**California State University, Northridge**

**College of Engineering & Computer Science**

**Electrical and Computer Engineering Department**

**ECE 443L Digital Electronics Laboratory Report 10**

**CMOS based Comparator Circuit Design, Simulation and Experimental Test as well as Analysis**

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**Abstract:**

Lab 4 exposes students of Comparators and their functionalities in everyday electronics. A comparator is simply a device which compares 2 input voltages or currents and outputs indicating which signal was larger. Comparators are largely utilized in Analog-to-digital converters, which are found in almost every advanced electronic.

**Key Terms:**

Comparator, ADC, converter

**Simulation and Experimental Result:**

Diagram

Description automatically generated with medium confidence

Figure 4.1: Case 1 EVAN Comparator Schematic @ 25kHz and 50kHz

Chart, line chart

Description automatically generated

Table

Description automatically generated

Figure 4.2: Case 1 EVAN Comparator Waveform and Cursor @ 25kHz and 50kHz

Chart, line chart

Description automatically generated

Figure 4.3: Case 1 EVAN Comparator Circuit Result @ 1kHz and 2kHz

Diagram, schematic

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Figure 4.4: Case 1 CLAYTON Comparator Schematic @ 25kHz and 50kHz

Chart

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Figure 4.5: Case 1 CLAYTON Comparator Waveform @ 25kHz and 50kHz

