

## Binary-Weighted Current Mode Digital-to-Analog Converter

Current Mode D/A converter is a frequently used component in sensor circuit. Many bio-sensors use such device to generate stimulus to body tissues or nerves. Such devices normally are required to generate different amount of current upon certain control signals.

Binary-weighted unit control is a commonly used method. The  $r$ -th bit of the control signal controls  $2^{r-1}$  units so that  $n$  control bits can make up any number of active units from 0 to  $2^n - 1$ . Therefore, if each unit is a  $10\mu\text{A}$  current source and 4 control bits are available, any output current from 0A to  $150\mu\text{A}$  with a  $10\mu\text{A}$  step can be achieved.

### Unit Current Source

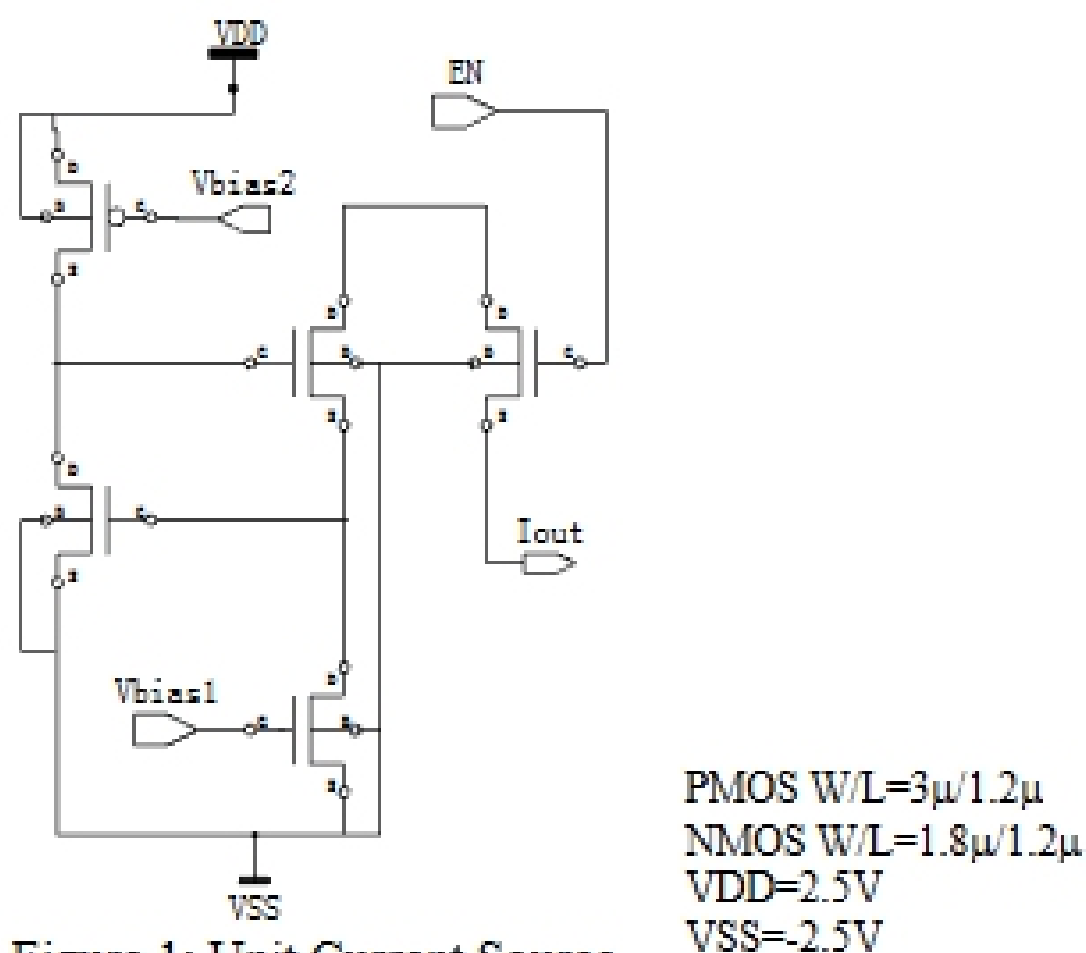


Figure 1: Unit Current Source

The unit current source can be seen as a regulated cascode current source with a PMOS switch. The two bias voltages control the output current amount and the EN control enables or disables the current source output.

