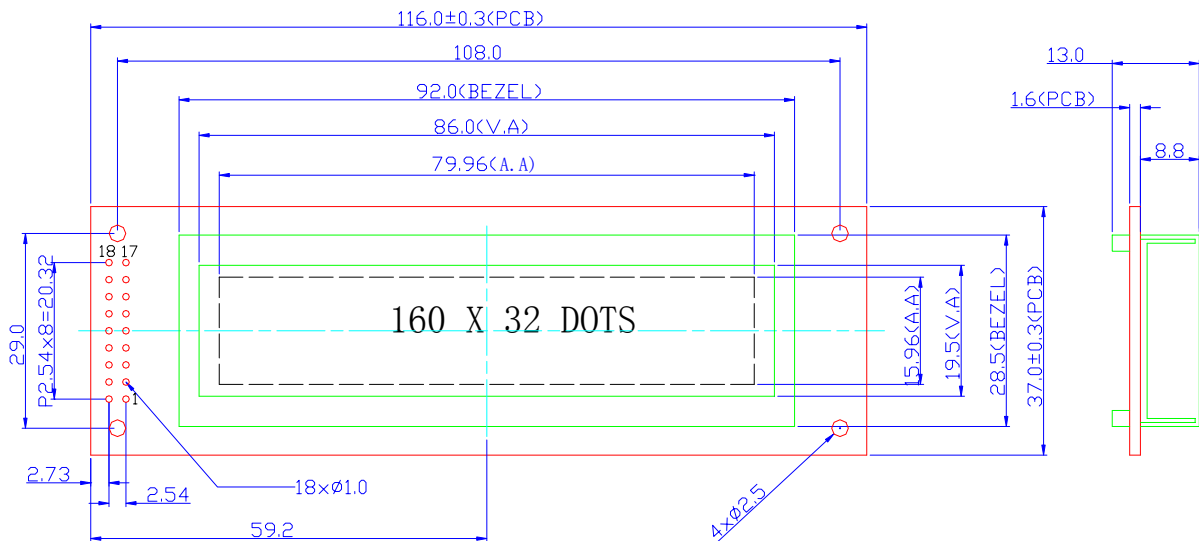
| | |
|------------------------|------------------------|
| Type Number: | GS16032A-D-BSXTSWW-100 |
| Description: | 160 X 32 DOTS |
| LCD Panel: | STN ,Blue Negative |
| Operating Temperature: | -20 °C – 70 °C |
| Storage Temperature: | -30 °C – 80 °C |
| Viewing angle: | 6H |
| BackLight Mode: | Side |
| BackLight Color: | White |
| Controller: | ST7920 |
| IC Package: | Bonding |
| Logic Voltage: | 5.0V |
| DC-DC Converter: | With |

2. LCD Module Numbering System



3. Mechanical Specifications:

| ITEM | STANDARD VALUE | UNIT |
|------------------------|-----------------------------|------|
| Display Content | 160 x 32 dots | |
| MODULE DIMENSION | 116.0(W) X 37.0(H) X13.0(T) | mm |
| EFFECTTVE DISPLAY AREA | 86.0(W) X 19.5(H) | mm |
| DOT SIZE | 0.45(W) X 0.45(H) | mm |
| DOT PITCH | 0.50(W) X 0.50(H) | mm |
| APPROX WEIGHT | 80G | g |
| LCD TYPE | STN,Blue | |
| DUTY AND BIAS | 1/33 DUTY; 1/5 BIAS | |
| VIEWING DIRECTION | 6:00 | |
| BACK LIGHT | White, Side LED | |