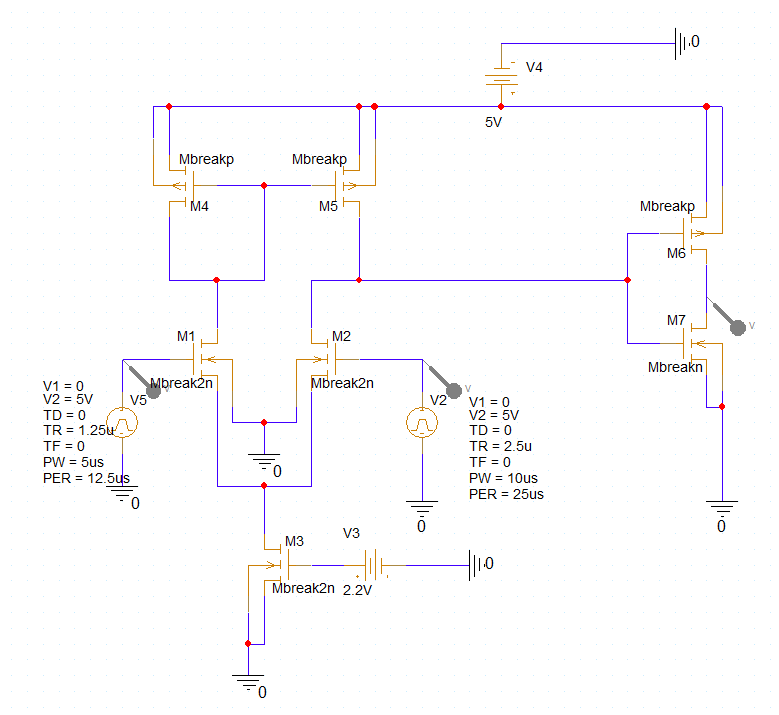


Figure 4.6: Case 2 HAROUTUN Comparator Schematic @ 20kHz and 40kHz

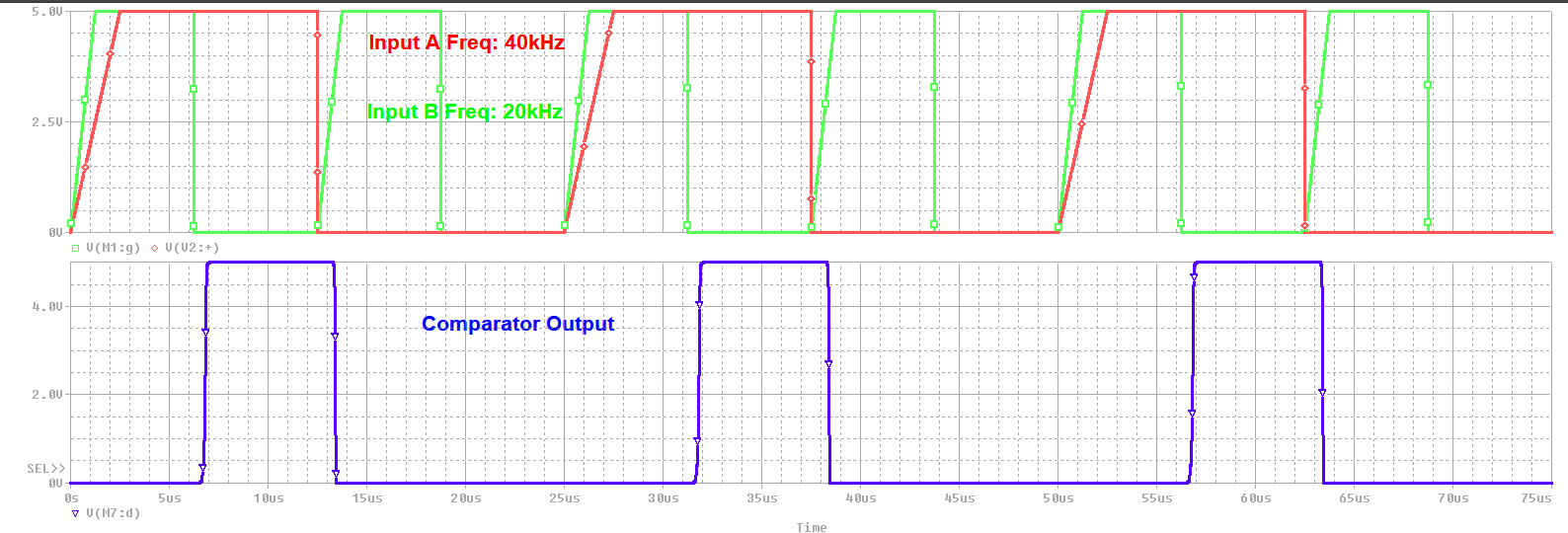




Figure 4.7: Case 2 HAROUTUN Comparator Waveform @ 20kHz and 40kHz

Diagram, schematic

Description automatically generated

Figure 4.8: Case 3 EVAN Comparator Schematic @ 50kHz and 4V

Chart, line chart

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Table

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Figure 4.9: Case 3 EVAN Comparator Waveform @ 50kHz and 4V

Chart, line chart

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Figure 4.10: Case 3 EVAN Comparator Circuit Output @ 1kHz and 3.92V

Diagram, schematic

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Figure 4.11: Case 3 CLAYTON Comparator Schematic @ 50kHz and 4V

Chart, line chart

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Figure 4.12: Case 3 CLAYTON Comparator Waveform @ 50kHz and 4V

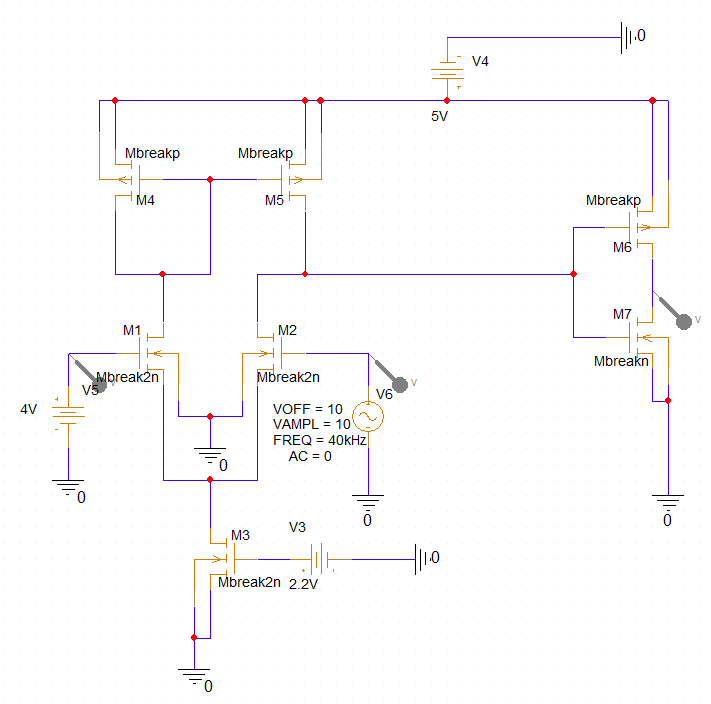


Figure 4.13: Case 4 HAROUTUN Comparator Schematic @ 40kHz and 4V

Chart, line chart

Description automatically generated



Figure 4.14: Case 4 HAROUTUN Comparator Waveform @ 40kHz and 4V

Diagram, schematic

Description automatically generated

Figure 4.15: Case 5 EVAN Comparator Waveform @ 25kHz and 50kHz

Graphical user interface, chart, line chart

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Table

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Figure 4.16: Case 5 EVAN Comparator Waveform @ 25kHz and 50kHz

Chart, line chart

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Figure 4.17: Case 5 EVAN Comparator Circuit Output @ 2kHz and 996Hz

Diagram, schematic

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Figure 4.18: Case 5 CLAYTON Comparator Schematic @ 25kHz and 50kHz

Chart, line chart

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Figure 4.19: Case 5 CLAYTON Comparator Waveform @ 25kHz and 50kHz

