

# DISPLAYTRONIC

*XIAMEN ZETTLER ELECTRONICS CO., LTD*

## SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

ACM1202K SERIES CHARACTER MODULE VER2.0

| CUSTOMER APPROVAL                                                                                                                                                                                                                                |  |                         |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------|--|
| <b>1.POLARIZER OPTIONS:</b> <input type="checkbox"/> R=REFLECTIVE <input checked="" type="checkbox"/> F=TRANSFLECTIVE<br><input type="checkbox"/> N=TRANSMISSIVE NEGATIVE<br><input type="checkbox"/> M=TRANSMISSIVE POSITIVE                    |  |                         |  |
| <b>2.BACKLIGHT OPTIONS:</b> <input type="checkbox"/> N=NONE <input type="checkbox"/> E=EL <input checked="" type="checkbox"/> L=LED (Y-G ) <input type="checkbox"/> C=CCFL                                                                       |  |                         |  |
| <b>3. BACKLIGHT COLOR:</b> <input type="checkbox"/> A= AMBER <input type="checkbox"/> B= BLUE <input type="checkbox"/> G= GREEN <input type="checkbox"/> W=WHITE<br><input type="checkbox"/> R= RED <input type="checkbox"/> RGB= RED+GREEN+BLUE |  |                         |  |
| <b>4.FLUID OPTIONS:</b> <input type="checkbox"/> T=TN <input type="checkbox"/> F=FSTN<br><input checked="" type="checkbox"/> Y=STN-YELLOW GREEN <input type="checkbox"/> G=STN-GRAY <input type="checkbox"/> B=STN-BLUE                          |  |                         |  |
| <b>5. VIEWING DIRECTION:</b> <input checked="" type="checkbox"/> B= BOTTOM VIEW(6 O'CLOCK)<br><input type="checkbox"/> T=TOP VIEW(12 O'CLOCK)                                                                                                    |  |                         |  |
| <b>6.TEMPERATURE RANGE:</b> <input type="checkbox"/> S=STANDARD TEMPERATURE RANGE<br><input checked="" type="checkbox"/> H=DUAL POWER,WIDE TEMPERATURE RANGE<br><input type="checkbox"/> W=SINGLE POWER,WIDE TEMPERATURE RANGE                   |  |                         |  |
| <b>7.OTHERS REQUIREMENT:</b>                                                                                                                                                                                                                     |  |                         |  |
| ※ <b>PART    NO.    :</b> ACM1202K-FL-YBH-01                                                                                                                                                                                                     |  |                         |  |
| <b>APPROVAL</b>                                                                                                                                                                                                                                  |  | <b>COMPANY<br/>CHOP</b> |  |
| <b>CUSTOMER<br/>COMMENTS</b>                                                                                                                                                                                                                     |  |                         |  |

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| DISPLAYTRONIC ENGINEERING APPROVAL |                   |                    |
|------------------------------------|-------------------|--------------------|
| <b>DESIGN BY</b>                   | <b>CHECKED BY</b> | <b>APPROVED BY</b> |
|                                    |                   |                    |

## REVISION RECORD

| REVISION | REVISION DATE | PAGE | CONTENTS                                          |
|----------|---------------|------|---------------------------------------------------|
| VER1.1   | 15/6-2006     |      | MODIFY THE COVER,ADD CONTENT AND REVISION RECORD. |

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**1.0 MECHANICAL SPECS**

|                              |                                      |
|------------------------------|--------------------------------------|
| 1. Overall Module Size       | 54.4mm(W) x 35.3mm(H) x max 7.0mm(D) |
| 2. Dot Size                  | 0.56X0.65 mm                         |
| 3. Character Pitch           | 3.5mm                                |
| 4. Duty                      | 1/16                                 |
| 5. Controller IC             | SPLC783A-01 or EQU                   |
| 6. LC Fluid Options          | STN YELLOW-GREEN MODE                |
| 7. Polarizer Options         | Transflective                        |
| 8. Backlight Options         | LED Yellow-Green                     |
| 9. Temperature Range Options | Wide(-20°C ~ 70°C)                   |

