

# Dynamic Display 4190.309 2008 Fall Semester

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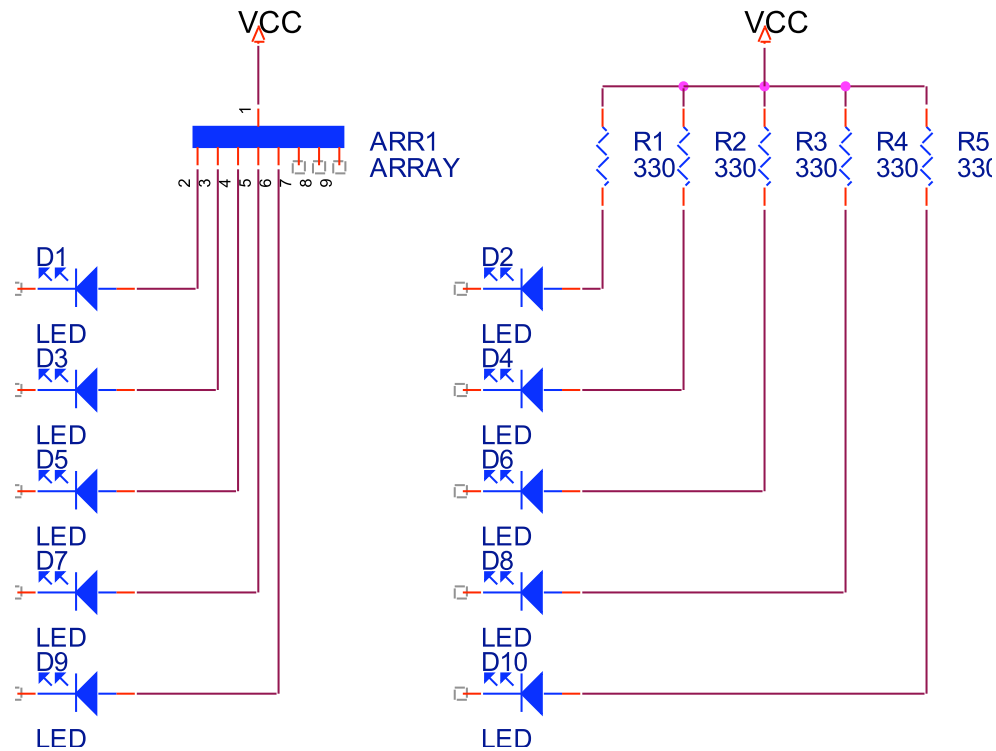
# LED static display

- Determination of the forward bias current.
  - Type of LED, brightness, supply voltage, power consumption, etc.
- Current sink configuration for totem-pole outputs.