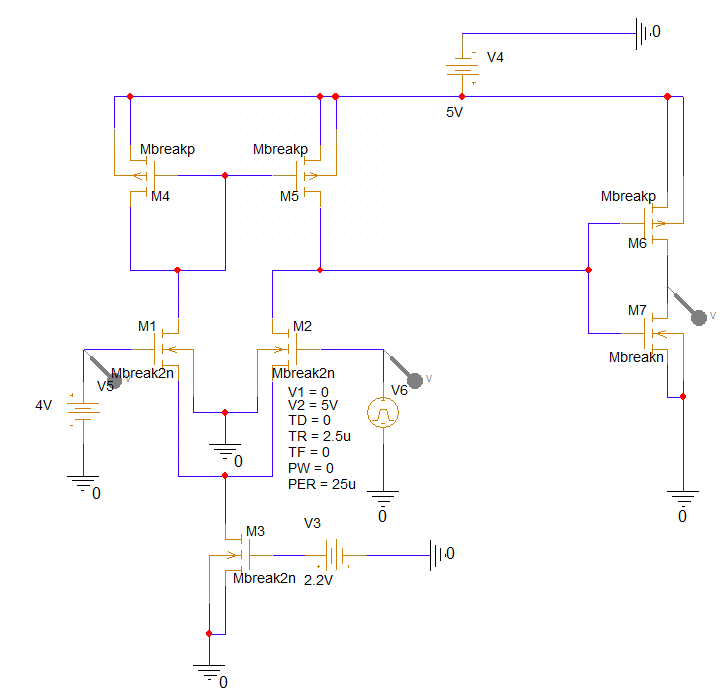


Figure 4.20: Case 6 HAROUTUN Comparator Schematic @ 40kHz and 4V

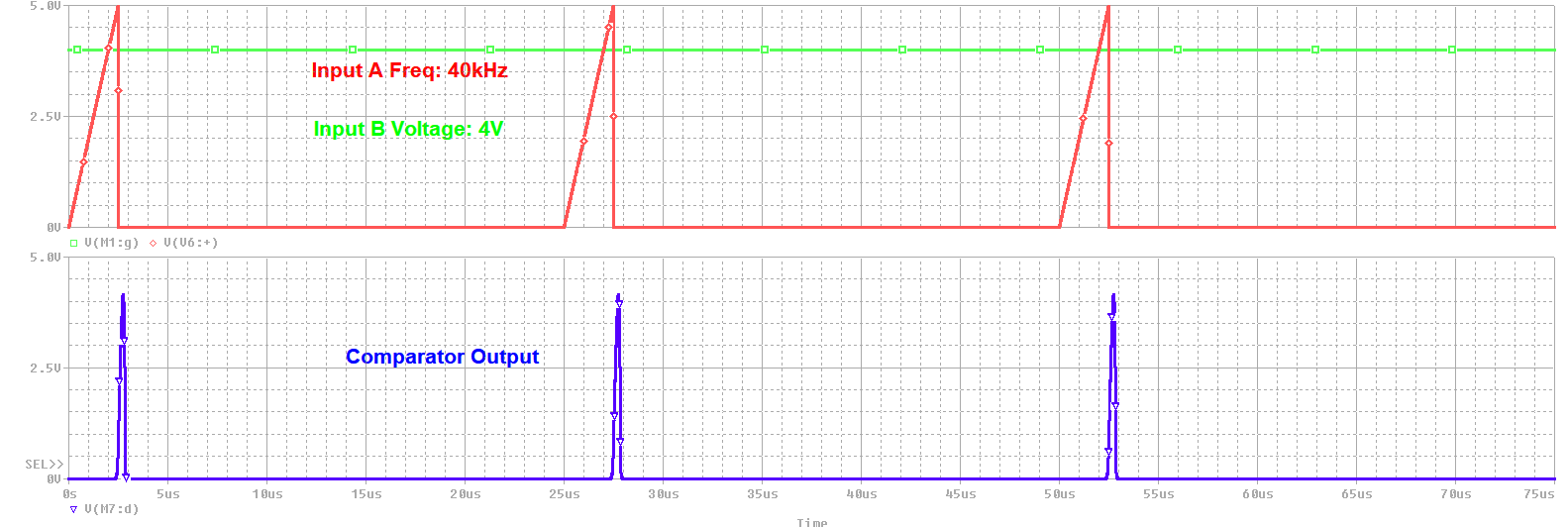




Figure 4.21: Case 6 HAROUTUN Comparator Waveform @ 40kHz and 4V

**Conclusion:**

Students not only constructed a comparator on the advanced software PSpice but recreated the circuit on a breadboard. As seen in figure 4.17, the comparator functions properly, indicating which input signal was higher. Comparators are found in almost every electronics which allows engineers to produce circuits based upon the comparative result of 2 signals.