**2.0 ABSOLUTE MAXIMUM RATINGS**

| Item                                     | Symbol   | Min | Typ | Max | Unit |
|------------------------------------------|----------|-----|-----|-----|------|
| Operating temperature (Wide temperature) | Top      | -20 | -   | 70  | °C   |
| Storage temperature (Wide temperature)   | Tst      | -25 | -   | 75  | °C   |
| Input voltage                            | Vin      | Vss |     | Vdd | V    |
| Supply voltage for logic                 | Vdd- Vss | 2.7 | -   | 5.5 | V    |
| Supply voltage for LCD drive             | Vdd- Vo  | 3.7 |     | 5.5 | V    |

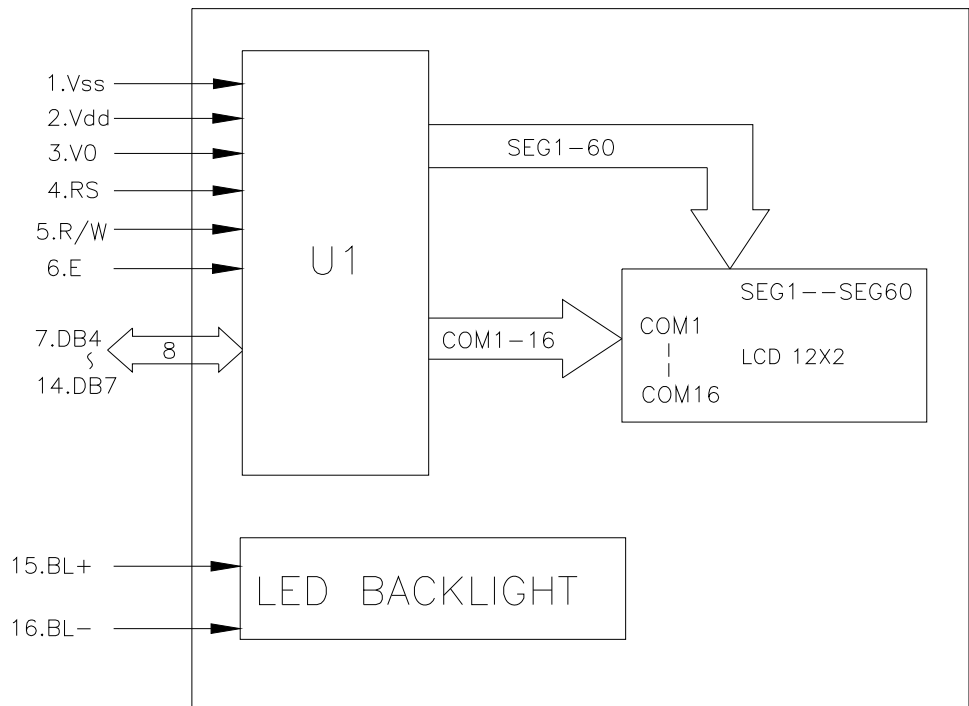
**3.0 ELECTRICAL CHARACTERISTICS**

| Item                                       | Symbol  | Condition                | Min | Typ | Max | Unit |
|--------------------------------------------|---------|--------------------------|-----|-----|-----|------|
| Input voltage (high)                       | Vih     | H level                  | 2.5 | -   | 3.3 | V    |
| Input voltage (low)                        | Vil     | L level                  | 0   | -   | 0.6 | V    |
| Recommended LC Driving Voltage (Wide Temp) | Vdd -Vo | -20°C                    | -   |     | 5.5 | V    |
|                                            |         | 25°C                     | -   | 4.5 | -   |      |
|                                            |         | 70°C                     | 3.7 |     | -   |      |
| Power Supply Current                       | Idd     | Vdd=3.3V,<br>fosc=270kHz | -   |     | 2.0 | mA   |
| Back Light                                 | Vf      | If=80mA                  |     | 2.1 | 2.3 | V    |