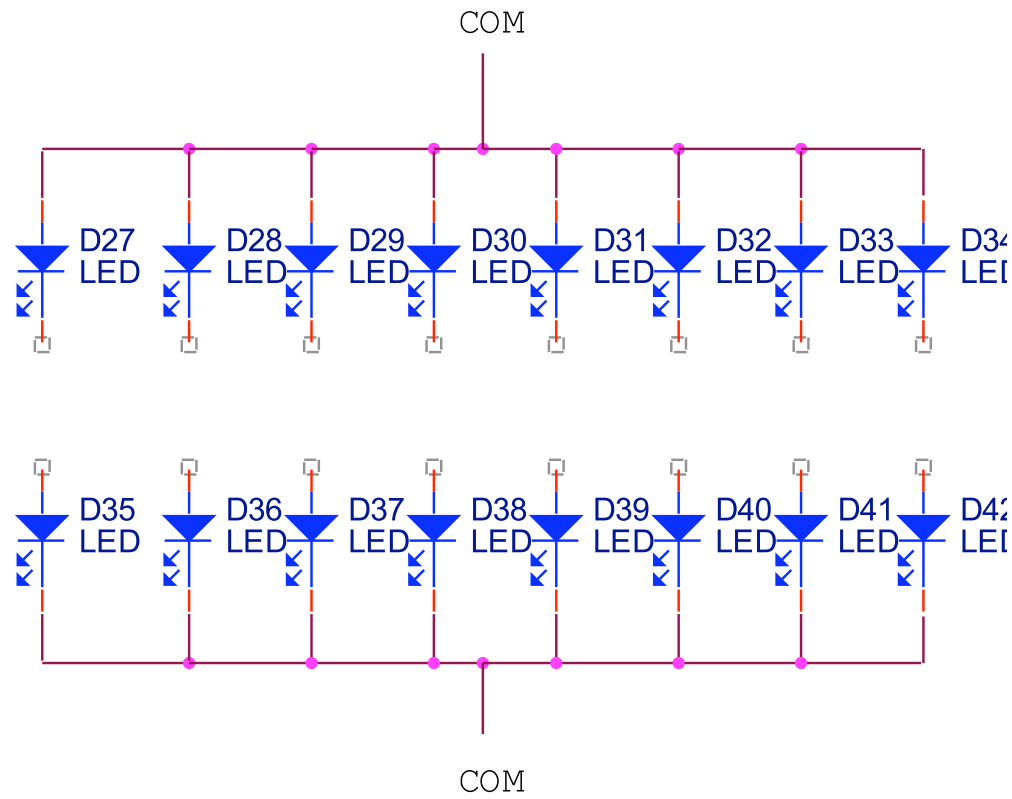
# Group of LEDs

- Use array resistor



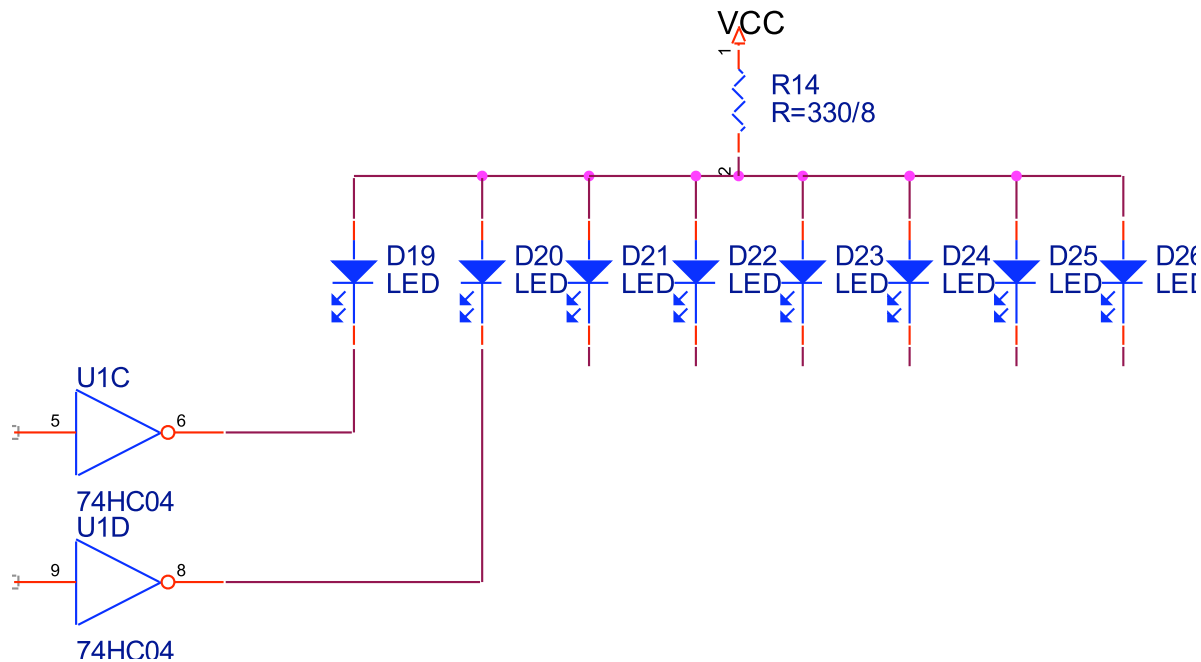
# LED module

- Common cathode and common anode



