Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	01A / 01B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 1]
SEMESTER 1, ACADEMIC YEAR 2011/2012
Date: 20 June 2011

Question:

For a MOSFET current source shown in Figure 1, the bias voltages are $V^+ = +2.5$ V and $V^- = 0$ V. Transistors are available with parameters: $k'_n = 120\ \mu A/V^2$, $V_{TN} = 0.4$ V, and $\lambda = 0$.
Design the circuit such that $I_{REF} = 120\ \mu A$, $I_O = 60\ \mu A$, and $V_{DS2}(sat) = 0.4$ V.

[10 marks]

Answer:

$V_{DS2}(sat) = V_{GS2} - V_{TN}$ [1]

$V_{GS2} = V_{DS2}(sat) + V_{TN} = 0.4 + 0.4 = 0.8$ V [1]

$(W/L)_2 = I_O / \{(k'_n/2)(V_{GS2} - V_{TN})^2\}$ [1]
$= (60\mu)/\{(120\mu/2)(0.8-0.4)^2\}$
$= 6.25$ [1]

$V_{GS1} = V_{GS2} = 0.8$ V [1]

$(W/L)_1 = I_{REF} / \{(k'_n/2)(V_{GS1} - V_{TN})^2\}$ [1]
$= (120\mu)/\{(120\mu/2)(0.8-0.4)^2\}$
$= 12.5$ [1]

$V_{GS3} = V^+ - V_{GS1} - V^- = 2.5 - 0.8 - 0 = 1.7$ V [1]

$(W/L)_3 = I_{REF} / \{(k'_n/2)(V_{GS3} - V_{TN})^2\}$ [1]
$= (120\mu)/\{(120\mu/2)(1.7-0.4)^2\}$
$= 1.183$ [1]

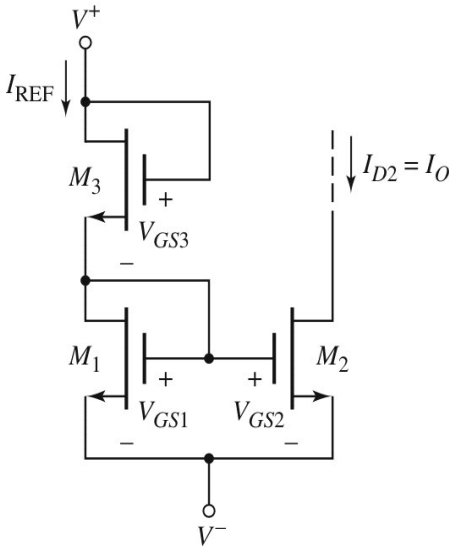

Figure 1

Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	05A / 05B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 1]
SEMESTER 1, ACADEMIC YEAR 2011/2012
Date: 20 June 2011

Question:

For a MOSFET current source shown in Figure 1, the bias voltages are $V^+ = +2.5$ V and $V^- = 0$ V. Transistors are available with parameters: $k'_n = 120\ \mu A/V^2$, $V_{TN} = 0.4$ V, and $\lambda = 0$.
Design the circuit such that $I_{REF} = 100\ \mu A$, $I_O = 50\ \mu A$, and $V_{DS2}(sat) = 0.4$ V.

[10 marks]

Answer:

$V_{DS2}(sat) = V_{GS2} - V_{TN}$ [1]

$V_{GS2} = V_{DS2}(sat) + V_{TN} = 0.4 + 0.4 = 0.8$ V [1]

$(W/L)_2 = I_O / \{(k'_n/2)(V_{GS2} - V_{TN})^2\}$ [1]
$= (50\mu)/\{(120\mu/2)(0.8-0.4)^2\}$
$= 5.208$ [1]

$V_{GS1} = V_{GS2} = 0.8$ V [1]

$(W/L)_1 = I_{REF} / \{(k'_n/2)(V_{GS1} - V_{TN})^2\}$ [1]
$= (100\mu)/\{(120\mu/2)(0.8-0.4)^2\}$
$= 10.417$ [1]

$V_{GS3} = V^+ - V_{GS1} - V^- = 2.5 - 0.8 - 0 = 1.7$ V [1]

$(W/L)_3 = I_{REF} / \{(k'_n/2)(V_{GS3} - V_{TN})^2\}$ [1]
$= (100\mu)/\{(120\mu/2)(1.7-0.4)^2\}$
$= 0.986$ [1]

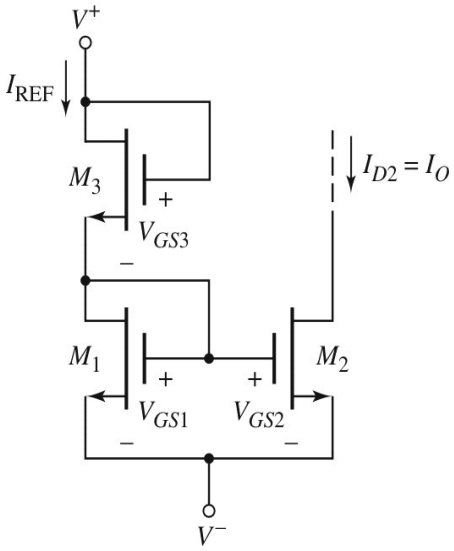

Figure 1

Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	05A / 05B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 2]
SEMESTER 1, ACADEMIC YEAR 2011/2012
Date: 20 June 2011

Question:

For a MOSFET current source shown in Figure 1, the bias voltages are $V^+ = +2.5$ V and $V^- = 0$ V. Transistors are available with parameters: $k'_n = 100\ \mu A/V^2$, $V_{TN} = 0.4$ V, and $\lambda = 0$.
Design the circuit such that $I_{REF} = 110\ \mu A$, $I_O = 60\ \mu A$, and $V_{DS2}(sat) = 0.4$ V.

