JHD204A SERIES

Display Content
- 20 CHAR x 4ROW
- CHAR. DOTS 5 x 8
- DRIVING MODE 1/16D

Available Types
- TN
- STN (YELLOW GREEN, GREY, B/W)
- REFLECTIVE

Parameter \((V_h=5, 0V \pm 10\%, V_s=0V, T_a=25^\circ C)\)

<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</td>
<td>V_{rs}</td>
<td>Min. Typ. Max.</td>
<td>V</td>
<td></td>
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<tr>
<td>Input high voltage</td>
<td>V_{ih}</td>
<td>4.5 5.0 5.5</td>
<td>V</td>
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<tr>
<td>Input low voltage</td>
<td>V_{il}</td>
<td>-2.2 - V_{oh}</td>
<td>V</td>
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<tr>
<td>Output high voltage</td>
<td>V_{oh}</td>
<td>-0.3 - 0.6</td>
<td>V</td>
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<tr>
<td>Output low voltage</td>
<td>V_{ol}</td>
<td>2.4 - -0.4 V</td>
<td>V</td>
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<tr>
<td>Operating voltage</td>
<td>I_{DD}</td>
<td>2.0 5.0 mA</td>
<td>mA</td>
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Application Circuit

Dimensions/Display Content
### PIN CONFIGURATION

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</tbody>
</table>

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

<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>$t_{R\cdot F}$</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E Pulse Width (High, Low)</td>
<td>$t_w$</td>
<td>230</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R/W and RS Setup Time</td>
<td>$t_{SU_1}$</td>
<td>40</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R/W and RS Hold Time</td>
<td>$t_{H_1}$</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Setup Time</td>
<td>$t_{SU_2}$</td>
<td>80</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Hold Time</td>
<td>$t_{H_2}$</td>
<td>10</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>120</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>

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

<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>$t_{R\cdot F}$</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E Pulse Width (High, Low)</td>
<td>$t_w$</td>
<td>450</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R/W and RS Setup Time</td>
<td>$t_{SU_1}$</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R/W and RS Hold Time</td>
<td>$t_{H_1}$</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Setup Time</td>
<td>$t_{SU_2}$</td>
<td>195</td>
<td>-</td>
<td>-</td>
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<td></td>
<td>Data Hold Time</td>
<td>$t_{H_2}$</td>
<td>10</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>
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<tr>
<td></td>
<td>Data Hold Time</td>
<td>$t_{DH}$</td>
<td>5</td>
<td>-</td>
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<td></td>
</tr>
</tbody>
</table>

Read Mode

(Refer to Fig-7)
Write Mode Timing Diagram

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  x  0  0  0</td>
<td>0  0  0  0  0  0  0  0</td>
<td>1  1  1  1  0  0  0  0</td>
<td>pattern 1</td>
</tr>
<tr>
<td>0  0  0  0  x  1  1  1</td>
<td>0  0  0  0  0  0  0  0</td>
<td>1  1  1  1  0  0  0  0</td>
<td>pattern 8</td>
</tr>
</tbody>
</table>

Example

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

sbit dc=0xa0;        // P 2.0
sbit rw=0xa1;        // P 2.1
sbit cs=0xa4;        // P 2.4

sfr lcdbus=0x80; // P0

unsigned int sysIOMscounter;
unsigned char syslimitcounter;

char path[8]=0x00,0x0f,0x00,0x0f,0x00,0x0f,0x00,0x0f; // 1/8
char path2[8]=0x0f,0x00,0x0f,0x00,0x0f,0x00,0x0f,0x00; // 2/8
char path3[8]=0x1f,0x1f,0x1f,0x1f,0x1f,0x1f,0x1f,0x1f; // 3/8
char path4[8]=0x00,0x0a,0x0a,0x0a,0x0a,0x0a,0x0a,0x0a; // 2/8

void soft_nop(){}
void soft_iomsl() {*

{  register int i;
  for(i=0;i<7111;++i);

