JHD162A SERIES

DISPLAY CONTENT 16 CHAR x 2ROW

CHARACTER SET

CHAR. DOTS 5 x 8
DRIVING MODE 1/16D

AVAILABLE TYPES

TN STN (YELLOW GREEN GREY B/W)
REFLECTIVE WITH EL OR LED BACKLIGHT
EL/100VAC 400HZ
LED/4.2VDC

PARAMETER (\(V_{th}=5\), \(0V \pm 10\%\), \(V_{ls}=0V\), \(T_{a}=25^\circ C\))

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Testing Criteria</th>
<th>Standard Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage VDD-SS</td>
<td>-</td>
<td>-</td>
<td>4.5</td>
<td>V</td>
</tr>
<tr>
<td>Input high voltage VIH</td>
<td>-</td>
<td>-</td>
<td>2.2</td>
<td>V</td>
</tr>
<tr>
<td>Input low voltage VIL</td>
<td>-</td>
<td>-</td>
<td>-0.3</td>
<td>V</td>
</tr>
<tr>
<td>Output high voltage VOH</td>
<td>-</td>
<td>-</td>
<td>2.4</td>
<td>V</td>
</tr>
<tr>
<td>Output low voltage VOL</td>
<td>-</td>
<td>-</td>
<td>-0.6</td>
<td>V</td>
</tr>
<tr>
<td>Operating voltage Ioo</td>
<td>-</td>
<td>-</td>
<td>1.5</td>
<td>mA</td>
</tr>
</tbody>
</table>

APPLICATION CIRCUIT

DIMENSIONS/ Display Content
**PIN CONFIGURATION**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VCC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VEE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R/W</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DB0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DB1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DB2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DB3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DB4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DB5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DB6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DB7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**AC Characteristics Read Mode Timing Diagram**
Table 12. AC Characteristics ($V_{DD} = 4.5V - 5.5V$, $Ta = -30 - +85^\circ C$)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write Mode</td>
<td>E Cycle Time</td>
<td>$t_c$</td>
<td>500</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>E Rise / Fall Time</td>
<td>$t_{RF}$</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E Pulse Width (High, Low)</td>
<td>$t_{wp}$</td>
<td>230</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R/W and RS Setup Time</td>
<td>$t_{su1}$</td>
<td>40</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R/W and RS Hold Time</td>
<td>$t_{H1}$</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Setup Time</td>
<td>$t_{su2}$</td>
<td>80</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Hold Time</td>
<td>$t_{H2}$</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Table 13. AC Characteristics ($V_{DD}=2.7V - 4.5V$, $Ta = -30 - +85^\circ C$)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write Mode</td>
<td>E Cycle Time</td>
<td>$t_c$</td>
<td>1000</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>E Rise / Fall Time</td>
<td>$t_{RF}$</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E Pulse Width (High, Low)</td>
<td>$t_{wp}$</td>
<td>450</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R/W and RS Setup Time</td>
<td>$t_{su1}$</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R/W and RS Hold Time</td>
<td>$t_{H1}$</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Setup Time</td>
<td>$t_{su2}$</td>
<td>195</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Hold Time</td>
<td>$t_{H2}$</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode</th>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read Mode</td>
<td>E Cycle Time</td>
<td>$t_c$</td>
<td>1000</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>E Rise / Fall Time</td>
<td>$t_{RF}$</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E Pulse Width (High, Low)</td>
<td>$t_{wp}$</td>
<td>450</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R/W and RS Setup Time</td>
<td>$t_{su}$</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R/W and RS Hold Time</td>
<td>$t_{H}$</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Output Delay Time</td>
<td>$t_{D}$</td>
<td>-</td>
<td>-</td>
<td>360</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Hold Time</td>
<td>$t_{DH}$</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
Write Mode Timing Diagram

Timing

1) Interface with 8-bit MPU
When interfacing data length are 8-bit, transfer is performed at a time through 8 ports, from DB0 to DB7. Example of timing sequence is shown below.
### Table 5. Relationship between Character Code (DDRAM) and Character Pattern (CGRAM)

