

Transistor Transistor Logic Basics

Last updated 3/8/22

Transistor Transistor Logic - Basics

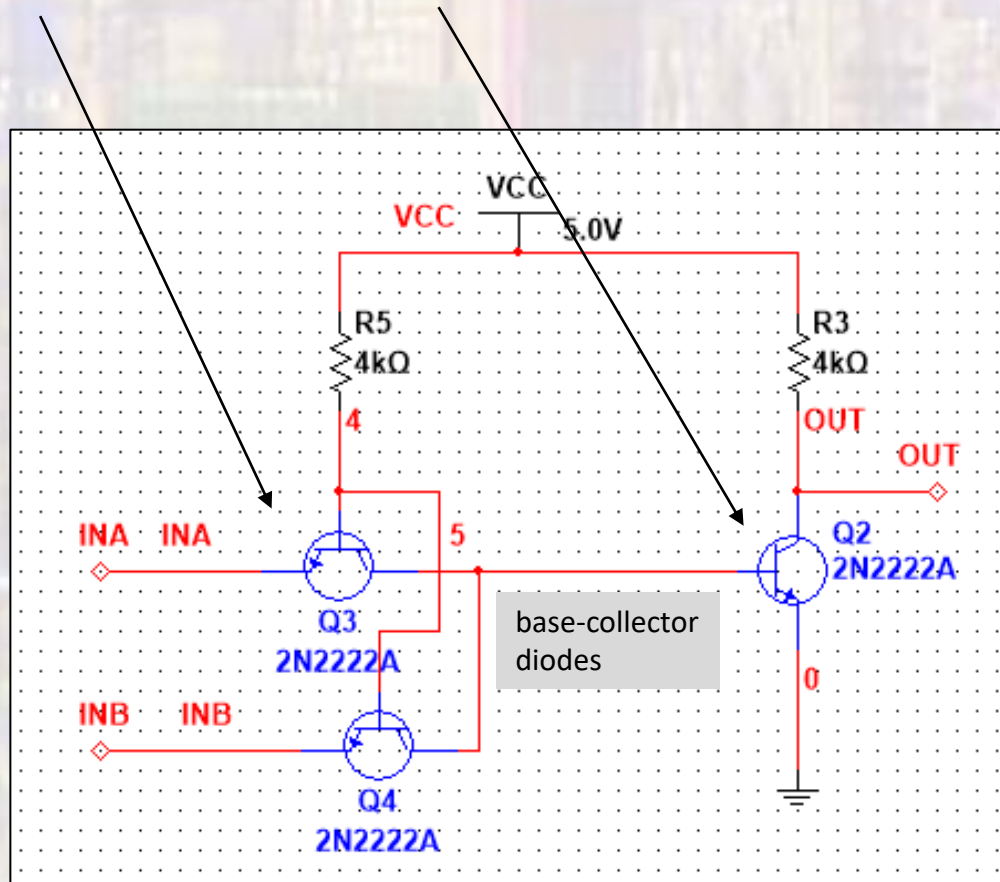
- History
 - Invented by TRW in 1961
 - Most widely used logic solution of the 60s and 70s
 - Many speed/power versions developed
- Low power: mW at 10s of ns
- Fast: ns at 10s of mW
- Replaced by NMOS and then CMOS in the 80s
- Still available
- Found on older systems

Transistor Transistor Logic - Basics

- TTL Families
 - Standard TTL designed as 74 or 54
 - Low-power TTL designed as 74L or 54L
 - High-power TTL designed as 74H or 54H
 - Low-power Schottky TTL designed as 74LS or 54LS
 - Schottky TTL designed as 74S or 54S
 - Advanced low-power Schottky TTL designed as 74ALS or 54ALS
 - Advanced Schottky TTL designed as 74AS or 54AS
 - Fast TTL designed as 74F or 54F
 - 54 – mil temp range (-55°C – 125°C)
 - 74 – com temp range (0°C – 70°C)