**4.0 OPTICAL CHARACTERISTICS (Ta=25°C, Vdd= 3.3V±0.25V, STN LC fluid)**

| Item                       | Symbol | Condition  | Min | Typ | Max | Unit |
|----------------------------|--------|------------|-----|-----|-----|------|
| Viewing angle (horizontal) | θ      | Cr ≥ 2.0   | -60 | -   | 35  | deg  |
| Viewing angle (vertical)   | φ      | Cr ≥ 2.0   | -40 | -   | 40  | deg  |
| Contrast Ratio             | Cr     | φ=0°, θ=0° | -   | 6   | -   |      |
| Response time (rise)       | Tr     | φ=0°, θ=0° | -   | 150 | 250 | ms   |
| Response time (fall)       | Tf     | φ=0°, θ=0° | -   | 200 | 300 | ms   |

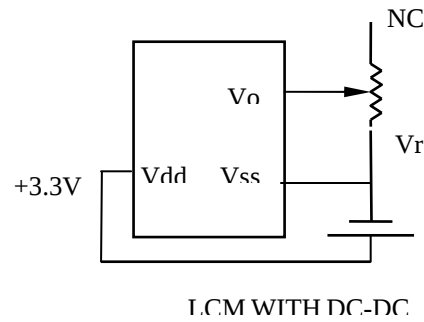
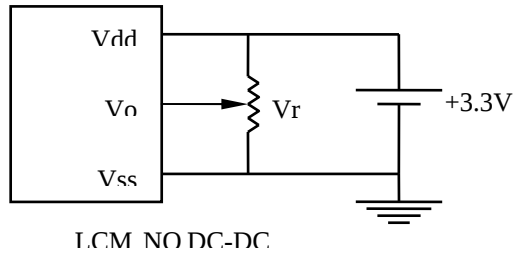
5.BLOCK DIAGRAM



6.0 PIN ASSIGNMENT

| Pin No. | Symbol | Function             |
|---------|--------|----------------------|
| 1       | Vss    | Ground               |
| 2       | Vdd    | +3.3V                |
| 3       | Vo     | LCD contrast adjust  |
| 4       | RS     | Register select      |
| 5       | R/W    | Read / write         |
| 6       | E      | Enable               |
| 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      | BL+    | Power Supply for BL+ |
| 16      | BL-    | Power Supply for BL- |

## 7.0 POWER SUPPLY



$V_r = 5K\Omega \sim 10K\Omega$

## 8.0 TIMING CHARACTERISTICS

### Write mode(write data from MPU to SPLC783A)

| Item               | Symbol     | Min. | Typ. | Max. | Unit | Test Condition   |
|--------------------|------------|------|------|------|------|------------------|
| E cycle time       | $t_c$      | 1400 | -    | -    | ns   | Pin E            |
| E pulse width      | $t_{PW}$   | 400  | -    | -    | ns   | Pin E            |
| E rise/fall time   | $t_R, t_F$ | -    | -    | 25   | ns   | Pin E            |
| Address Setup Time | $t_{SP1}$  | 60   | -    | -    | ns   | Pins: RS ,R/W ,E |
| Address hold time  | $t_{HD1}$  | 20   | -    | -    | ns   | Pins: RS ,R/W ,E |
| Data set up time   | $t_{SP2}$  | 140  | -    | -    | ns   | Pins: DB0-DB7    |
| Data hold time     | $t_{HD2}$  | 10   | -    | -    | ns   | Pins: DB0-DB7    |

### Read mode(read data from SPLC783A to MPU)

| Item               | Symbol     | Min. | Typ. | Max. | Unit | Test Condition   |
|--------------------|------------|------|------|------|------|------------------|
| E cycle time       | $t_c$      | 1400 | -    | -    | ns   | Pin E            |
| E pulse width      | $t_{PW}$   | 400  | -    | -    | ns   | Pin E            |
| E rise/fall time   | $t_R, t_F$ | -    | -    | 25   | ns   | Pin E            |
| Address Setup Time | $t_{SP1}$  | 60   | -    | -    | ns   | Pins: RS ,R/W ,E |
| Address hold time  | $t_{HD1}$  | 20   | -    | -    | ns   | Pins: RS ,R/W ,E |
| Data set up time   | $t_{SP2}$  |      | -    | -360 | ns   | Pins: DB0-DB7    |
| Data hold time     | $t_{HD2}$  | 50   | -    | -    | ns   | Pins: DB0-DB7    |