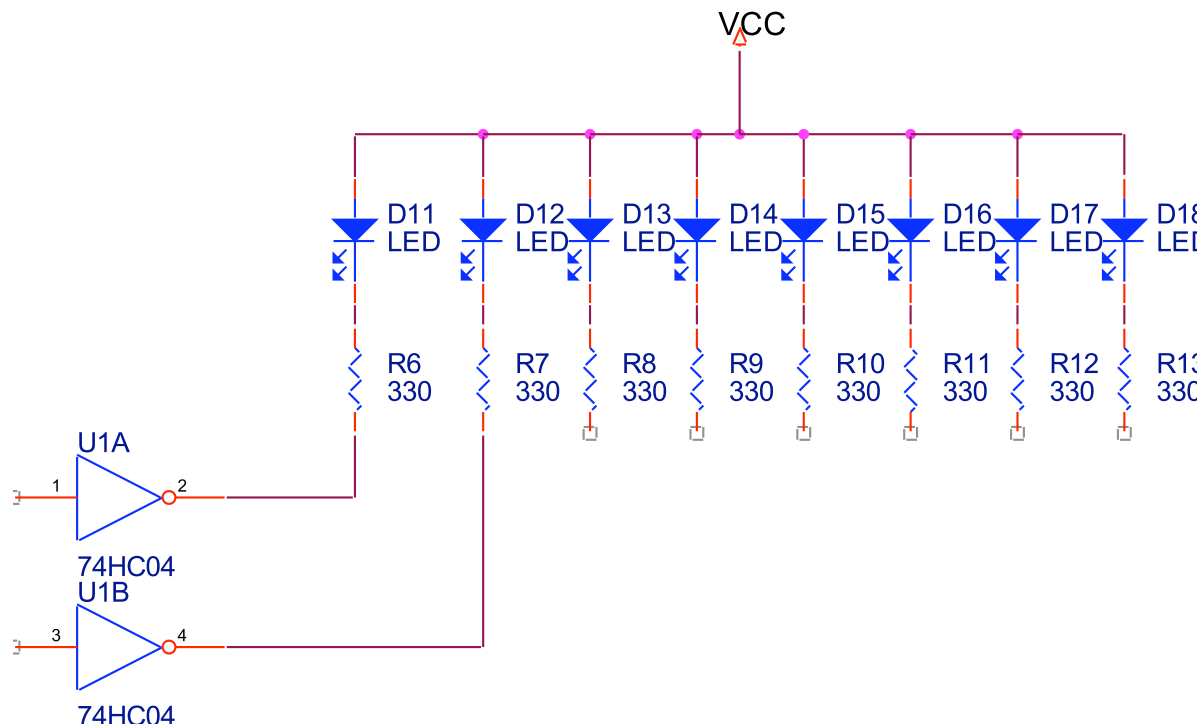
# Limiting current (1)

- Correct design?



# Limiting current (2)

- Correct design!



