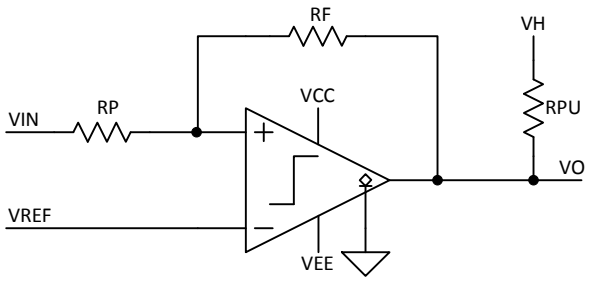
Schmitt Trigger Homework

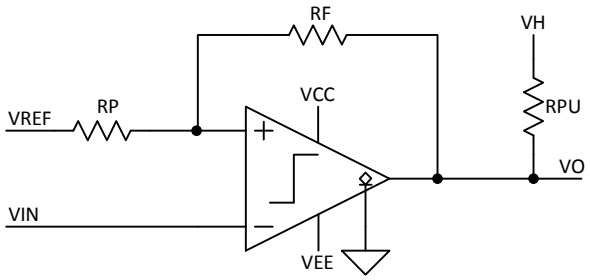
March 18, 2013

Derive the analytical and design equations in the notes for both the non-inverting and inverting forms of the Schmitt Trigger. Be able to efficiently derive these as you will likely have to perform one of them on the test (hint, hint, hint!). Then solve the following analytical and design problems.

1. Calculate the upper and lower input thresholds voltages for the following non-inverting Schmitt Trigger circuits. Use V_{OH} = 4.5 volts and V_{OL} = 0.3 volts.
(a) R_P = 43K, R_F = 10K, V_{REF} = 2.0 volts
(b) R_P = 10K, R_F = 100K, V_{REF} = 2.5 volts
(c) R_P = 10K, R_F = 15K, V_{REF} = 2.5 volts



2. Calculate the upper and lower input threshold voltages for the following inverting Schmitt Trigger circuits. Use V_{OH} = 5 volts and V_{OL} = 0.1 volts.
(a) R_P = 2.7K, R_F = 10K, V_{REF} = 2.5 volts
(b) R_P = 10K, R_F = 30K, V_{REF} = 1.0 volts
(c) R_P = 8.2K, R_F = 27K, V_{REF} = 3.0 volts



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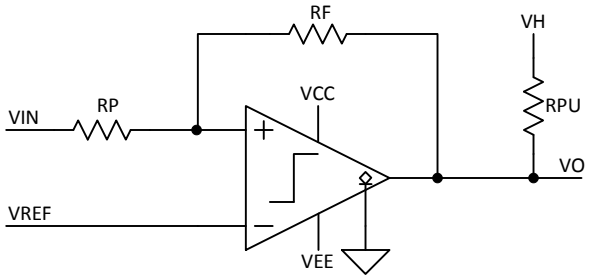
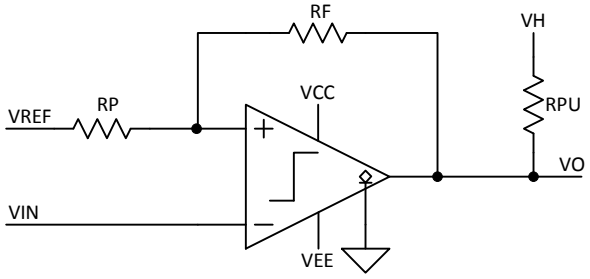
3. Calculate the required (R_P/R_F) ratio and V_{REF} for the following design requirements. Use V_{OH} = 4.7 volts and V_{OL} = 0.1 volts.
(a) V_{UT} = 2.2, V_{LT} = 0.9
(b) V_{UT} = 3.0, V_{LT} = 1.0
(c) V_{UT} = 3.67, V_{LT} = 1.33



4. Calculate the required (R_P/R_F) ratio and V_{REF} for the following design requirements. Use V_{OH} = 4.7 volts and V_{OL} = 0.1 volts.
(a) V_{UT} = 2.2, V_{LT} = 0.9
(b) V_{UT} = 3.0, V_{LT} = 1.0
(c) V_{UT} = 3.67, V_{LT} = 1.33



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Answers:

1a: $V_{UT} = 2.7$, $V_{LT} = 0.93$
1b: $V_{UT} = 2.7$, $V_{LT} = 2.3$
1c: $V_{UT} = 4.0$, $V_{LT} = 1.2$

2a: $V_{UT} = 3.0$, $V_{LT} = 2.0$
2b: $V_{UT} = 2.0$, $V_{LT} = 0.83$
2c: $V_{UT} = 3.5$, $V_{LT} = 2.4$

3a: $(R_P/R_F) = 0.283$, $V_{REF} = 1.737$
3b: $(R_P/R_F) = 0.435$, $V_{REF} = 2.121$
3c: $(R_P/R_F) = 0.509$, $V_{REF} = 2.466$

4a: $(R_P/R_F) = 0.394$, $V_{REF} = 1.215$
4b: $(R_P/R_F) = 0.769$, $V_{REF} = 1.692$
4c: $(R_P/R_F) = 1.035$, $V_{REF} = 2.604$