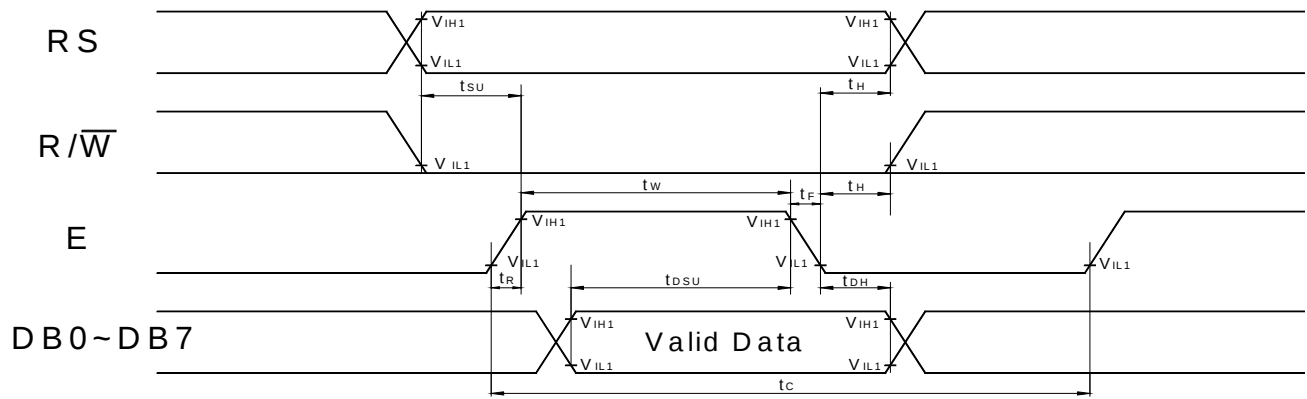


Fig. a Interface timing (data write)