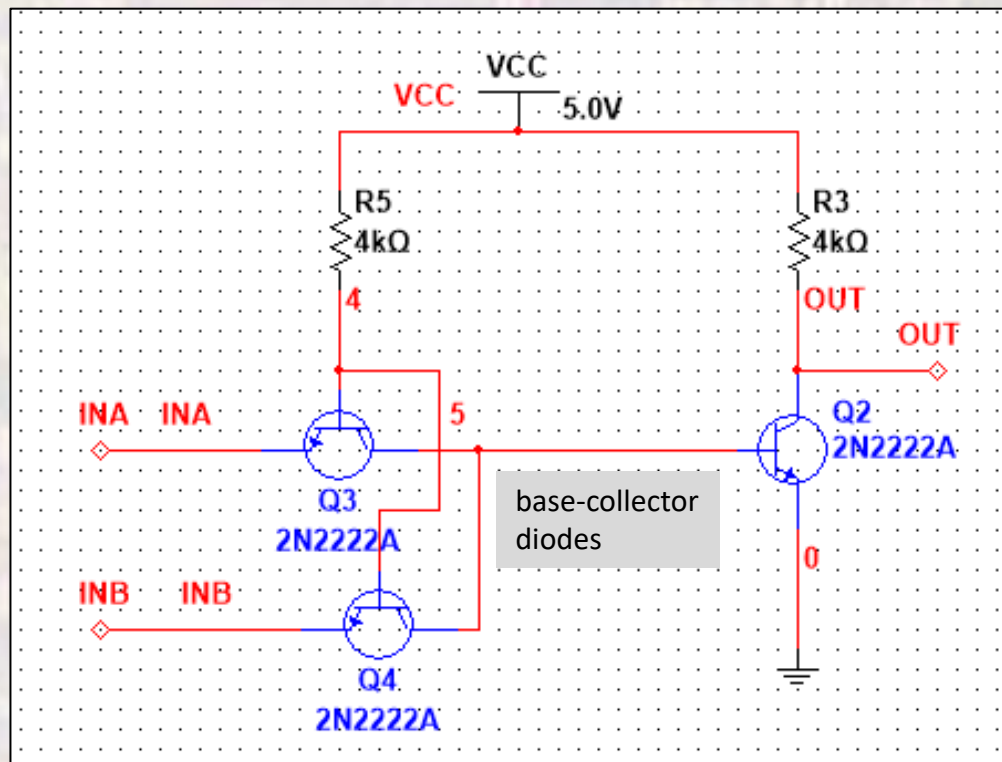
Transistor Transistor Logic - Basics

- Transistor Transistor Logic
 - Transistor input, Transistor gain



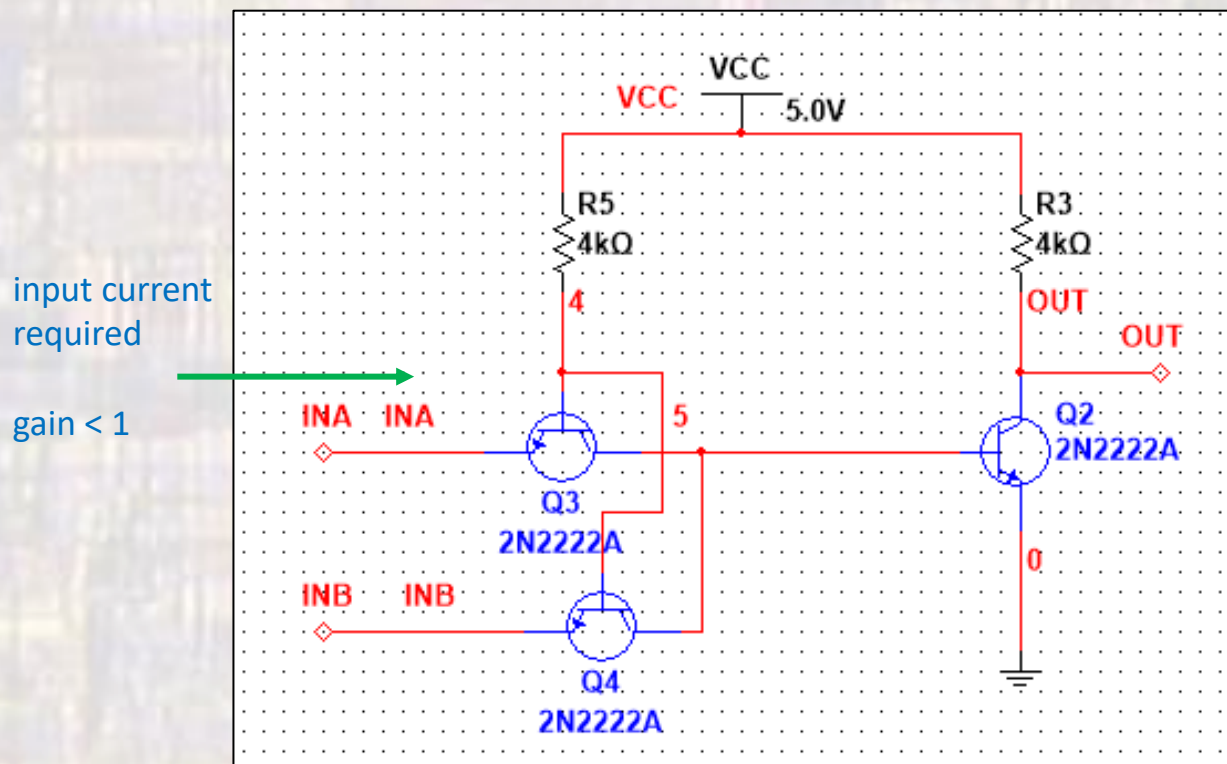
Transistor Transistor Logic - Basics

- Transistor Transistor Logic
 - One or both Inputs low
