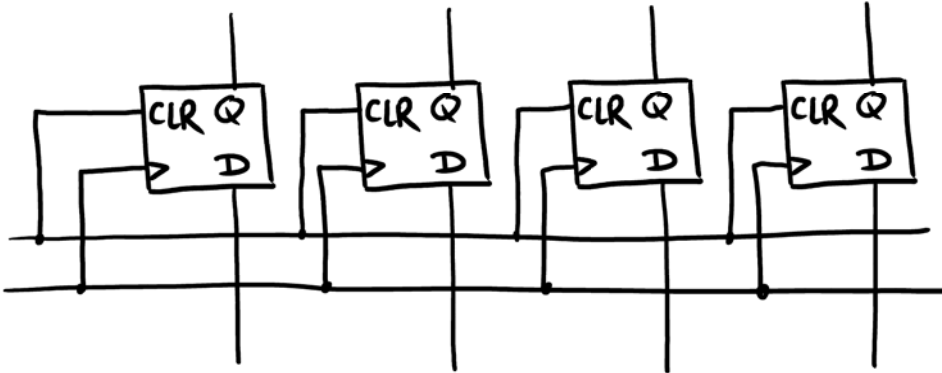


P3360/AEP3630  
Lecture 29

FF applications

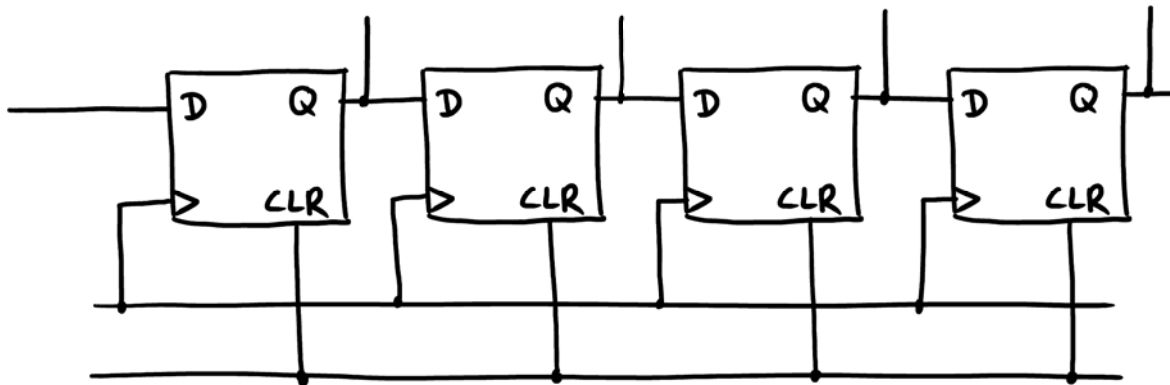
① Parallel data storage



\* inputs stored

\* CLR input \_\_\_\_\_ the data \_\_\_\_\_

② Shift register



\* data \_\_\_\_\_ after each \_\_\_\_\_

Apps :

\* \_\_\_\_\_ data conversion

\*

\*

## Timing terminology

transition time = time for FF output to go

setup time = min time inputs must be stable

hold time = min time inputs must be stable

### ③ Counters , ripple counters

T flip-flops

asynchronous vs. synchronous counters

see LT spice ex.

0111 → 1000

actually can work as

0111 → 0110 → 0100 → 0000 → 1000

## Timing circuits & clocks

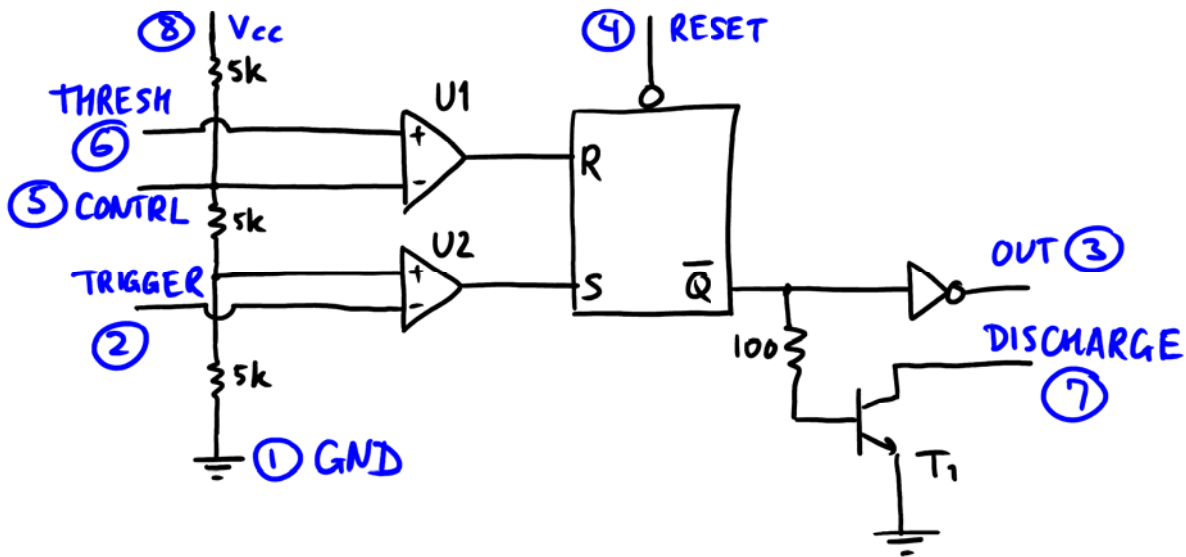
- \* many cases when one needs to output a pulse at/after some event



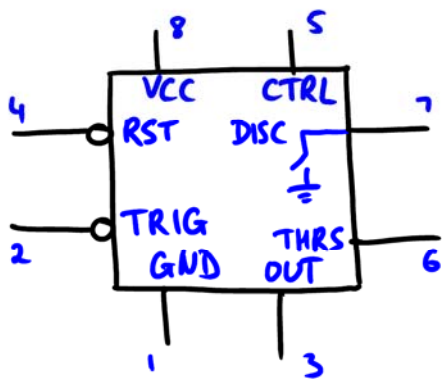
- \* are important to synchronize sequential circuits

## 555 Timer

- \* 8 DIP package
- \* in part \_\_\_\_\_, in part \_\_\_\_\_
- \* can be wired as \_\_\_\_\_  
or as a \_\_\_\_\_



Simplified symbol



supply voltage  
 $4.5V \leq V_{cc} \leq 16V$   
 output current  
 $(I_{out})_{max} \sim 200mA$

\* as a one-shot :  $T_w \sim 1\mu s \rightarrow 100s$   
 \* as a clock :  $f \sim 0.01Hz \rightarrow 1MHz$