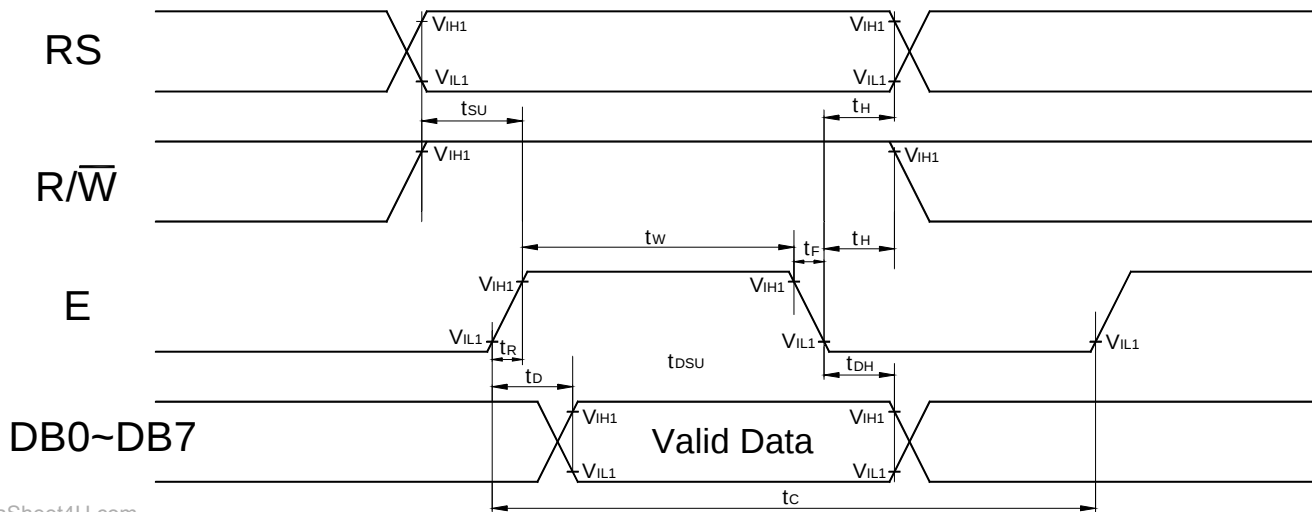
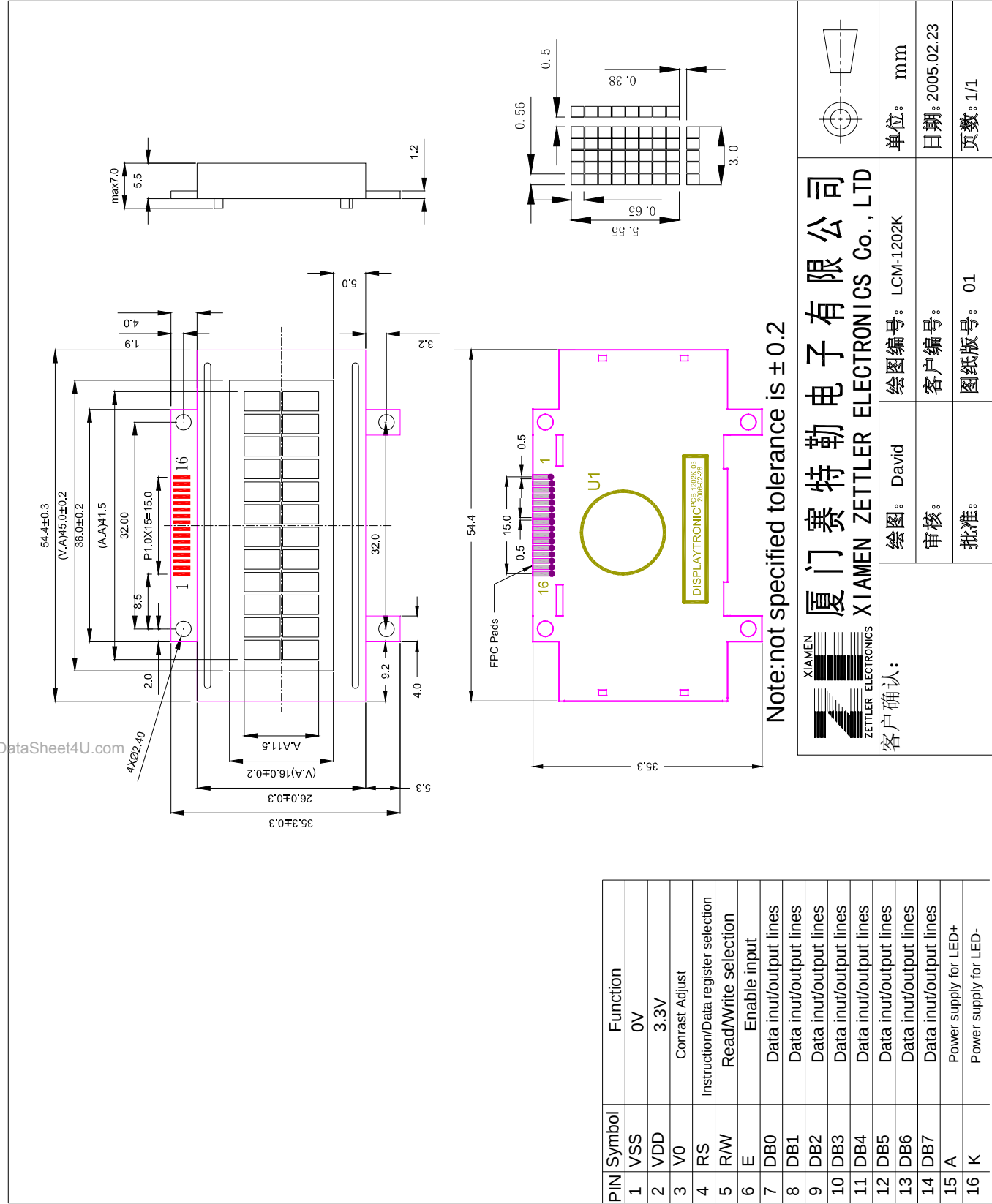