<table>
<thead>
<tr>
<th>Character Code (DDRAM data)</th>
<th>CGRAM Address</th>
<th>CGRAM Data</th>
<th>Pattern number</th>
</tr>
</thead>
<tbody>
<tr>
<td>D7  D6  D5  D4  D3  D2  D1  D0</td>
<td>A5  A4  A3  A2  A1  A0</td>
<td>P7  P6  P5  P4  P3  P2  P1  P0</td>
<td></td>
</tr>
<tr>
<td>0   0   0   0   0   0   0   0</td>
<td>0   0   0   0   0   0   0   0</td>
<td>x   x   x   0   1   1   1   0</td>
<td>pattern 1</td>
</tr>
<tr>
<td>0   0   0   0   0   0   0   0</td>
<td>0   0   0   0   0   0   0   0</td>
<td>x   x   x   1   0   0   0   1</td>
<td></td>
</tr>
<tr>
<td>0   0   0   0   0   0   0   0</td>
<td>0   0   0   0   0   0   0   0</td>
<td>x   x   x   1   1   1   1   1</td>
<td></td>
</tr>
<tr>
<td>0   0   0   0   0   0   0   0</td>
<td>0   0   0   0   0   0   0   0</td>
<td>x   x   x   1   1   1   1   1</td>
<td></td>
</tr>
<tr>
<td>0   0   0   0   0   0   0   0</td>
<td>0   0   0   0   0   0   0   0</td>
<td>x   x   x   1   1   1   1   1</td>
<td></td>
</tr>
<tr>
<td>0   0   0   0   0   0   0   0</td>
<td>0   0   0   0   0   0   0   0</td>
<td>x   x   x   1   1   1   1   1</td>
<td></td>
</tr>
<tr>
<td>0   0   0   0   0   0   0   0</td>
<td>0   0   0   0   0   0   0   0</td>
<td>x   x   x   1   1   1   1   1</td>
<td></td>
</tr>
<tr>
<td>0   0   0   0   0   0   0   0</td>
<td>0   0   0   0   0   0   0   0</td>
<td>x   x   x   1   1   1   1   1</td>
<td></td>
</tr>
<tr>
<td>0   0   0   0   0   0   0   0</td>
<td>0   0   0   0   0   0   0   0</td>
<td>x   x   x   1   1   1   1   1</td>
<td></td>
</tr>
<tr>
<td>0   0   0   0   0   0   0   0</td>
<td>0   0   0   0   0   0   0   0</td>
<td>x   x   x   1   1   1   1   1</td>
<td></td>
</tr>
<tr>
<td>0   0   0   0   0   0   0   0</td>
<td>0   0   0   0   0   0   0   0</td>
<td>x   x   x   1   1   1   1   1</td>
<td></td>
</tr>
</tbody>
</table>