 - Q3/Q4 forward active and the base of Q2 is pulled low
 - → out goes high



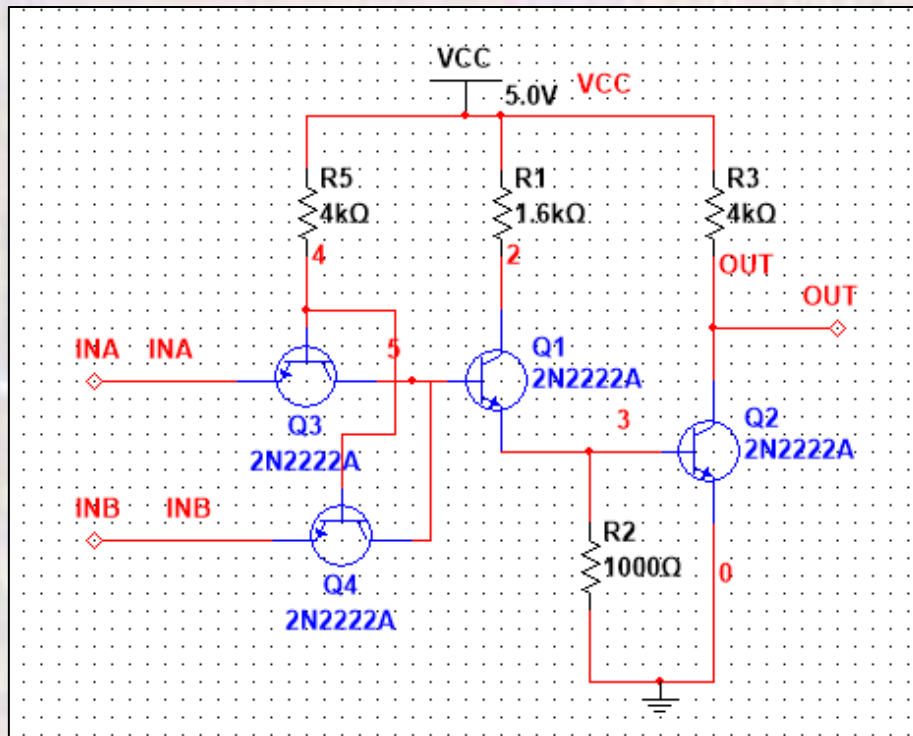
Transistor Transistor Logic - Basics

- Transistor Transistor Logic
 - Both Inputs high
 - Q3/Q4 **reverse active** and the base of Q2 is pulled high
 - → out goes low



