Designing and Plotting the characteristics of a Cascode Current Mirror

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Abstract

Current Mirror, as the name suggests, it simply mirrors the input current at the output terminal. In other words, a current mirror is a device made up of transistors which replicates the same amount of output current as that of its input. But where does this current mirror finds its use? See, we all are aware that the integrated circuits are the charm of electronics industry since 1970s. Now, for these ICs, biasing is really essential and here comes the current mirror into the picture. These devices acts as biasing elements for the ICs because of their insensitivity towards the variations in parameters like power supply and temperature. Here, a Cascode Current mirror is designed and its characteristics are studied.
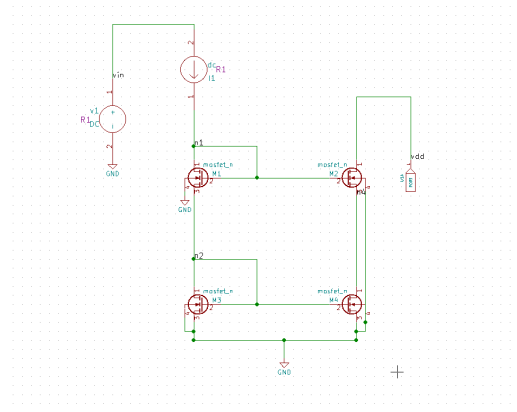
1 Circuit Details

The intent here is to design the cascode current mirror and study its various characteristics. Herein, this design uses the "cascoding" topology of the transistors. Cascoding can be simply defined as subsequent cascading of two stages,i.e., common source stage and common gate stage. Due to this cascode connection, the overall output impedance of the circuit increases which is also necessary to keep the output current constant.In the process of designing a simple current mirror, we generally ignore the "channel length modulation" effect, and this makes the circuit less accurate. In case of cascode current mirror, along with the simple current mirror circuit, two more MOSFETs are used to ensure the proper matching of the transistors, that means, equal drain-source voltage of the transistors.So, here, in this circuit a Cascode current mirror is implemented using four MOSFETs and its transfer characteristics, i.e., between output current and input current, and the output characteristics,i.e. between output current and supply voltage is plotted and studied. The sizing of the transistor can be done to achieve the desired and accurate results. Also, the region of operation of all the MOSFETs should be "Saturation" and in the results, it is expected that the cascode current mirror should be much more accurate than simple current mirror.
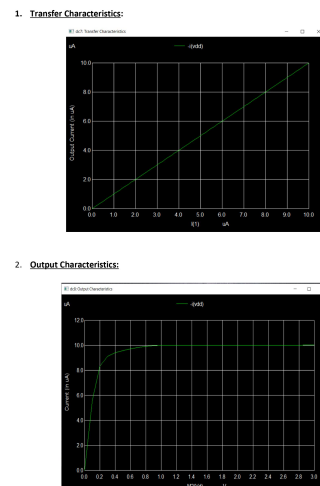
2 Implemented Circuit

Figure 1: Implemented circuit diagram.

3 Implemented Waveforms

Figure 2: Implemented waveform.

References

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