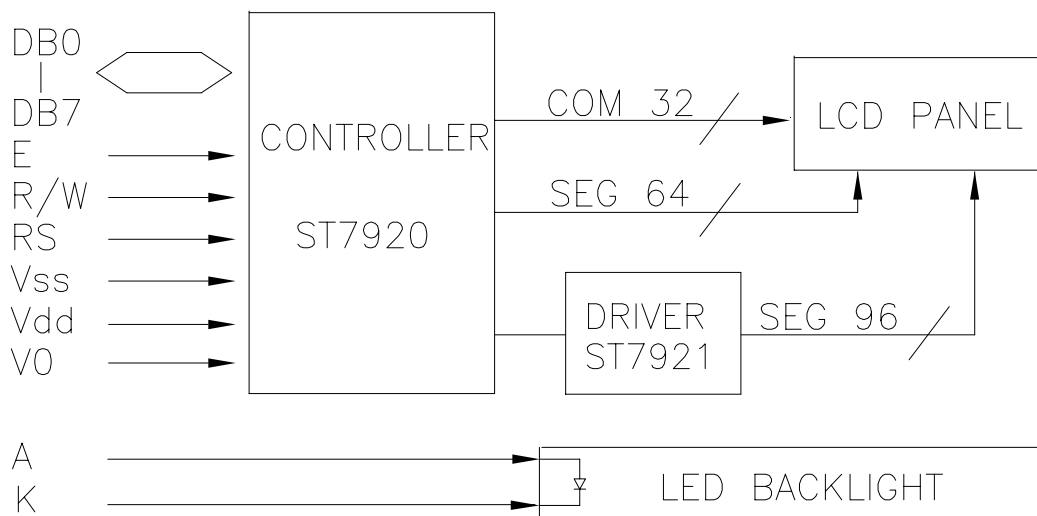


4. Electrical Block Diagram

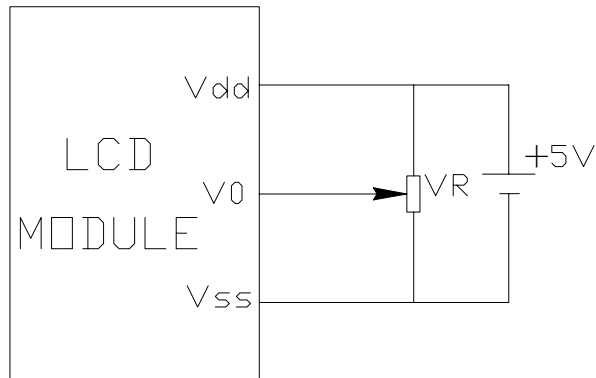
4.1 PINS DEFINITION

| PIN | SYMBOL | SIGNAL DESCRIPTION |
|------|---------|----------------------------------|
| 1 | VSS | GND(0V) |
| 2 | VDD | Power Supply for Logic |
| 3 | V0 | Operating Voltage for LCD |
| 4 | D/I | H:Data L:Instrction |
| 5 | R/W | H:MPU<-Module L:MPU->Module |
| 6 | E | Enable Signal |
| 7-14 | DB0-DB7 | Data Bus |
| 15 | /RST | Reset Signal |
| 16 | NC | NO Connection |
| 17 | A | Supply Voltage for BackLight (+) |
| 18 | K | Supply Voltage for BackLight (-) |

4.2 ELECTRICAL BLOCK DIAGRAM



4.3 POWER SUPPLY FOR LCD MODULE



$(V_{dd} - V_0) \times 2$: LCD Driving Voltage
 VR: 10K-20K

5. Absolute Maximum Ratings

5.1 Electrical Maximum Ratings

| ITEM | SYMBOL | CONDITION | MIN | MAX | UNIT |
|----------------------------|-------------------|-----------|------|----------------|------|
| Supply Voltage (Logic) | $V_{dd} - V_{ss}$ | - | -0.3 | 5.5 | V |
| Supply Voltage (LCD Drive) | $V_{dd} - V_0$ | - | -0.3 | 7.0 | V |
| Input Voltage | V_i | - | -0.3 | $V_{dd} + 0.3$ | V |

5.2 Environmental Conditions

| ITEM | SYMBOL | CONDITION | MIN | MAX | UNIT |
|--------------------|-----------|-------------------------------------|----------------------|-----|-------|
| Operating Temp | T_{opr} | - | -20 | 70 | deg C |
| Storage Temp | T_{tsg} | - | -30 | 80 | deg C |
| Humidity Endurance | RH | no ondensation $T_a \leq 40$ deg | - | 95 | % |
| Vibration | - | 3 directions | see note (a), page 3 | | - |
| Shock | - | 3 directions | see note (b), page 3 | | - |