Fig. b Interface timing (data read)

9.0 MECHANICAL DIAGRAM



## 10.0 RELIABILITY TEST

| Test Item                     | Content      | Evaluations and Assessment* |        |                                |                   |
|-------------------------------|--------------|-----------------------------|--------|--------------------------------|-------------------|
|                               |              | Current Consumption         | Oozing | Contrast                       | Other Appearances |
| Operation at high temperature | 70°C,96hrs   | Twice initial value or less | none   | More than 50% of initial value | No abnormality    |
| Operation at low temperature  | -20°C,96hrs  | Twice initial value or less | none   | More than 50% of initial value | No abnormality    |
| High temperature storage      | 75°C, 96hrs  | Twice initial value or less | none   | More than 50% of initial value | No abnormality    |
| Low temperature storage       | -25°C, 96hrs | Twice initial value or less | none   | More than 50% of initial value | No abnormality    |

\*Evaluations and assessment to be made two hours after returning to room temperature (25°C±5°C).

\*The LCDs subjected to the test must not have dew condensation.

**11.0 DISPLAY INSTRUCTION TABLE**

| COMMAND                  | R<br>S | R/<br>W | DB<br>7    | DB<br>6                                           | DB<br>5                              | DB<br>4 | DB<br>3 | DB<br>2 | DB<br>1 | DB<br>0 | DESCRIPTION                                                                                                                                                                                             | Executing<br>time<br>fosc=250khz |
|--------------------------|--------|---------|------------|---------------------------------------------------|--------------------------------------|---------|---------|---------|---------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Clear Display            | 0      | 0       | 0          | 0                                                 | 0                                    | 0       | 0       | 0       | 0       | 1       | Clears Display & Returns to Address 0.                                                                                                                                                                  | 1.64ms                           |
| Cursor at Home           | 0      | 0       | 0          | 0                                                 | 0                                    | 0       | 0       | 0       | 1       | x       | Returns Cursor to Address 0. Also returns the display being shifted to the original position. DDRAM contents remain unchanged.                                                                          | 1.64ms                           |
| Entry Mode Set           | 0      | 0       | 0          | 0                                                 | 0                                    | 0       | 0       | 1       | I/D     | S       | I/D: Set Cursor Moving Direction<br>I/D=1: Increment<br>I/D=0: Decrement<br><br>S: Specify Shift of Display<br>S=1: The display is shifted<br>S=0: The display is not shifted                           | 40μs                             |
| Display ON/OFF Control   | 0      | 0       | 0          | 0                                                 | 0                                    | 0       | 1       | D       | C       | B       | Display D=1: Display on<br>D=0: Display off<br>Cursor C=1: Cursor on<br>C=0: Cursor off<br>Brink B=1: Brink on<br>B=0: Brink off                                                                        | 40μs                             |
| Cursor / Display Shift   | 0      | 0       | 0          | 0                                                 | 0                                    | 1       | S/C     | R/L     | x       | x       | Moves cursor or shifts the display w/o changing DD RAM contents<br>S/C=0: Cursor Shift (RAM unchanged)<br>S/C=1: Display Shift (RAM unchanged)<br>R/L=1: Shift to the Right<br>R/L=0: Shift to the Left | 40μs                             |
| Function Set             | 0      | 0       | 0          | 0                                                 | 1                                    | DL      | N       | F       | x       | x       | Sets data bus length (DL), # of display lines (N), and character fonts (F).<br>DL=1: 8 bits F=0: 5x7 dots<br>DL=0: 4 bits F=1: 5x10 dots<br>N=0: 1 line display<br>N=1: 2 lines display                 | 40μs                             |
| Set CG RAM Address       | 0      | 0       | 0          | 1                                                 | Character Generator (CG) RAM Address |         |         |         |         |         | Sets CG RAM address. CG RAM data is sent and received after this instruction.                                                                                                                           | 40μs                             |
| Set DD RAM Address       | 0      | 0       | 1          | Display Data (DD) RAM Address / Cursor Address    |                                      |         |         |         |         |         | Sets DD RAM address. DD Ram data is sent and received after this instruction.                                                                                                                           | 40μs                             |
| Busy Flag / Address Read | 0      | 1       | B<br>F     | Address counter used for both DD & CG RAM address |                                      |         |         |         |         |         | Reads Busy Flag (BF) and address counter contents.                                                                                                                                                      | 40μs                             |
| Write Data               | 1      | 0       | Write Data |                                                   |                                      |         |         |         |         |         | Writes data into DDRAM or CGRAM.                                                                                                                                                                        | 46μs                             |
| Read Data                | 1      | 1       | Read Data  |                                                   |                                      |         |         |         |         |         | Reads data from DDRAM or CGRAM.                                                                                                                                                                         | 46μs                             |