## Bias Voltage Generator

The bias voltage Vbias1 and Vbias2 are generated through a circuit as shown in figure 2. The two resistors are external resistors. Therefore, in actual design, pin Rin1 and Rin2 should be used instead of the resistors.

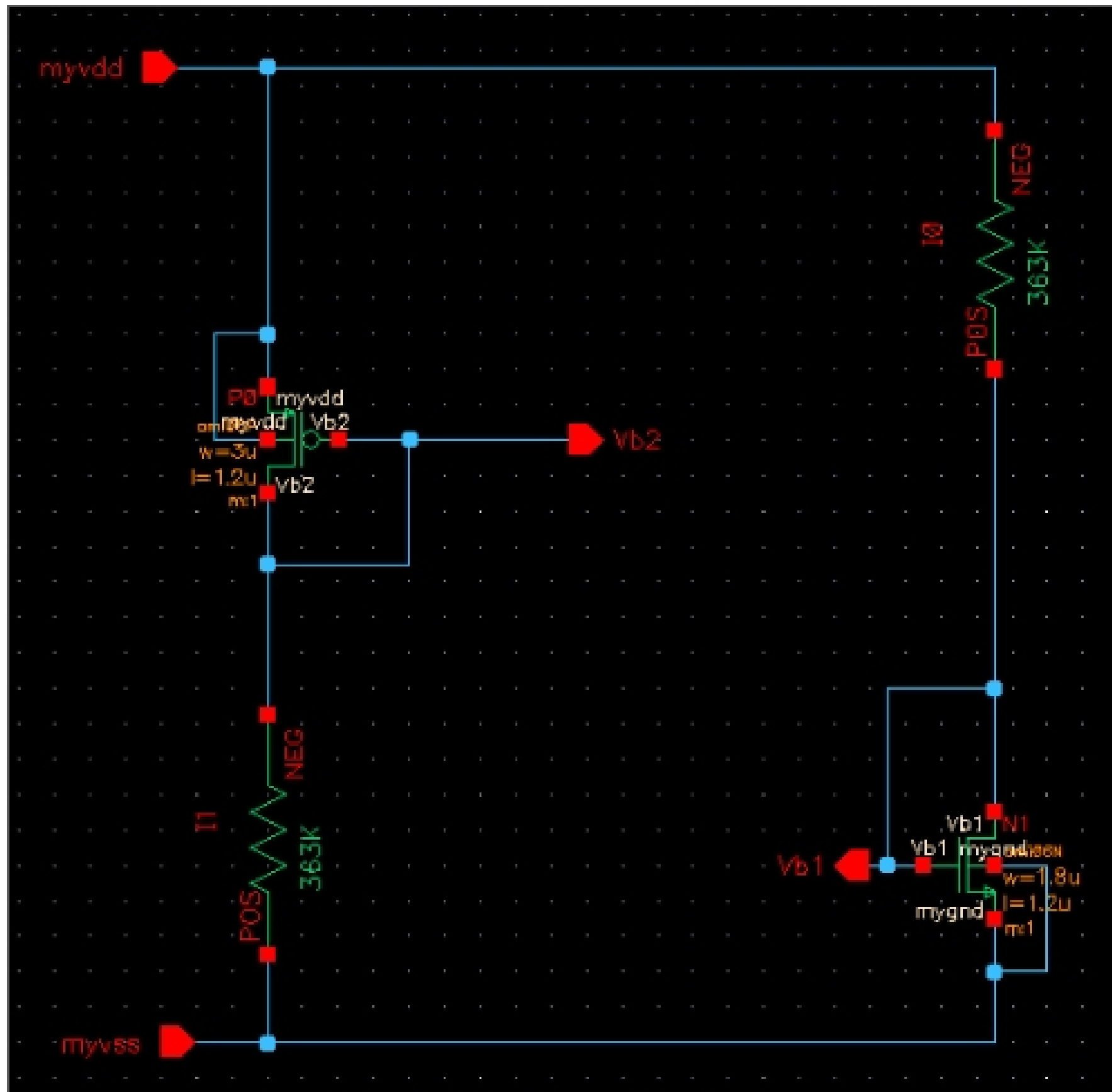


Figure 2: Bias Voltage Generator

## D/A Converter

The D/A converter is done in the way that:

- i) Digital input bit 0 to n-1 are connected to the enable signal of  $2^0, 2^1, \dots, 2^{n-1}$  current sources.
- ii) Only one bias generator is created for all current sources.
- iii) All outputs of the current sources are tied together as the total current output.