note (a): frequency : varying from 10 Hz in a 1-minute cycle

amplitude : 1.5mm

duration : 120 cycles, each lasting 1 minute,

for each of the 3 directions, x,y,z

note (b): mutually perpendicular directions

direction normal to surface of LCD glass

80G, half-sine pulse of duration 11ms

other 2 directions

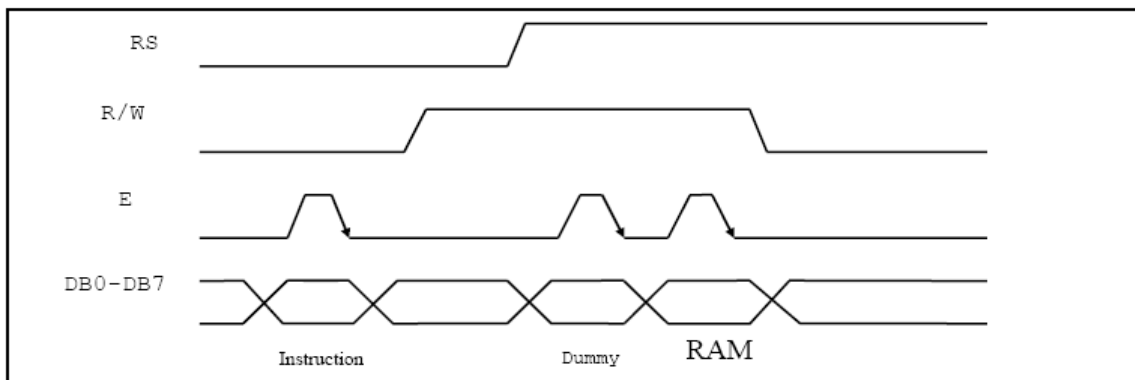
100G, half-sine pulse of duration 11ms

6. Electrical Specifications

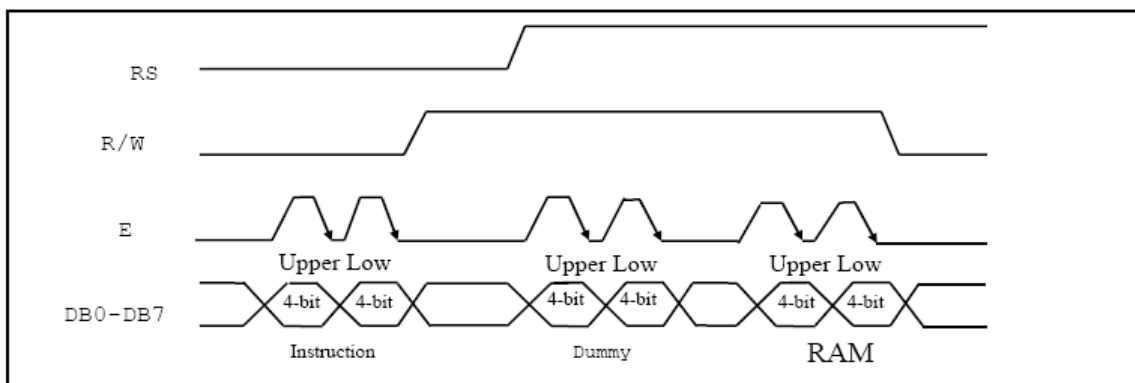
6.1 Electrical Characteristics at Ta=25 deg C, Vdd = 5V + / - 5%

| ITEM | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT |
|------------------------|---------|------------|-----|-----|-----|------|
| Supply Voltage (logic) | Vdd-Vss | - | 4.5 | 5 | 5.5 | V |
| Supply Voltage (LED) | V-bl | see note 1 | 2.9 | 3.2 | 3.5 | V |
| Supply Current (LED) | I-bl | see note 1 | - | 15 | 25 | mA |