#### Example

```c
#include <reg51.h>
#include <intrins.h>

sbit dc=0xa0;        // P2.0
sbit rw=0xa1;        // P2.1
sbit cs=0xa4;        // P2.4

sfr lcdbus=0x80;     // sfr 0x80

unsigned int sysmscounter;
unsigned char syslimitcounter;

char path[]=[0x00,0x01,0x02,0x03,0x04,0x05,0x06,0x07];
char path2[]=[0x08,0x09,0x0a,0x0b,0x0c,0x0d,0x0e,0x0f];
char path3[]=[0x10,0x11,0x12,0x13,0x14,0x15,0x16,0x17];
char path4[]=[0x18,0x19,0x1a,0x1b,0x1c,0x1d,0x1e,0x1f];
char path5[]=[0x20,0x21,0x22,0x23,0x24,0x25,0x26,0x27];

void soft_nop();
void soft_10ms();

{ register int i;
  for(i=0;i<7;i++);

void soft_nop();
void soft_10ms();

{ register int i;
  for(i=0;i<7;i++);
```
```c
void soft_20ms() {  // 20HZ 20MS
    soft_10ms();
    soft_10ms();
}

void hard_10ms(unsigned int delaytime) {
    sys10mscounter = delaytime;
    while(sys10mscounter);
}

unsigned char data lcdcounter;
bit lcdusing1,lcdusing2;
bit lcd_checkbusy() {  // LCD

    register lcdstate;
    dc=0;  // dc=1,0,0,0,0
    rw=1;  // rw=1,0,0,0
    cs=1;  // cs=1,0,0,0
    soft_nop();
    lcdstate = lcdbus;
    cs=0;
    return((bit)(lcdstate&0x80));
}

void lcd_wrcmd(unsigned char lcdcmd) {  // LCD

    lcdbus = lcdcmd;
    dc=0;  // dc=1,0,0,0,0
    rw=0;  // rw=1,0,0,0
    cs=1;  // cs=1,0,0,0
    soft_nop();

    cs=0;
    lcdbus = 0xff;
    lcdusing1 = 0;

}

void lcd_moveto(char position) {  // 0-79
    register cmd = 0x80;

    lcdcounter = position;
    if (position > 59)
        position += 0x30;
    else
```
```c
{
if (position > 39) position = 0x14;
else
{
    if (position > 19) position += 0x2c;
}
}

void lcd_wr(char data) {
    cmd = cmd | position;
    lcd_wr_cmd(cmd);

    char i;
    lcdusing2 = 1;
    while (lcd_checkbusy());
    if (lcdcounter == 20) {
        lcd_mvt(20);
        while (lcd_checkbusy());
    }
    if (lcdcounter == 40) {
        lcd_mvt(40);
        while (lcd_checkbusy());
    }
    if (lcdcounter == 60) {
        lcd_mvt(60);
        while (lcd_checkbusy());
    }
    if (lcdcounter == 80) {
        lcd_mvt(0);
        while (lcd_checkbusy());
        lcdcounter = 0;
    }
    dc = 1;
    rw = 0;
    cs = 1;
    soft_nop();
    cs = 0;
    lcdbus = 0xff;
    lcdusing2 = 0;
}

void lcd_string(char *strpoint) {
    {register i = 0;
    while (strpoint[i] != 0) {
```


```c

void lcd_init(){

    lcd_wr_cmd(0x38); /* 8 8 ,2 .5*/
    lcd_wr_cmd(0xc);  /* */
    lcd_wr_cmd(0x06); /* */
    lcd_wr_cmd(0x01); /* */
    lcd_counter=0;
}

void lcd_clr(){

    lcd_counter=0; void timer0(void) interrupt 1/*T0 */{TH0=0x80; /*12M,10ms*/
    TL0=0x96;
    TR0=1;
    if(sys10ms_counter!=0)sys10ms_counter-- ; /*10ms*/
    if(sys_limit_counter!=0)sys_limit_counter-- ; /*10ms*/
}

main()
{
    unsigned char j;
    IE = 0; P0 = 0xff; P1 = 0xff; P2 = 0xff; P3 = 0xff; /* */
    lcd_init(); soft_20ms();
    TMOD = 0x51;
    TH0 = 0x80; /*12M,10ms*/
    TL0 = 0x96;
    TR0 = 1; ET0 = 1; EA = 1;

    while(1)
    {
        /*U Q ABCD...*/
        lcd_init(); /* */
        for(j = 0;j < 80;j++)lcd_wr_data(0xff);
        hard_10ms(50);
        lcd_init(); /* */
        lcd_wr_cmd(0x40);
        for(j = 0;j < 80;j++)lcd_wr_data(path1[j]);

        for(j = 0;j < 10;j++)lcd_wr_data(0);
        hard_10ms(50);
        lcd_init(); /* */
```

```c

}```
lcd_wrcmd(0x40);
for(j =0;j <8; j++)lcd_wrdata(path2[i]);
for(j =0;j <100; j++)lcd_wrdata(0);
hard_30ms(50);
lcd_init(); /* */
lcd_wrcmd(0x40);
for(j =0;j <8; j++)lcd_wrdata(pats1[j]);
for(j =0;j <100; j++)lcd_wrdata(0);
hard_30ms(50);
lcd_init(); /* */
lcd_wrcmd(0x40);
for(j =0;j <8; j++)lcd_wrdata(pats2[j]);
for(j =0;j <100; j++)lcd_wrdata(0);
hard_30ms(50);
lcd_init();
lcd_string(UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
APLICACIONES

- TABLEROS INDICADORES
- INDICADORES PARA ASCENSORES
- INDICADORES DE NÚMEROS DE HABITACIÓN
- TORNQUIETES
- TABLEROS PARA ALARMA