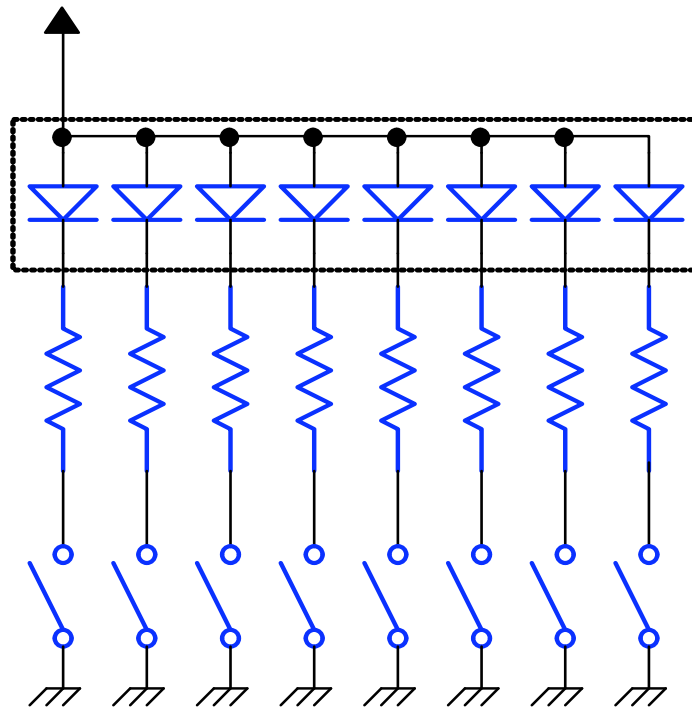
# Multi-digit 7 segment display

- Static drive requires
  - 8 × digits drivers
  - 8 × digits resistors



# Dynamic display (1)

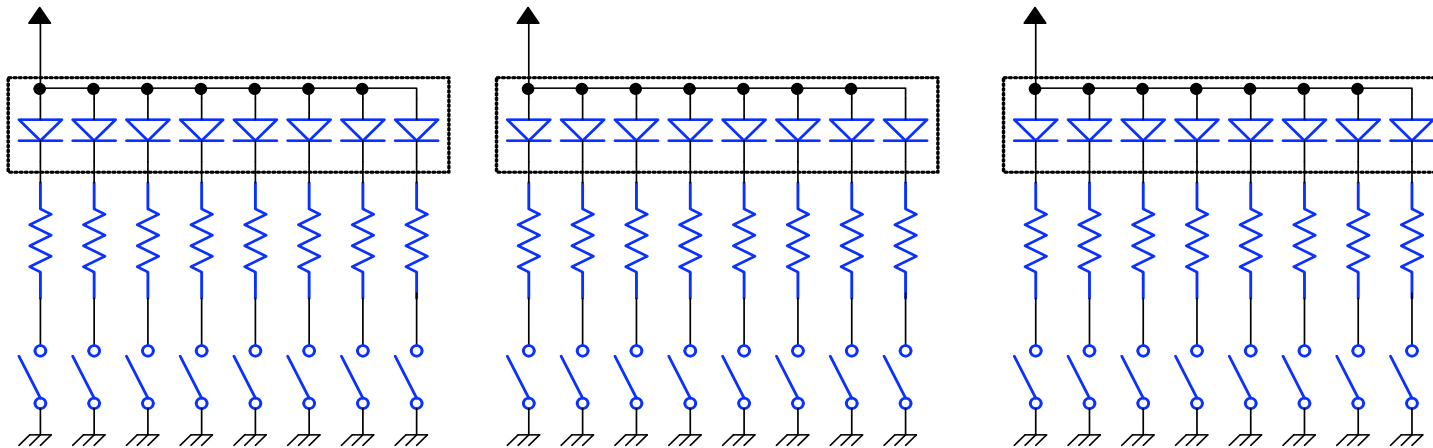