6.2 Parallel Interface

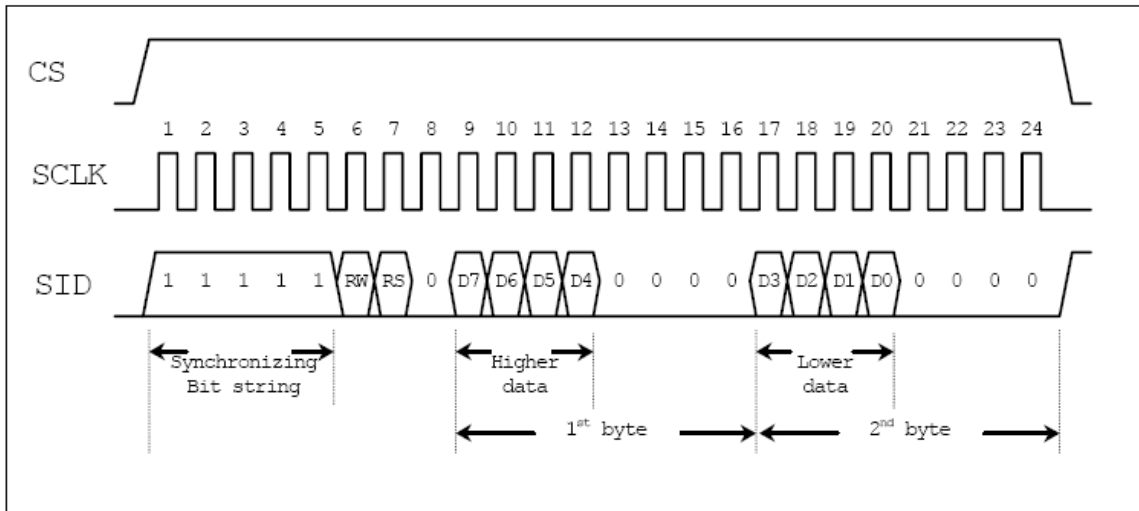


Timing Diagram of 8-bit Parallel Bus Mode Data Transfer



Timing Diagram of 4-bit Parallel Bus Mode Data Transfer

6.3 Serial Interface



Timing Diagram of Serial Mode Data Transfer

7. Electro-Optical Characteristic

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | REF. |
|-----------------|-----------------------|-----------|------|------|------|------|--------|
| Contrast | CR | 25°C | -- | 12 | -- | | Note1 |
| Rise Time | tr | 25°C | -- | 160 | 240 | ms | Note2 |
| Fall Time | tf | 25°C | -- | 100 | 150 | ms | note 2 |
| Viewing Angle | $\theta_1 - \theta_2$ | 25°C | -- | -- | 60 | DEG | Note 3 |
| | ϕ_1, ϕ_2 | | -40 | -- | 40 | | |
| Frame Frequency | Ff | 25°C | -- | 70 | -- | Hz | note 2 |

Note(3): Contrast ratio is defined under the following condition:

$$CR = \frac{\text{brightness of non-selected condition}}{\text{brightness of selected condition}}$$

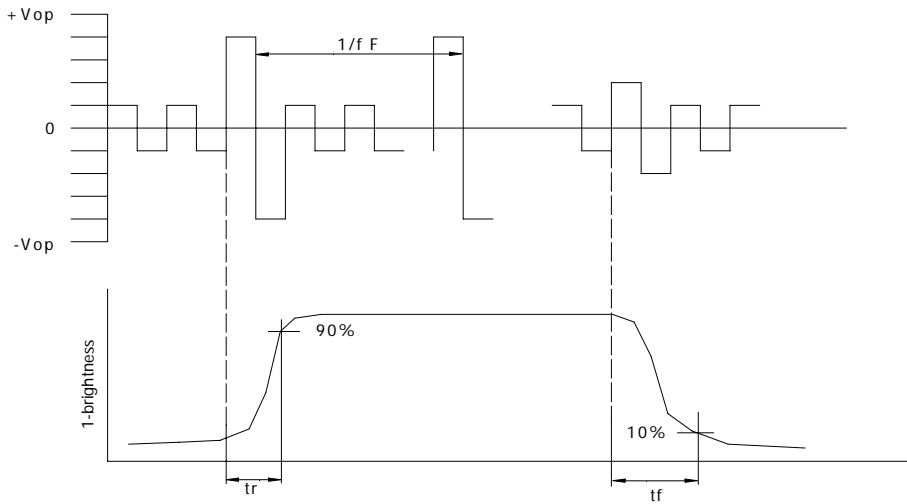
brightness of non-selected condition

(a). Temperature-----25C

(b). Frame Frequency-----64Hz

- (c). Viewing angle----- $\theta = 0, \varnothing = 0$
- (d). Operating Voltage---5.0V

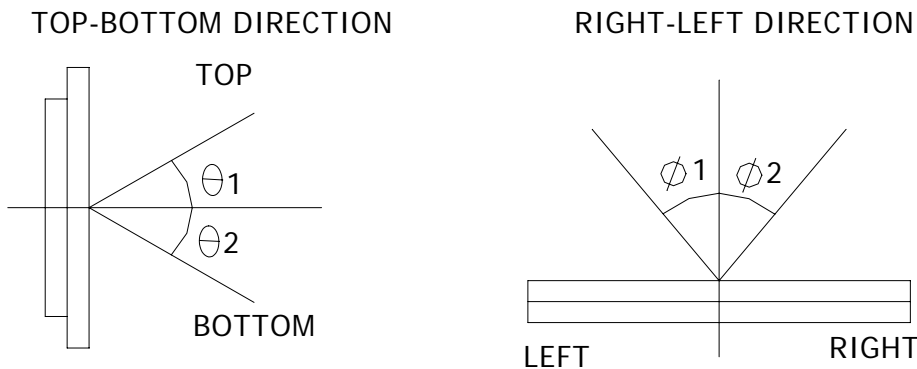
Note(1): definition of response time:



