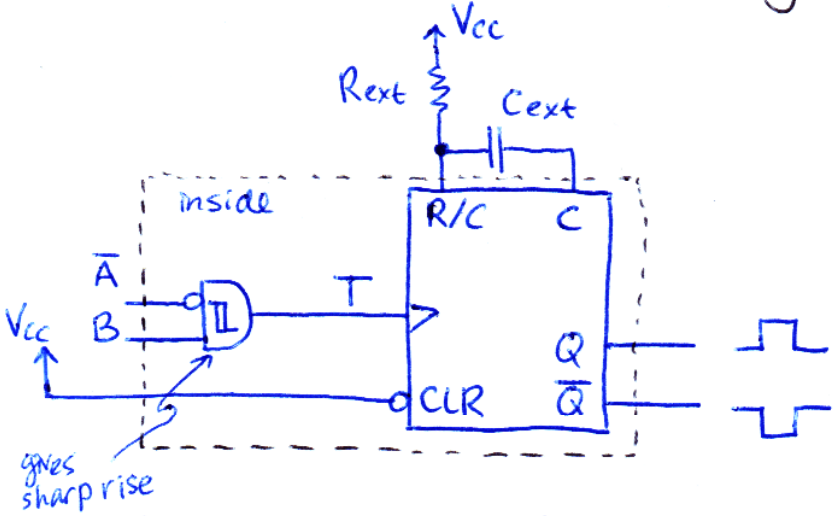
PHYS 3360/AEP 3630

Lecture 32

TTL (and variants) family of one-shots



74×221 dual non-retriggerable monostable multivibrator

$T_{HI} = R_{ext} \cdot C_{ext} \cdot \ln 2$; 50 ns to 60 s

$\bar{A}$	B	$\overline{CLR}$	Q	$\bar{Q}$
LO	↑	HI	⊓	⊔
↓	HI	HI	⊓	⊔
X	X	LO	LO	HI

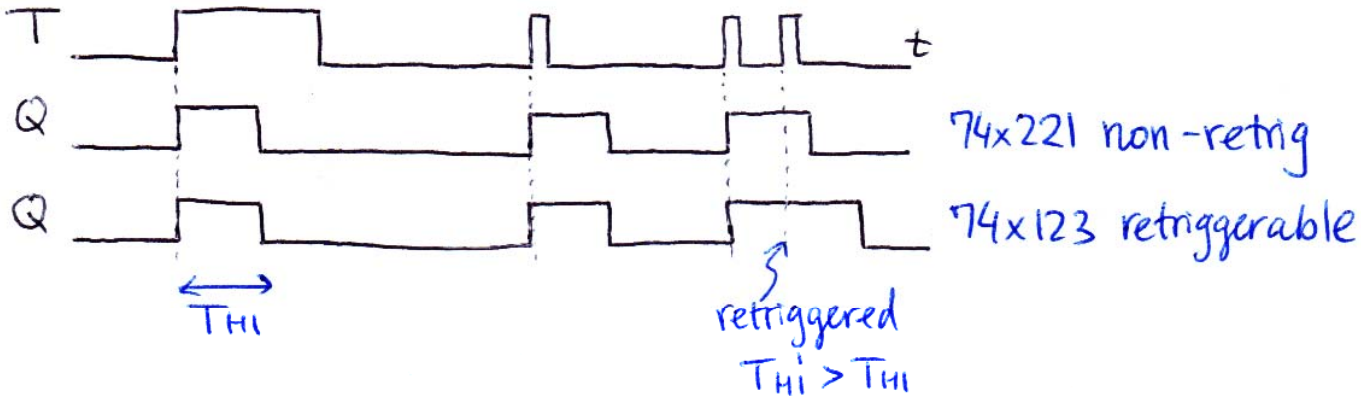
- see spec sheets for min/max R_{ext} / C_{ext}

555 can only do ↓

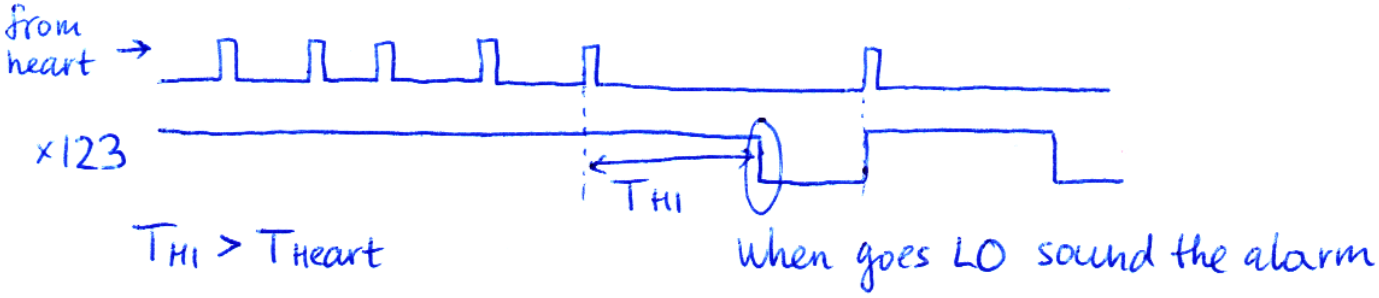
- edge triggered one-shot (either ↓ or ↑)
- trigger pulse longer than output OK (not so for 555)