- Single digit static drive





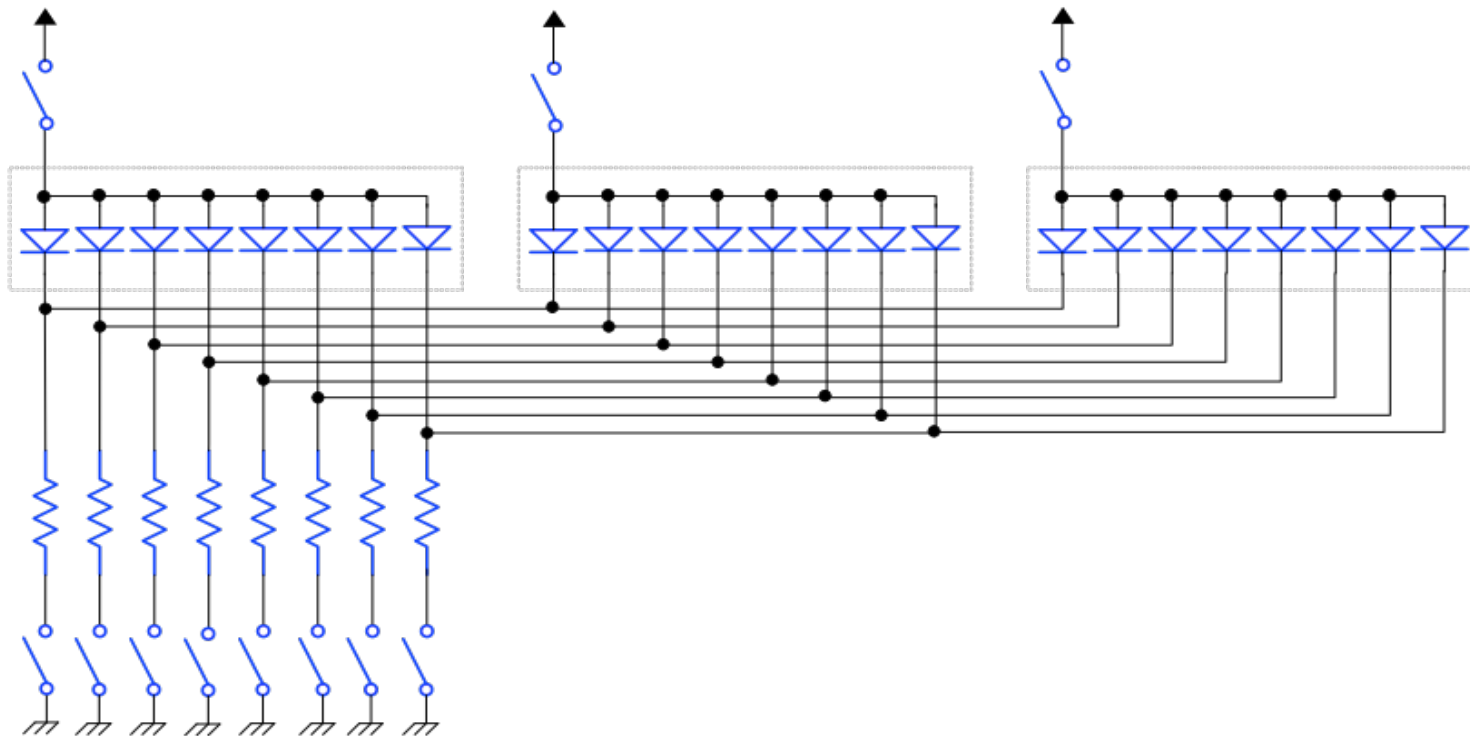
# Dynamic display (2)

- Three digits static drive



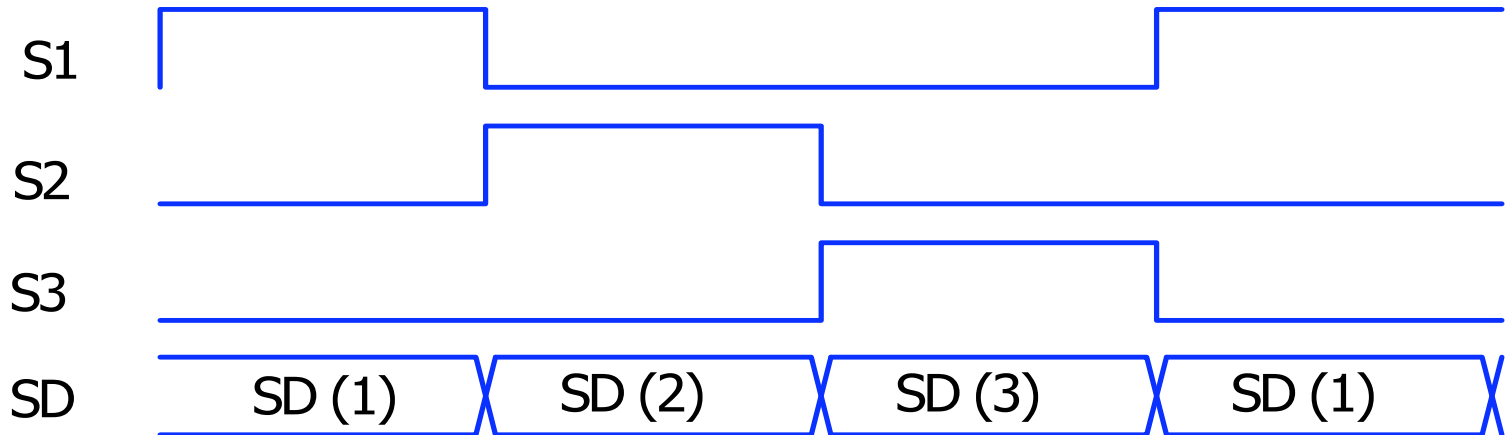
# Dynamic display (3)