Condition:

- (a). Temperature-----25C
- (b). Frame Frequency-----64Hz
- (c). Viewing angle----- $\theta = 0, \varnothing = 0$
- (d). Operating Voltage---5.0V

Note(2): definition of view



8. Instruction Table

Instruction set 1: (RE=0: basic instruction)

| Ins | code | | | | | | | | | | Description | Exec time (540KHZ) | |
|-----------------------------|------|----|-----|-----|-----|-----|-----|-----|-----|-----|--|---|-------|
| | RS | RW | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | | |
| CLEAR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Fill DDRAM with "20H", and set DDRAM address counter (AC) to "00H" | 1.6 ms | |
| HOME | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | Set DDRAM address counter (AC) to "00H", and put cursor to origin ; the content of DDRAM are not changed | 72us |
| ENTRY MODE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | S | Set cursor position and display shift when doing write or read operation | 72us |
| DISPLAY ON/OFF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | D=1: display ON C=1: cursor ON B=1: blink ON | 72 us |
| CURSOR DISPLAY CONTROL | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | X | X | Cursor position and display shift control ; the content of DDRAM are not changed | 72 us | |
| FUNCTION SET | 0 | 0 | 0 | 0 | 1 | DL | X | 0 | RE | X | X | DL=1 8-BIT interface DL=0 4-BIT interface <u>RE=1: extended instruction</u> <u>RE=0: basic instruction</u> | 72 us |
| SET CGRAM ADDR. | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address to address counter (AC) <u>Make sure that in extended instruction SR=0 (scroll or RAM address select)</u> | 72 us | |
| SET DDRAM ADDR. | 0 | 0 | 1 | 0 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set DDRAM address to address counter (AC) AC6 is fixed to 0 | 72 us | |
| READ BUSY FLAG (BF) & ADDR. | 0 | 1 | BF | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Read busy flag (BF) for completion of internal operation, also Read out the value of address counter (AC) | 0 us | |
| WRITE RAM | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Write data to internal RAM (DDRAM/CGRAM/IRAM/GDRAM) | 72 us | |
| READ RAM | 1 | 1 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Read data from internal RAM (DDRAM/CGRAM/IRAM/GDRAM) | 72 us | |

Instruction set 2: (RE=1: extended instruction)

| Inst. | code | | | | | | | | | | description | Exec. time (540KHZ) |
|-------------------------------------|------|----|-----|-----|-----|-----|-----|-----|-----|-------|--|------------------------|
| | RS | RW | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | |
| STAND BY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Enter stand by mode, any other instruction can terminate (Com1..32 halted, only Com33 ICON can display) | 72 us |
| SCROLL or RAM ADDR. SELECT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | SR=1: enable vertical scroll position SR=0: enable IRAM address (extended instruction) SR=0: enable CGRAM address(basic instruction) | 72 us |
| REVERSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | R1 R0 | Select 1 out of 4 line (in DDRAM) and decide whether to reverse the display by toggling this instruction R1,R0 initial value is 00 | 72 us |
| EXTENDED FUNCTION SET | 0 | 0 | 0 | 0 | 1 | DL | X | 1 | RE | G | DL=1 8-BIT interface DL=0 4-BIT interface RE=1: extended instruction set RE=0: basic instruction set G=1 :graphic display ON G=0 :graphic display OFF | 72 us |
| SET IRAM or SCROLL ADDR | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | SR=1: AC5~AC0 the address of vertical scroll SR=0: AC3~AC0 the address of ICON RAM | 72 us |
| SET GRAPHIC RAM ADDR. | 0 | 0 | 1 | 0 | 0 | 0 | AC3 | AC2 | AC1 | AC0 | Set GDRAM address to address counter (AC) First set vertical address and the horizontal address by consecutive writing Vertical address range AC5...AC0 Horizontal address range AC3...AC0 | 72 us |

