**8051 Family Special Function Registers**

**PCON – Power Control Register**

<table>
<thead>
<tr>
<th>D7</th>
<th>D6</th>
<th>D5</th>
<th>D4</th>
<th>D3</th>
<th>D2</th>
<th>D1</th>
<th>D0</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMOD</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>GF1</td>
<td>GF0</td>
<td>PD</td>
<td>IDL</td>
</tr>
</tbody>
</table>

Address: 87H (not bit addressable)

SMOD – Serial mode bit used to determine the baud rate with Timer 1.

\[
\text{Baud rate} = \frac{\text{Oscillator frequency in Hz}}{N[256 - (TH1)]}
\]

If SMOD = 0 then N = 384. If SMOD = 1 then N = 192. TH1 is the high byte of timer 1 when it is in 8-bit autoreload mode.

GF1 and GF0 are General purpose flags not implemented on the standard device

PD is the power down bit. Not implemented on the standard device

IDL activate the idle mode to save power. Not implemented on the standard device

**TCON – Timer Control Register**

<table>
<thead>
<tr>
<th>D7</th>
<th>D6</th>
<th>D5</th>
<th>D4</th>
<th>D3</th>
<th>D2</th>
<th>D1</th>
<th>D0</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF1</td>
<td>TR1</td>
<td>TF0</td>
<td>TR0</td>
<td>IE1</td>
<td>IT1</td>
<td>IE0</td>
<td>IT0</td>
</tr>
</tbody>
</table>

Address: 88H (bit addressable)

TF1 – Timer 1 overflow flag

TR1 – Timer 1 run control bit

TF0 – Timer 0 overflow flag

TR0 – Timer 0 run control bit

IE1 – External interrupt 1 edge flag. Set to 1 when edge detected.

IT1 – Edge control bit for external interrupt 1. 1 = edge, 0 = level

IE0 – External interrupt 0 edge flag. Set to 1 when edge detected

IT0 – Edge control bit for external interrupt 0. 1 = edge, 0 = level

**SCON – Serial Control Register**

<table>
<thead>
<tr>
<th>D7</th>
<th>D6</th>
<th>D5</th>
<th>D4</th>
<th>D3</th>
<th>D2</th>
<th>D1</th>
<th>D0</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM0</td>
<td>SM1</td>
<td>SM2</td>
<td>REN</td>
<td>TB8</td>
<td>RB8</td>
<td>TI</td>
<td>RI</td>
</tr>
</tbody>
</table>

Address: 98H (bit-addressable)

- **SM0** **SM1** Operation | Baud rate
  - 0 0 Shift register | Osc/12
  - 0 1 8-bit UART | Set by timer
  - 1 0 9-bit UART | Osc/12 or Osc/64
  - 1 1 9-bit UART | Set by timer

SM2 – Enables multiprocessor communication in modes 2 and 3.

REN – Receiver enable

TB8 – Transmit bit 8. This is the 9th bit transmitted in modes 2 and 3.

RB8 – Receive bit 8. This is the 9th bit received in modes 2 and 3.

TI – Transmit interrupt flag. Set at end of character transmission. Cleared in software.

**TMOD – Timer Mode Control Register**

<table>
<thead>
<tr>
<th>D7</th>
<th>D6</th>
<th>D5</th>
<th>D4</th>
<th>D3</th>
<th>D2</th>
<th>D1</th>
<th>D0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gate</td>
<td>C/T</td>
<td>M1</td>
<td>M0</td>
<td>Gate</td>
<td>C/T</td>
<td>M1</td>
<td>M0</td>
</tr>
</tbody>
</table>

**Gate** – if 1 timer x is enabled when intx is high and TRx is high. if 0 timer x is enabled when TRx is high.

C/T - if 1 timer x is clocked from Tx pin. if 0 timer x is clocked from oscillator/12

**M1 M0 Mode**

- 0 0 13-bit mode for compatibility to 8048 family
- 0 1 16-bit Timer/Counter. User must reload in software
- 1 0 8-bit autoreload. TLx is automatically loaded from THx
- 1 1 TL0 is 8-bit counter controlled by Timer0 control bits. TH0 is 8-bit counter controlled by Timer1 control bits. Timer 1 is stopped

**IE – Interrupt Enable Register**

<table>
<thead>
<tr>
<th>D7</th>
<th>D6</th>
<th>D5</th>
<th>D4</th>
<th>D3</th>
<th>D2</th>
<th>D1</th>
<th>D0</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA</td>
<td>x</td>
<td>ET2</td>
<td>ES</td>
<td>ET1</td>
<td>EX1</td>
<td>ET0</td>
<td>EX0</td>
</tr>
</tbody>
</table>

Address: 0A8H (bit addressable)

EA – Global interrupt enable
x – not defined

ET2 – Timer 2 interrupt enable
ES – Serial port interrupt enable
ET1 – Timer 1 interrupt enable
EX1 – External interrupt 1 enable
ET0 – Timer 0 interrupt enable
EX0 – External interrupt 0 enable

**IP – Interrupt Priority Register**

<table>
<thead>
<tr>
<th>D7</th>
<th>D6</th>
<th>D5</th>
<th>D4</th>
<th>D3</th>
<th>D2</th>
<th>D1</th>
<th>D0</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>PT2</td>
<td>PS</td>
<td>PT1</td>
<td>PX1</td>
<td>PT0</td>
<td>PX0</td>
</tr>
</tbody>
</table>

Address: 0B8H (bit addressable)

x – not defined

PT2 – Priority for timer 2 interrupt
PS – Priority for serial port interrupt
PT1 – Priority for timer 1 interrupt
PX1 – Priority for external interrupt 1
PT0 – Priority for timer 0 interrupt
PX0 – Priority for external interrupt 0

**T2CON – Timer 2 Control Register**

<table>
<thead>
<tr>
<th>D7</th>
<th>D6</th>
<th>D5</th>
<th>D4</th>
<th>D3</th>
<th>D2</th>
<th>D1</th>
<th>D0</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF2</td>
<td>EXF2</td>
<td>RCLK</td>
<td>TCLK</td>
<td>EXEN2</td>
<td>TR2</td>
<td>C/T2</td>
<td>CP/RL2</td>
</tr>
</tbody>
</table>

Address: 0C8H (bit addressable)

TF2 – Timer 2 overflow flag
EXF2 – Timer 2 external flag.
RCLK – Receive clock. When set causes the serial port to use timer 2 for reception.
TCLK – Transmit clock. When set causes the serial port to use timer 2 for transmission.

C/T2 – Counter/Timer select. if 0 use internal timer. if 1 use external pin
CP/RL2 – Capture/reload flag.