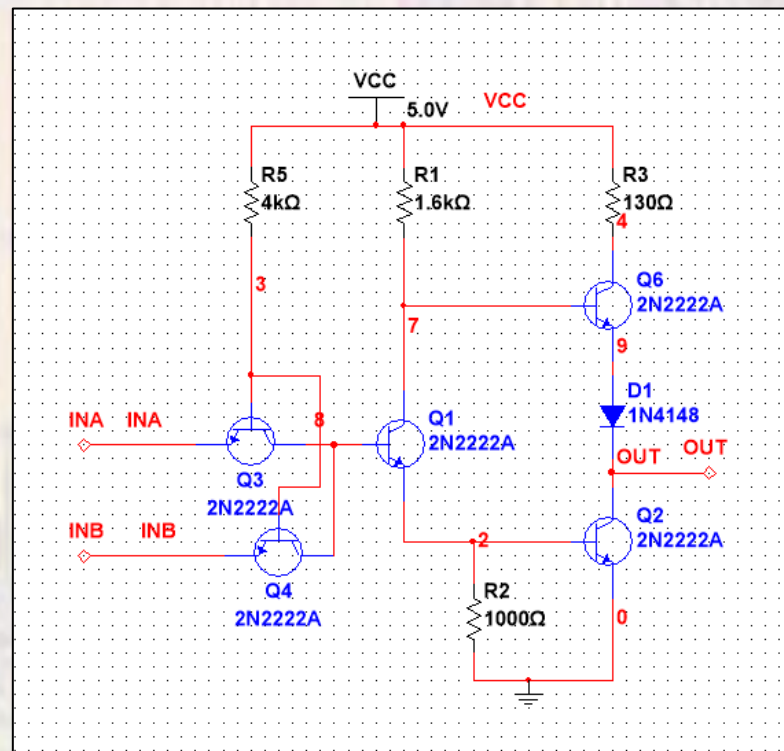
Transistor Transistor Logic - Basics

- Transistor Transistor Logic
 - Buffer stage
 - Reduces input current requirements
 - Introduces a recovery time element for Q2



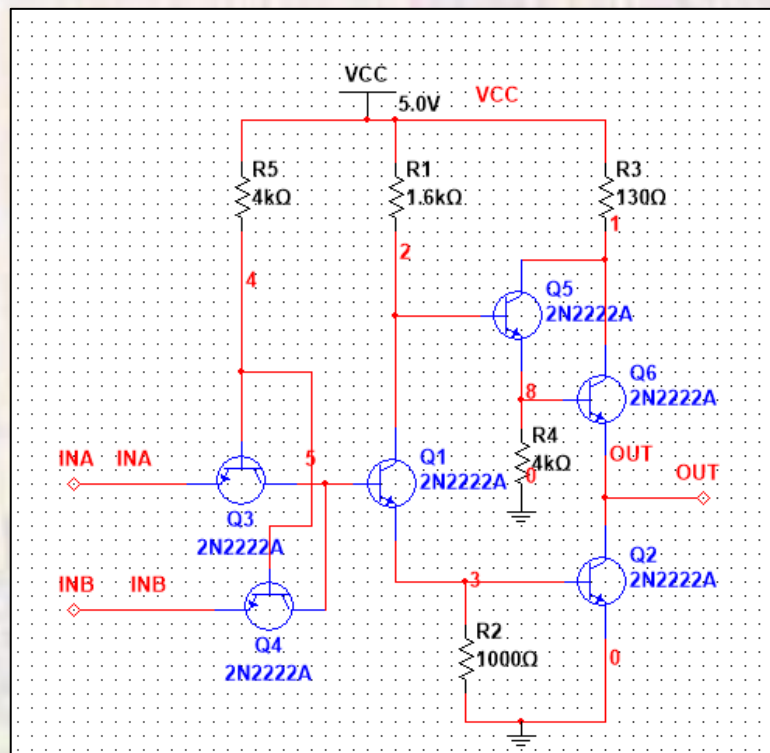
Transistor Transistor Logic - Basics

- Transistor Transistor Logic
 - Totem-Pole Output
 - Improved pull-up drive
 - Lower effective $R \rightarrow$ faster \uparrow transition and higher fanout
 - Reduces signal swing