9. Standard character pattern

| H/L | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|-----|---|---|---|----|----|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | ☺ | ☹ | ♥ | ♠ | ♣ | ♣ | • | ◐ | ◑ | ◕ | ♂ | ♀ | ♫ | ♫ | ✳ |
| 1 | ▶ | ◀ | ↕ | !! | ¶ | § | - | ‡ | ↑ | ↓ | → | ← | └ | ↔ | ▲ | ▼ |
| 2 | | ! | " | # | \$ | % | & | ' | (|) | * | + | , | - | . | / |
| 3 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | : | ; | < | = | > | ? |
| 4 | @ | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
| 5 | P | Q | R | S | T | U | V | W | X | Y | Z | [| \ |] | ^ | _ |
| 6 | ' | a | b | c | d | e | f | g | h | i | j | k | l | m | n | o |
| 7 | p | q | r | s | t | u | v | w | x | y | z | { | ! | } | ~ | △ |

Table 7 16x8 half-height characters

10. Precaution For Using LCM

1. LIQUID CRYSTAL DISPLAY (LCD)

LCD is made up of glass, organic sealant, organic fluid, and polymer based polarizers. The following precautions should be taken when handling,

- (1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel off or bubble.
- (2). Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface. Wipe gently with cotton. Chamois or other soft material soaked in petroleum benzine.
- (3). Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.
- (4). Glass can be easily chipped or cracked from rough handling, especially at corners and edges.
- (5). Do not drive LCD with DC voltage.

2. Liquid Crystal Display Modules

2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.

- (1). Do not tamper in any way with the tabs on the tabs on the metal frame.
- (2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.
- (3). Do not touch the elastomer connector, especially insert an backlight panel (for example, EL).
- (4). When mounting a LCM make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
- (5). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

2.2. Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

- (1). The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.
- (2). The modules should be kept in antistatic bags or other containers resistant to static for

storage.

- (3). Only properly grounded soldering irons should be used.
- (4). If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.
- (5). The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.
- (6). Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

2.3. Soldering

- (1). Solder only to the I/O terminals.
- (2). Use only soldering irons with proper grounding and no leakage.
- (3). Soldering temperature: $280\text{ }^{\circ}\text{C} \pm 10^{\circ}\text{C}$
- (4). Soldering time: 3 to 4 sec.
- (5). Use eutectic solder with resin flux fill.
- (6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed afterwards.

2.4. Operation

- (1). The viewing angle can be adjusted by varying the LCD driving voltage V_0 .
- (2). Driving voltage should be kept within specified range; excess voltage shortens display life.
- (3). Response time increases with decrease in temperature.
- (4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
- (5). Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured".

2.5. Storage

If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

2.6. Limited Warranty

Unless otherwise agreed between EASTERNTRONIC and customer, EASTERNTRONIC will replace or repair any of its LCD and LC, which is found to be defective electrically and visually when inspected in accordance with EASTERNTRONIC acceptance standards, for a period on one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of EASTERNTRONIC is limited to repair and/or replacement on the terms set forth above. EASTERNTRONIC will not be responsible for any subsequent or consequential events.

Declaration of conformity regarding the limitation of dangerous substances

深圳易事通液晶显示模块有限公司

SHENZHEN EASTERNTRONIC LCM CO., LTD.

4F, B3 Building , FuYuan Industrial Zone , FuYong Town,

BaoAn District, ShenZhen, P.R.China

DECLARATION OF CONFORMITY REGARDING THE LIMITATION OF
DANGEROUS SUBSTANCES

WE, SHENZHEN EASTERNTRONIC LCM CO., LTD,

Declare that the product of GS16032A-D-BSXTSWW-100 complies
with:

The directive 2002/95/EC Dated 2003/01/27 regarding the
limitation of dangerous substances, in particular to
clause 4 which forbids the use of the following elements:

- Lead
- Mercury
- Cadmium
- Hexavalent chromium
- Polybrominated biphenyls
- Polybrominated diphenylethers

And to the annex which points out the exempted implementations

To the directive 73/23/eec dated 1973/02/19 and the standard
EN60335-1 regarding prohibition of following elements:

- Oils containing polychlorinated biphenyl
- Asbestos
- Radioactive substances

Name: Ewing Liu /

SHENZHEN EASTERNTRONIC LCM CO., LTD.

Issued on September 7, 2006

According with the proposal of Technical Adaptation
Committee(TAC) of a limit of 0.1% by weight for lead
hexavalent chromium, mercury, PBBs and PBDRs and 0.01% by
weight for Cadmium