**JHD162A SERIES**

**CHARACTER DISPLAY**
- 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_{DD}=5.0V ±10%, V_{SS}=0V, T_{A}=25°C)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Testing Criteria</th>
<th>Standard Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>V_{DD}</td>
<td></td>
<td>Min. 4.5, Typ. 5.0, Max. 5.5 V</td>
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<tr>
<td>Input high voltage</td>
<td>V_{IH}</td>
<td></td>
<td>V_{DD} V</td>
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<tr>
<td>Input low voltage</td>
<td>V_{IL}</td>
<td>-0.3 mA</td>
<td>0.6 V</td>
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<tr>
<td>Output high voltage</td>
<td>V_{OH}</td>
<td>2.4 mA</td>
<td>V</td>
</tr>
<tr>
<td>Output low voltage</td>
<td>V_{OL}</td>
<td>1.2 mA</td>
<td>0.4 V</td>
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<tr>
<td>Operating voltage</td>
<td>I_OH</td>
<td>1.5 mA</td>
<td>3.0 mA</td>
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**APPLICATION CIRCUIT**

**DIMENSIONS/DISPLAY CONTENT**
AC Characteristics Read Mode Timing Diagram

**PIN CONFIGURATION**

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</tbody>
</table>
Table 12. AC Characteristics ($V_{DD} = 4.5V \sim 5.5V$, $Ta = -30 \sim +85^\circ C$)

<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 (Refer to Fig-6)</td>
<td>E Cycle Time</td>
<td>tc</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>
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<tr>
<td></td>
<td>E Pulse Width (High, Low)</td>
<td>tw</td>
<td>230</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td></td>
<td>R/W and RS Setup Time</td>
<td>tsu1</td>
<td>40</td>
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<tr>
<td></td>
<td>R/W and RS Hold Time</td>
<td>$t_{H1}$</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td></td>
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<td></td>
<td>Data Setup Time</td>
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<td></td>
<td>Data Hold Time</td>
<td>$t_{H2}$</td>
<td>10</td>
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</table>

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

<table>
<thead>
<tr>
<th>Mode</th>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
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<tr>
<td></td>
<td>E Pulse Width (High, Low)</td>
<td>tw</td>
<td>450</td>
<td>-</td>
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</tr>
<tr>
<td></td>
<td>R/W and RS Setup Time</td>
<td>tsu1</td>
<td>60</td>
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</tr>
<tr>
<td></td>
<td>R/W and RS Hold Time</td>
<td>$t_{H1}$</td>
<td>20</td>
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</tr>
<tr>
<td></td>
<td>Data Setup Time</td>
<td>tsu2</td>
<td>195</td>
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<tr>
<td></td>
<td>Data Hold Time</td>
<td>$t_{H2}$</td>
<td>10</td>
<td>-</td>
<td>-</td>
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</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 (Refer to Fig-7)</td>
<td>E Cycle Time</td>
<td>tc</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>
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<tr>
<td></td>
<td>E Pulse Width (High, Low)</td>
<td>tw</td>
<td>450</td>
<td>-</td>
<td>-</td>
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<td>R/W and RS Setup Time</td>
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<tr>
<td></td>
<td>R/W and RS Hold Time</td>
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<td></td>
<td>Data Output Delay Time</td>
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<td>Data Hold Time</td>
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</table>
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>
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<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>
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</tr>
<tr>
<td>0 0 0 0 0 × 0 0 0</td>
<td>0 0 0 0 0 0 0 0</td>
<td>× × × 0 1 1 1 0</td>
<td>pattern 1</td>
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<td>0 0 1 1 0 0 0 1</td>
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<td>0 1 0 0 0 0 1 1</td>
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<td>0 0 0 0 0 0 0 0</td>
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</table>

