PHYS 3360/AEP 3630

Lecture 32

**TTL (and variants) family of one-shots**

![Diagram of a one-shot circuit]

\[ T_{HI} = R_{ext} \cdot C_{ext} \cdot \ln 2 \text{, } 50\text{ns to } 60\text{ns} \]

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>CLR</th>
<th>Q</th>
<th>\overline{Q}</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

- See spec sheets for min/max \( R_{ext} / C_{ext} \)

- Edge triggered one-shot (either 0 or 1)
- Trigger pulse longer than output OK (not so for 555)

74x221 dual non-resettable monostable multivibrator
74x123 retriggerable one-shot

Application: missing pulse monitor (aka. heart monitor)

Use of one-shots

- convenient for small applications
- can be issues with noise immunity (part analog)
  - may misfire
  - long pulses => large caps => leakage current
  - timing accuracy is limited
Most functionality can be achieved with counters and precision clock.

\[ 2^{14} = 8192 \text{ clock ticks} \]

- using combinational logic can program any delay up to \( 2^{14} \)
- all digital

**Precision clocks**

- 555 oscillator has limited accuracy (~1%) ask (temp, pressure, humidity)

- often require much better accuracy
  - to remain precise within 30 min over a couple of years (to record a TV show) \( \Rightarrow \) \( \sim 10^{-5} \) accuracy
  - key to a number of applications
Quartz Crystal oscillators

uses Piezo effect: stress $\rightarrow$ electricity
to define reference frequency with great precision

- weak dep. of $R, L, C$ on temperature, etc.
- recall: oscillations require loop gain $\geq 1$ & loop phase $360^\circ$ (or $0^\circ$) (incl. $180^\circ$ from neg.FB)
- QCO meets the phase req. to specific frequency

- available as a single chip
- few kHz to 100's of MHz
- accuracy 1 sec over 30 years
  (still need temp. control, etc. to achieve the best results)