- Three digit dynamic display



# Dynamic display (4)

- Timing and sequence



# Dynamic display (5)

- Forward bias current
  - Equivalent RMS value
  - Current for 8 digits?
- Switching frequency
  - Refresh rate: avoid flicking



# Dynamic display (6)

- Maximum current

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A=25^\circ\text{C}$ )	<b>-9246</b>	<b>-9248</b>	<b>-9250</b>	<b>-9704</b>
Power Dissipation (mW)	135	85	135	135
Derating (mW/°C) <i>From 25°C 1. (mA/°C) From 50°C</i>	1.8	1.6	1.8	.5'
Forward Current (mA)	25	20	25	30
Peak Current (mA) <i>Pulse width = 10μs</i>	500	500	500	500
Operating Temperature (°C)	-55/+100	-55/+100	-20/+100	-55/+100
Storage Temperature (°C)	-55/+100	-55/+100	-55/+100	-55/+100
Soldering Temperature	260°C, 5 seconds, 1.6 mm from case			

*Solder Adherence per MIL-STD-202E, Method 208C*



# Dynamic display (7)

- How many digits can I dynamically display?
  - Maximum forward current
  - Refresh rate



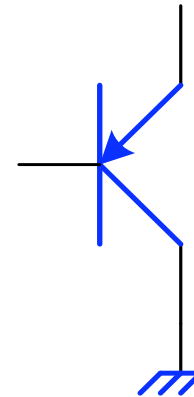
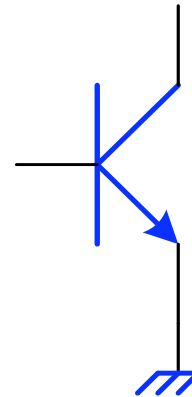
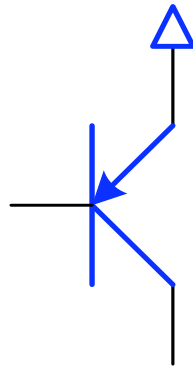
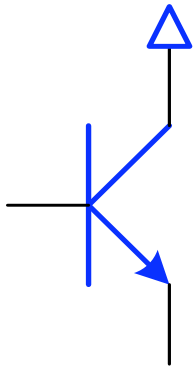
# Dynamic display (8)

- Digit selection switch
  - Low voltage drop: low power dissipation
  - Fast response
  - High current (in comparison with logic gates) up to hundreds mA to a few A
- Segment selection switch
  - Low voltage drop
  - Less high current up to hundreds mA