Example

```c
#include <reg51.h>
#include <intrins.h>
sbit dc=0xa0;       /
                    /*2.0
sbit rw=0xa1;       /
                    /*2.1
sbit cs=0xa4;       /
                    /*2.4
sfr lcdbus=0x80;    /
                    /*p0L CD D0=0.0/
unsigned int sys10mscounter;
unsigned char syslimitcounter;
char path1[8]=0x00,0x0,0x00,0x0,0x00,0x00,0x00,0x00 /
                    /*1/
char path2[8]=0x00,0x00,0x0,0x00,0x00,0x00,0x00,0x00 /
                    /*2/
char paths[8]=0x15,0x15,0x15,0x15,0x15,0x15,0x15,0x15 /
                    /*3/
char paths2[8]=0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00 /
                    /*4/

void soft_nop(){};
void soft_10ms() /*2.0 */
                {register int i;
                for(i=0;i<11;i++);
                }
```
void soft_20ms() /***********12MHZ 20MS ***********/
{
  soft_10ms();
  soft_10ms();
}
void hard_10ms(unsigned int delaytime) /*10MS */
{
  sys10mscounter=delaytime;
  while(sys10mscounter);
}
unsigned char data lcdcounter;
bib cdusing1,cdusing2;
bib lcd_checkbusy() /* LCD */
{
  register lcdstate;
  dc=0;         /* dc=1 */
  rw=1;         /* rw=1 */
  cs=1;         /* cs=1 */
  soft_nop();
  lcdstate=lcdbus;
  cs=0;
  return((bit)(lcdstate&0x80));
}
void lcd_wrcmd(unsigned char lcdcmd) /* LCD */
{
  lcdnusing1=1;
  while(lcd_checkbusy());
  lcdnbus=lcdcmd;
  dc=0;         /* dc=1 */
  rw=0;         /* rw=1 */
  cs=1;         /* cs=1 */
  soft_nop();
  cs=0;
  lcdbus=0xff;
  lcdnusing1=0;
}
void lcd_moveto(char position) /* 0- 79 */
{
  register cmd=0x80;
  lcdcounter=position;
  if (position > 59)
    position += 0x13;
  else
}
{  if (position > 39) position -= 0x14;
    else
        {  if (position > 19) position += 0x2c;

        }

    cmd = cmd | position;
    lcd_wrcmd(cmd); void lcd_wrdata(char lcddata) { char i;
    lcdusing2 = 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 ++;
    lcdbus = lcddata;
    dc = 1; /* dc=1】" 0 0 。=0】" 0 0 。*/
    rw = 0; /* rw=1】" 0 0 。*/
    cs = 1; /* cs=1】" 0 0 。*/
    soft_nop();
    cs = 0;

    lcdbus = 0xff;
    lcdusing2 = 0; void lcd_string(char *strpoint) { register i = 0;
        while(strpoint[i] != 0){
void lcd_init() {  
  lcd_wrcmd(0x38);  
  lcd_wrcmd(0x0c);  
  lcd_wrcmd(0x06);  
  lcd_wrcmd(0x01);  
  lcdcounter=0;  
}  

void lcd_cls() {  
  lcd_wrcmd(0x01);  
  lcdcounter=0;  
}  

void timer0(void) interrupt 1 {  
  TH0=0x0d8;  
  TL0=0x0f6;  
  TR0=1;  
  if(sys10mscounter!=0)sys10mscounter--;  
  if(sys10mscounter==0) {  
    TR0=0;  
  }  
}  

int main() {  
  unsigned char j;  
  IE=0;P0=0x0f;P1=0x0f;P2=0xff;P3=0xff;  
  lcd_init();soft_20ms();  
  TMOD=0x51;  
  TH0=0x0d8;  
  TL0=0x0f6;  
  TR0=1;ET0=1;EA=1;  
  while(1) {  
    lcd_init();  
    for(j=0;j<80;j++)lcd_wrdata(0xff);  
    hard_10ms(50);  
    for(j=0;j<8;j++)lcd_wrdata(path[j]);  
  }  
}
```
lcd_wrcmd(0x40);
for(j =0;j <8j ++)lcd_wrd(data(path2[j ]));
for(j =0;j <100;j ++)lcd_wrd(data(0);
hard_10ms(50);
lcd_init(); / *\ */
lcd_wrcmd(0x40);
for(j =0;j <8j ++)lcd_wrd(data(pats1[j ]));
for(j =0;j <100;j ++)lcd_wrd(data(0);
hard_10ms(50);
lcd_init(); / *\ */
lcd_wrcmd(0x40);
for(j =0;j <8j ++)lcd_wrd(data(pats2[j ]));
for(j =0;j <100;j ++)lcd_wrd(data(0);
hard_10ms(50);
lcd_init();
lcd_string("UUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU
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