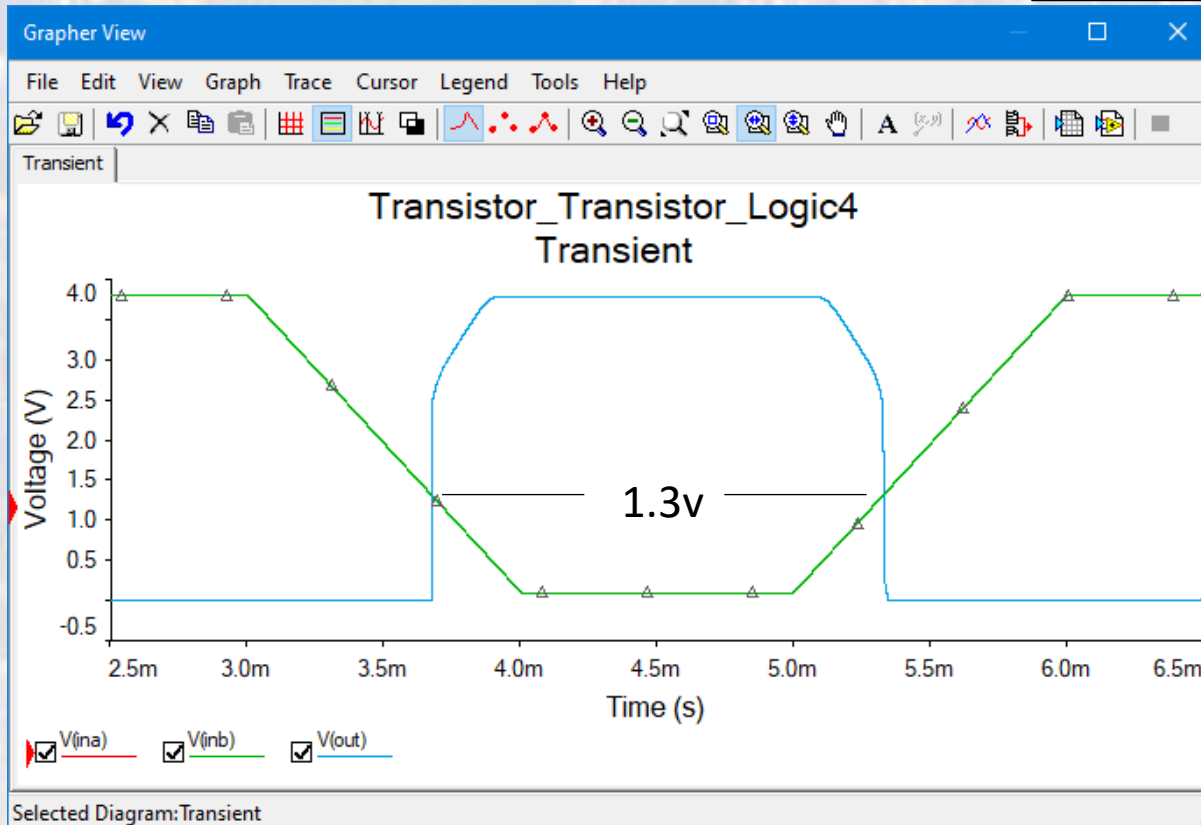
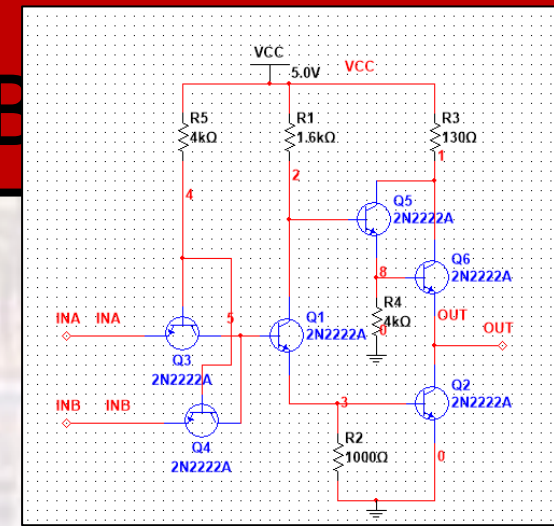
Transistor Transistor Logic - Basics

- Transistor Transistor Logic
 - Enhanced Totem-Pole Output
 - Improved pull-up drive
 - Lower effective $R \rightarrow$ faster \uparrow transition and higher fanout
 - Reduces signal swing



Transistor Transistor Logic - B

- Transistor Transistor Logic
 - Low Speed Transitions
 - Symmetric switching points



Transistor Transistor Logic - B

- Transistor Transistor Logic
 - High Speed Transitions
 - Significant difference rising vs. falling