x: Don't Care

## 12.0 STANDARD CHARACTER PATTERNS

| Lower<br>4 Bits    | Upper 4<br>Bits  | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |   |
|--------------------|------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---|
| xxxx0000           | CG<br>RAM<br>(1) |      |      | 0    | @    | P    | `    | P    |      |      |      |      | 一    | 夕    | ミ    | α    | ρ    |   |
| xxxx0001           | (2)              |      |      | !    | 1    | A    | Q    | a    | q    |      |      |      | 。    | ア    | チ    | 厶    | ä    | q |
| xxxx0010           | (3)              |      |      | "    | 2    | B    | R    | b    | r    |      |      |      | 「    | イ    | ツ    | ×    | ƒ    | θ |
| xxxx0011           | (4)              |      |      | #    | 3    | C    | S    | c    | s    |      |      |      | 」    | ウ    | テ    | モ    | ε    | ∞ |
| xxxx0100           | (5)              |      |      | \$   | 4    | D    | T    | d    | t    |      |      |      | 、    | エ    | ト    | ㇿ    | μ    | Ω |
| xxxx0101           | (6)              |      |      | %    | 5    | E    | U    | e    | u    |      |      |      | ・    | オ    | ナ    | 1    | ε    | ü |
| xxxx0110           | (7)              |      |      | &    | 6    | F    | V    | f    | v    |      |      |      | ヲ    | カ    | ニ    | ヨ    | ρ    | Σ |
| xxxx0111           | (8)              |      |      | '    | 7    | G    | W    | g    | w    |      |      |      | ア    | キ    | ヌ    | ウ    | g    | π |
| xxxx1000           | (1)              |      |      | (    | 8    | H    | X    | h    | x    |      |      |      | イ    | ク    | ネ    | リ    | フ    | ⌘ |
| xxxx1001           | (2)              |      |      | )    | 9    | I    | Y    | i    | y    |      |      |      | ウ    | ケ    | ノ    | ル    | ´    | y |
| xxxx1010           | (3)              |      |      | *    | :    | J    | Z    | j    | z    |      |      |      | エ    | コ    | ハ    | レ    | j    | 〒 |
| xxxx1011           | (4)              |      |      | +    | ;    | K    | [    | k    | (    |      |      |      | オ    | サ    | ヒ    | ロ    | ×    | ⌘ |
| 4U.com<br>xxxx1100 | (5)              |      |      | ,    | <    | L    | ¥    | l    | l    |      |      |      | ヤ    | シ    | フ    | ワ    | ⌘    | ⌘ |
| xxxx1101           | (6)              |      |      | -    | =    | M    | ]    | m    | }    |      |      |      | ユ    | ズ    | ハ    | ン    | ⌘    | ÷ |
| xxxx1110           | (7)              |      |      | .    | >    | N    | ^    | n    | ÷    |      |      |      | ヨ    | セ    | ホ    | ゝ    | ⌘    |   |
| xxxx1111           | (8)              |      |      | /    | ?    | O    | _    | o    | +    |      |      |      | ッ    | リ    | マ    | □    | ö    | ■ |

Note: The character generator RAM is the RAM with which the user can rewrite character patterns by program.