The schematic of the complete system is not given, but should be easily conducted from the description.

## Simulation

The simulation of the system uses a testbench schematic as shown in figure 3. A 4-bit DAC is used as an example.

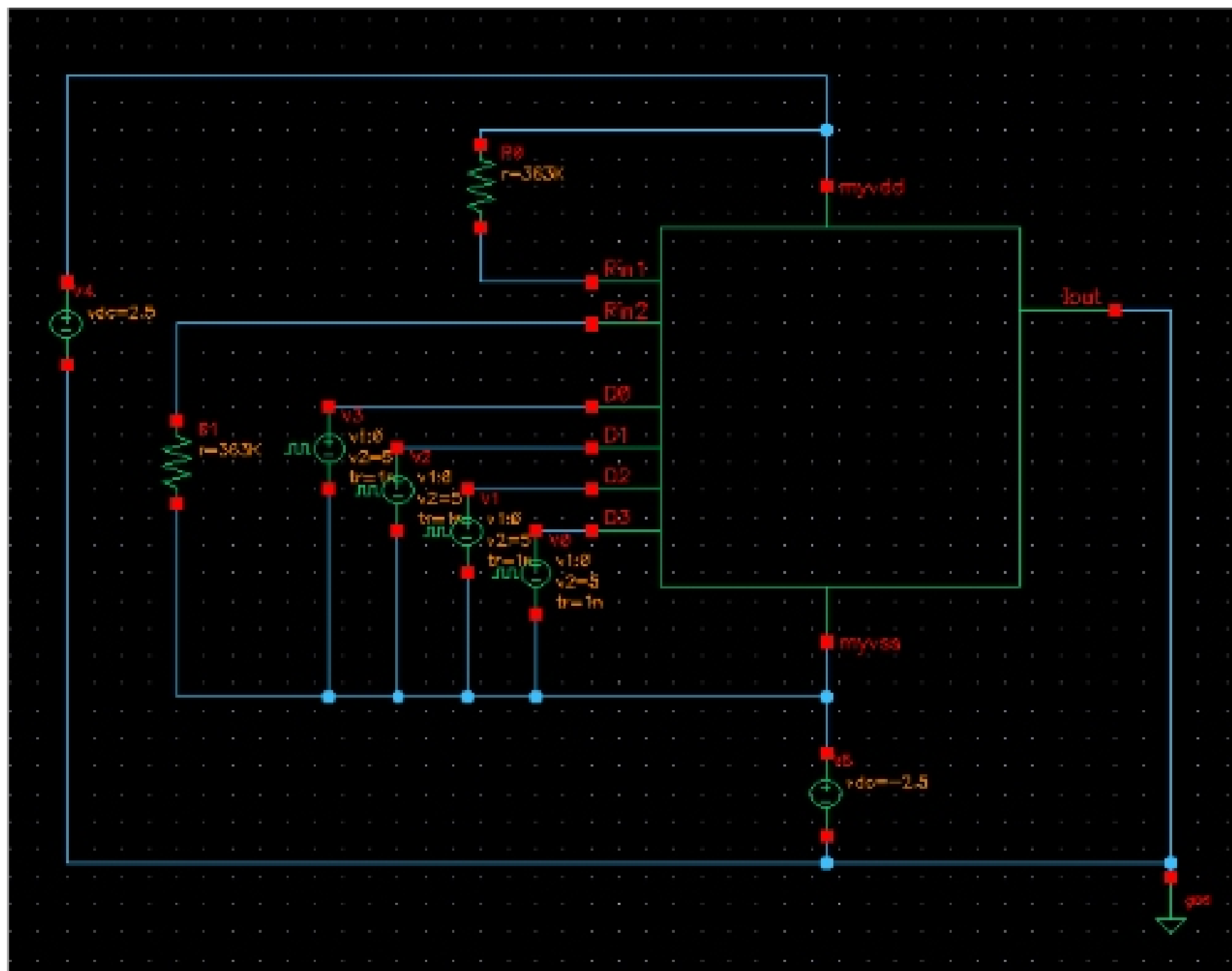


Figure 3: TestBench of a 4-bit DAC