  }*/
```c
void soft_20ms(/***********2MHz 20MS [] [] */
{
    soft_10ms();
    soft_10ms();
}
void hard_10ms(unsigned int delaytime)/* [] 10MS [] [] */
{
    sys10mscounter=delaytime;
    while(sys10mscounter);
}
unsigned char data lcdcounter;
bit lcdusing1,lcdusing2;
bit lcd_checkbusy()/* [] LCD */
{
    register lcdstate;
    dc=0; /*dc=1 [] [] ,=0 [] */
    rw=1; /*rw=1 [] ,=0 [] */
    cs=1; /*cs=1 [] */
    soft_nop();
    lcdstate=lcdbus;
    cs=0;
    return((bit)(lcdstate&0x80));
}
void lcd_wrcmd(unsigned char lcmd)/* LCD */
{
    lcdusing1=1;
    while(lcd_checkbusy());
    lcdbus=lcmd;
    dc=0; /*dc=1 [] [] ,=0 [] */
    rw=0; /*rw=1 [] ,=0 [] */
    cs=1; /*cs=1 [] */
    soft_nop();
    cs=0;
    lcdbus=0xff;
    lcdusing1=0;
}
void lcd_moveto(char position)/* [] 0-79 */
{
    register cmd=0x80;
    lcdcounter=position;
    if (position > 59)
        position += 0x18;
    else
```
```c
    { if (position > 39) position - = 0x14;
        else
            { if (position > 19) position += 0x2c;
            }
    }

    cmd = cmd | position;
    lcd_wr_cmd(cmd); /*
     void lcd_wr_data(char lccdta) /*
     {char i;
     lccdusing2 = 1;
     while(lcd_checkbusy());
     if (lcdcounter == 20){
         lcd_moveto(20);
         while(lcd_checkbusy());
     }

     if (lcdcounter == 40){
         lcd_moveto(40);
         while(lcd_checkbusy());
     }

     if (lcdcounter == 60){
         lcd_moveto(60);
         while(lcd_checkbusy());
     }

     if (lcdcounter == 80){
         lcd_moveto(0);
         while(lcd_checkbusy());
        lcdcounter = 0;
         }/*

     lcdcounter++;
     lcdnbus = lccdta;
     dc = 1; /*
     rw = 0; /*
     cs = 0; /*
     soft_nop();
     cs = 0;

     lcdnbus = 0xff;
     lcdnusing2 = 0; /*
     void lcd_string(char *strpoint) /*
     {register i = 0;
         while(strpoint[i] != 0){
```
lcd_wrdata(strPoint[i]);
i++;  
}

}void lcd_init(void)
{
    lcd_wrcmd(0x38);  / * 8 4 0 . 2 . 5 */
    lcd_wrcmd(0x0c);  / * 7 6 5 4 3 2 1 0 */
    lcd_wrcmd(0x06);  / * 7 6 5 4 3 2 1 0 */
    lcd_wrcmd(0x01);  / * 7 6 5 4 3 2 1 0 */
    lcdcounter=0;
}

void lcd_cls(void) {lcd_wrcmd(0x01);
    lcdcounter=0;  void timer0(void) interrupt 1  /* T0 */
    {TH0=0x08;  /* 12M, 10ms */
        TL0=0x06;
        TR0=1;
        if(sys10mscounter!=0)sys10mscounter--;  /* 10ms */
        if(sys10mslimcounter!=0)sys10mslimcounter--;  /* 10ms */
    }
}

main()
{
    unsigned char j;
    IE=0;P0=0;P1=0;P2=0;P3=0; /* T */
    lcd_init();soft_20ms();
    TMOD=0x51;
    TH0=0x08; /* 12M, 10ms */
    TL0=0x06;
    TR0=1;ET0=1;EA=1;

    while(1)
    {
        /* U Q A B C D . . . */
        lcd_init(); /* */
        for(j=0;j<80;j++)lcd_wrdata(0xff);
        hard_10ms(50);
        lcd_init(); /* */
        lcd_wrcmd(0x40);
        for(j=0;j<87;j++)lcd_wrdata(path[i][j]);

        for(j=0;j<100;j++)lcd_wrdata(0);
        hard_10ms(50);
        lcd_init(); /* */
    }
}
lcd_wrCmd(0x40);
for(j = 0; j < 8; j++)lcd_wrData(path2[j]);
for(j = 0; j < 100; j++)lcd_wrData(0);
hard_10ms(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_10ms(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_10ms(50);
lcd_init();
lcd_string("UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
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