# Dynamic display (9)

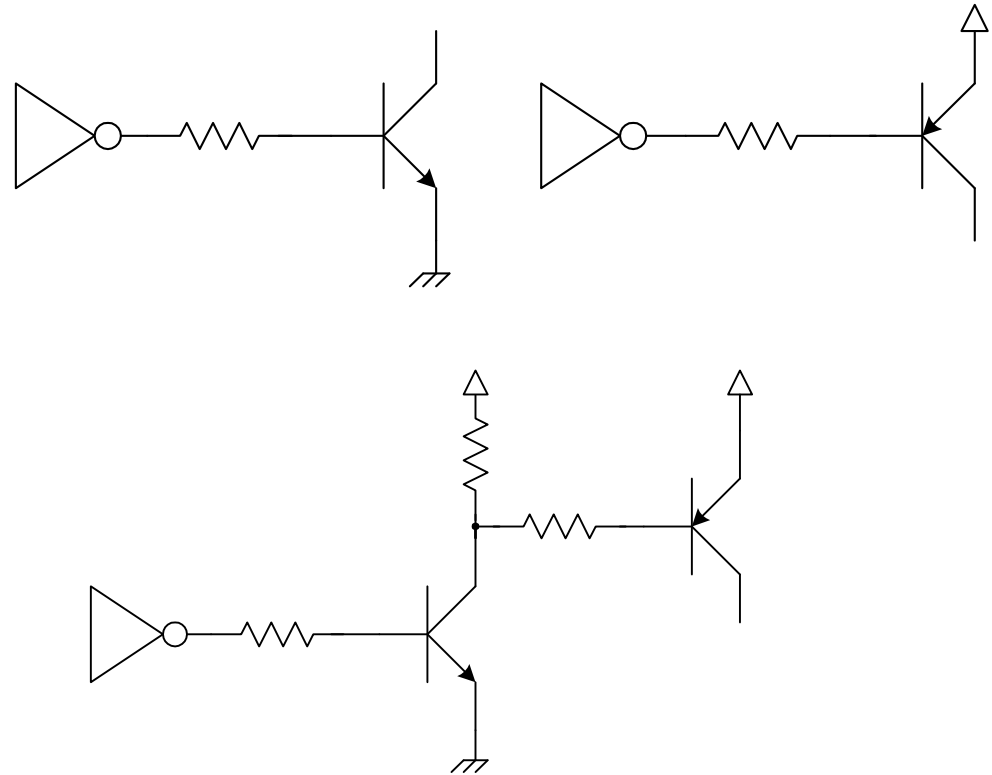
- NPN switch versus PNP switch
  - V-CE
  - Drive circuit





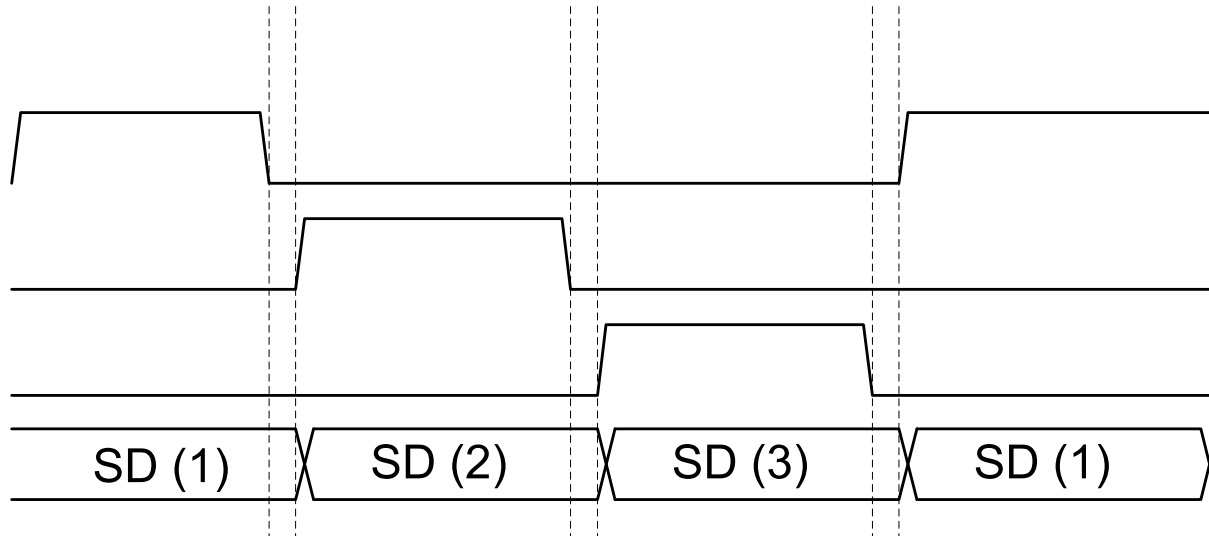
# Dynamic display (10)

- Biasing
  - NPN
  - PNP
  - PNP high voltage



# Dynamic display (11)

- Avoid timing fault
  - Dead zone



# Conclusions

- Design the following circuit
  - 4-digit 7 segment display including dot.
  - 8-bit dip switch and 1 push button switch
    - Dip switch: data
    - Push button switch: load and shift
  - Display binary number from left to right
  - Logic simulation and implementation

