Lab 2 - Time Multiplexed dual Seven Segment display

18 available breadboard switches

- 4 additional DIP
- 7 segment controls
- 2 anode controls

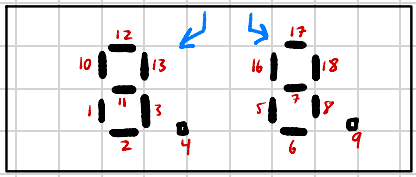
★ LED Summage! display on 5 Leds

3 by FPGA, 2 by MCU echo.

PNP

base Selector

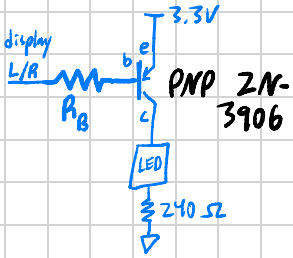
seg[i]	1	0	2	3	Common Anodes	1	2	3
Cathode Pins	10	11	12	13	14	15	16	17	18



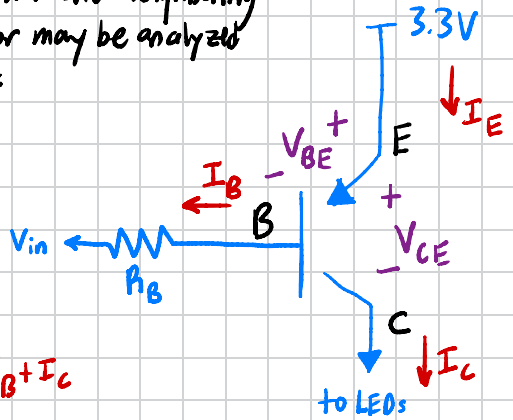
Cathode Pins	1	2	3	4	5	6	7	8	9
seg[i]	4	5	6	X	4	5	0	6	X

Transistor Calculations

We use the following transistor circuit as a PNP transistor switch to send power to the LED segments:



The transistor and neighboring base resistor may be analyzed as follows:



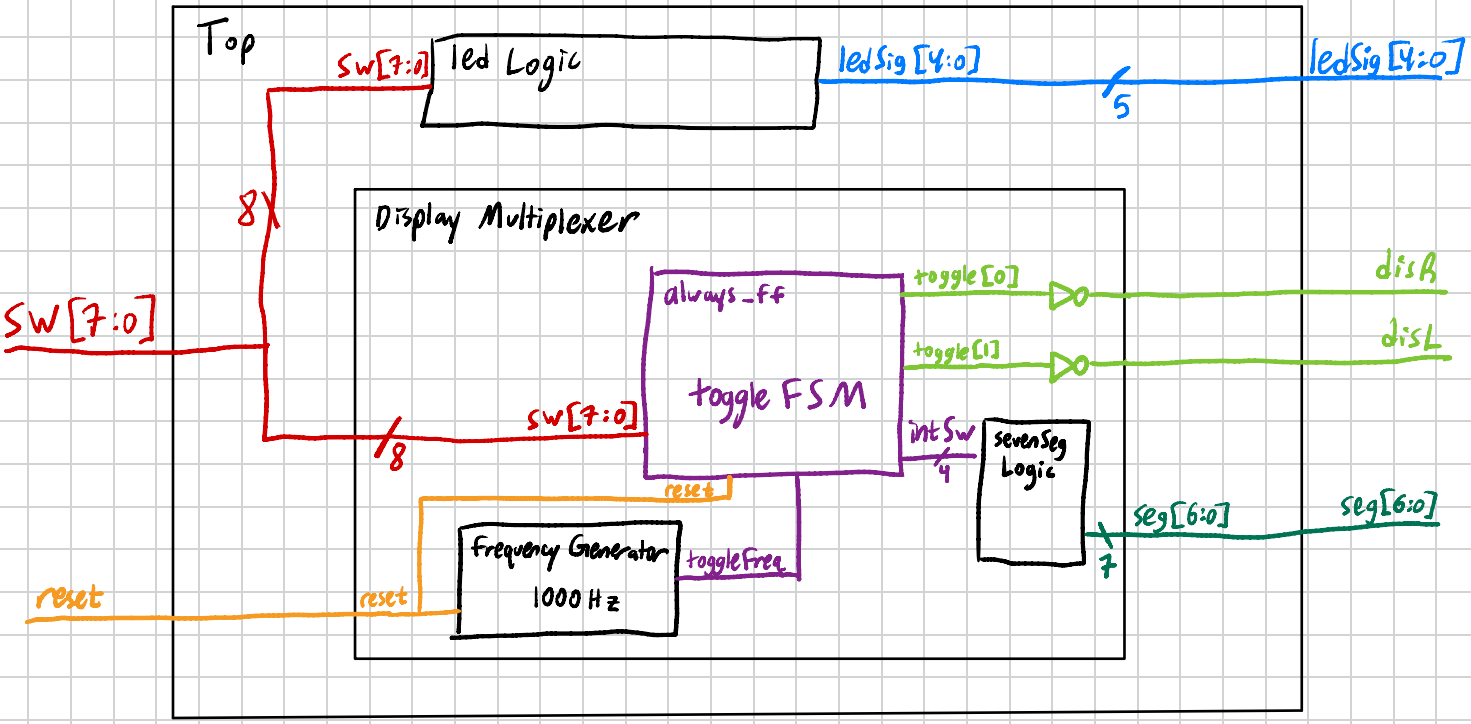
$I_E = I_B + I_C$

$I_C = \beta I_B = 10 I_B$

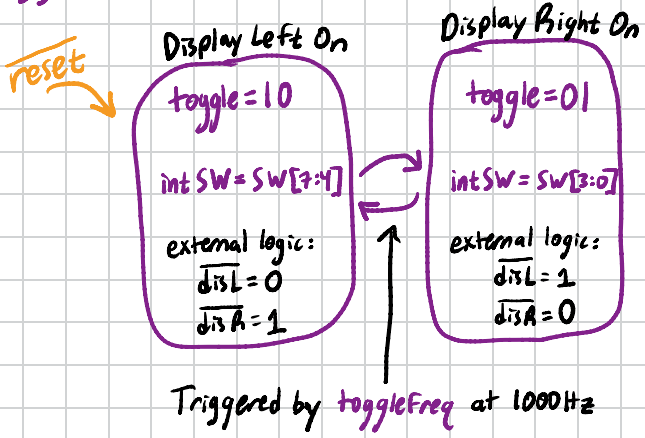
$$R_B = \frac{V_{in} - V_{BE}}{I_B} = \frac{3.3 - 0.7}{I_B}$$

Let $I_B = 6mA$ max.
$I_C = 60mA$, enough to power every segment without ever exceeding 30mA each.

Additionally, using 3.3V logic, our iCE40 FPGA chip recommends +/- 8mA as a current in/out limit on our GPIO pins. 6mA sits below this. Note: actual $R_B = 470\Omega \rightarrow I_B = 5.5mA$.



Toggle FSM:



'h02c7

vec2 = 0000 0010 1100 0111

1110 1001

1011