74x123 retriggerable one-shot

other families HC, HCT, LS
- HC: hybrid CMOS
- HCT: TTL compat.
- LS: low power
- shottky



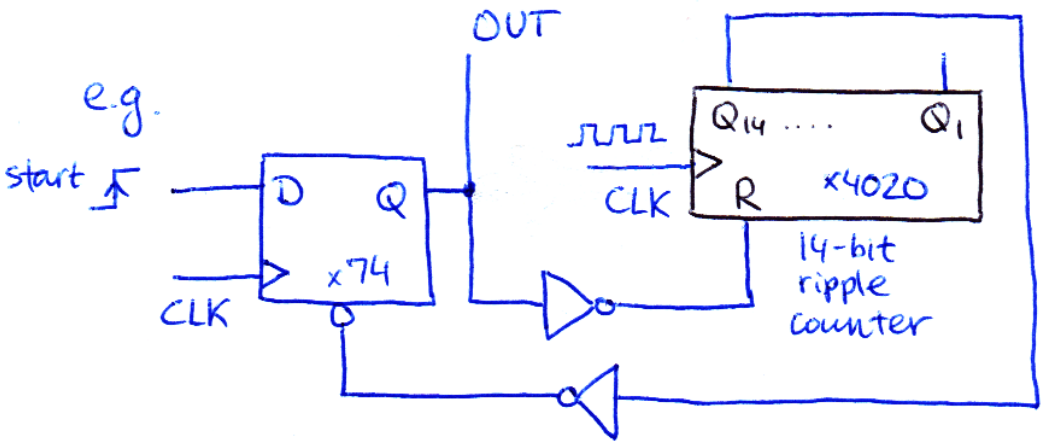
Application: missing pulse monitor (a.k.a. heart monitor)



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



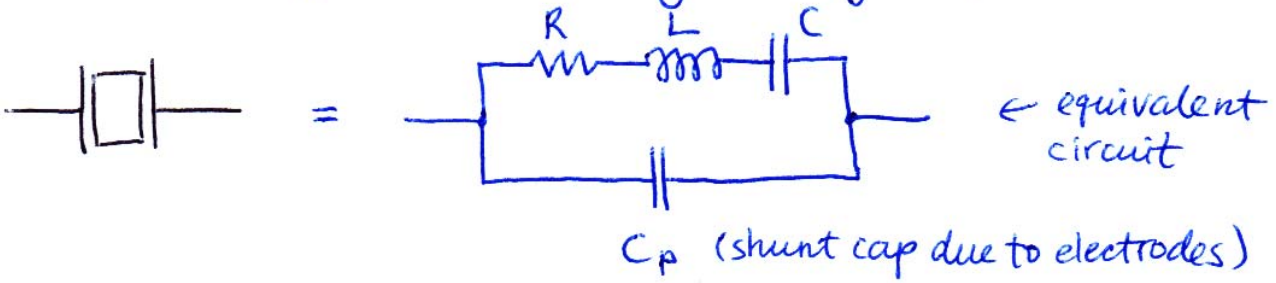
- OUT will stay HI $2^{14-1} = 8192$ clock ticks
- using combinational logic can program any delay up to 2^{14}
- all digital

Precision clocks

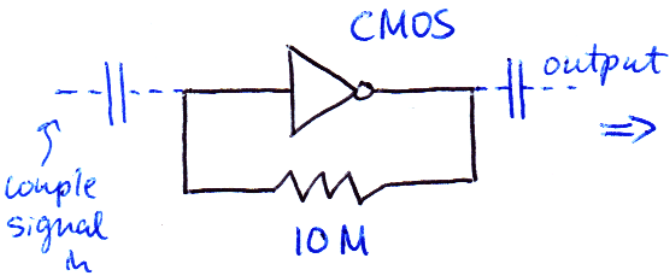
- 555 oscillator has limited accuracy (~1%)
  ask (temp, pressure, humidity
- often require much better accuracy
  → to remain precise within 30 min over a couple of years (to record a TV show) => $\sim 10^{-5}$ accuracy
  → key to a number of applications

Quartz Crystal oscillators

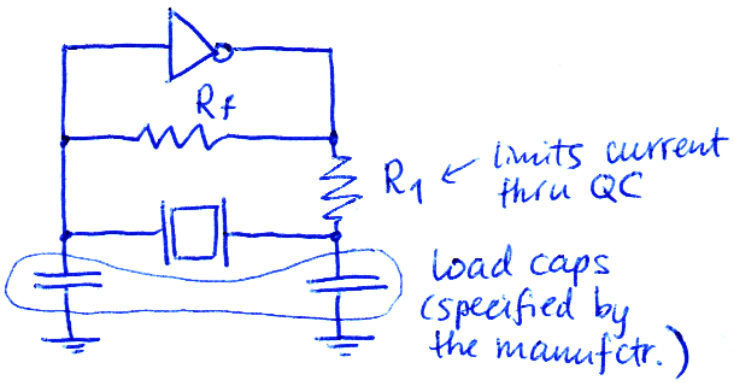
uses Piezo effect : stress ⟷ electricity
to define reference frequency with great precision



- weak dep. of R, L, C on temperature, etc.
- recall : oscillations require <u>loop gain</u> ≥ 1 & <u>loop phase</u> 360° (or 0°) (incl. 180° from neg. FB)
- QCO meets the phase req. @ <u>specific frequency</u>



⇒ high gain amp



- 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)