[10 marks]

Answer:

$V_{DS2}(sat) = V_{GS2} - V_{TN}$ [1]

$V_{GS2} = V_{DS2}(sat) + V_{TN} = 0.4 + 0.4 = 0.8$ V [1]

$(W/L)_2 = I_O / \{(k'_n/2)(V_{GS2} - V_{TN})^2\}$ [1]
$= (60\mu)/\{(100\mu/2)(0.8-0.4)^2\}$
$= 7.5$ [1]

$V_{GS1} = V_{GS2} = 0.8$ V [1]

$(W/L)_1 = I_{REF} / \{(k'_n/2)(V_{GS1} - V_{TN})^2\}$ [1]
$= (110\mu)/\{(100\mu/2)(0.8-0.4)^2\}$
$= 13.75$ [1]

$V_{GS3} = V^+ - V_{GS1} - V^- = 2.5 - 0.8 - 0 = 1.7$ V [1]

$(W/L)_3 = I_{REF} / \{(k'_n/2)(V_{GS3} - V_{TN})^2\}$ [1]
$= (110\mu)/\{(100\mu/2)(1.7-0.4)^2\}$
$= 1.302$ [1]

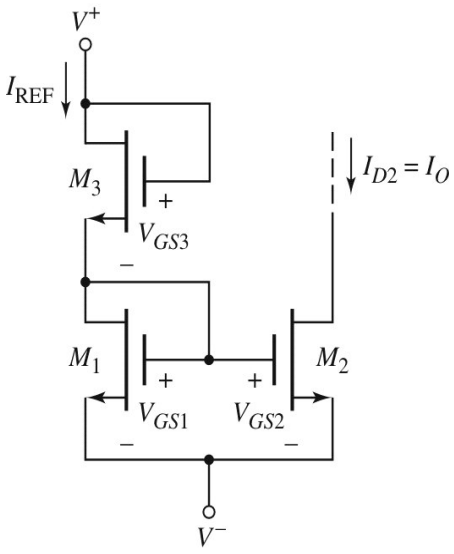

Figure 1

Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	05A / 05B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 3]
SEMESTER 1, ACADEMIC YEAR 2011/2012
Date: 20 June 2011

Question:

For a MOSFET current source shown in Figure 1, the bias voltages are $V^+ = +2.5$ V and $V^- = 0$ V. Transistors are available with parameters: $k'_n = 110\ \mu A/V^2$, $V_{TN} = 0.4$ V, and $\lambda = 0$.
Design the circuit such that $I_{REF} = 100\ \mu A$, $I_O = 60\ \mu A$, and $V_{DS2}(sat) = 0.4$ V.

[10 marks]

Answer:

$V_{DS2}(sat) = V_{GS2} - V_{TN}$ [1]

$V_{GS2} = V_{DS2}(sat) + V_{TN} = 0.4 + 0.4 = 0.8$ V [1]

$(W/L)_2 = I_O / \{(k'_n/2)(V_{GS2} - V_{TN})^2\}$ [1]
$= (60\mu)/\{(110\mu/2)(0.8-0.4)^2\}$
$= 6.818$ [1]

$V_{GS1} = V_{GS2} = 0.8$ V [1]

$(W/L)_1 = I_{REF} / \{(k'_n/2)(V_{GS1} - V_{TN})^2\}$ [1]
$= (100\mu)/\{(110\mu/2)(0.8-0.4)^2\}$
$= 11.364$ [1]

$V_{GS3} = V^+ - V_{GS1} - V^- = 2.5 - 0.8 - 0 = 1.7$ V [1]

$(W/L)_3 = I_{REF} / \{(k'_n/2)(V_{GS3} - V_{TN})^2\}$ [1]
$= (100\mu)/\{(110\mu/2)(1.7-0.4)^2\}$
$= 1.076$ [1]

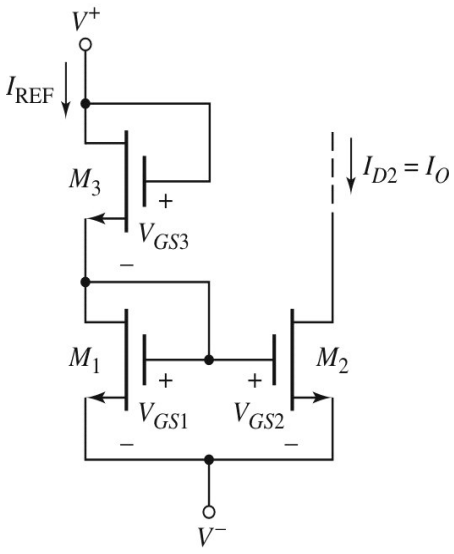

Figure 1

Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	05A / 05B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 4]
SEMESTER 1, ACADEMIC YEAR 2011/2012
Date: 20 June 2011

Question:

For a MOSFET current source shown in Figure 1, the bias voltages are $V^+ = +2.5$ V and $V^- = 0$ V. Transistors are available with parameters: $k'_n = 100\ \mu A/V^2$, $V_{TN} = 0.4$ V, and $\lambda = 0$.
Design the circuit such that $I_{REF} = 120\ \mu A$, $I_O = 50\ \mu A$, and $V_{DS2}(sat) = 0.4$ V.

[10 marks]

Answer:

$V_{DS2}(sat) = V_{GS2} - V_{TN}$ [1]

$V_{GS2} = V_{DS2}(sat) + V_{TN} = 0.4 + 0.4 = 0.8$ V [1]

$(W/L)_2 = I_O / \{(k'_n/2)(V_{GS2} - V_{TN})^2\}$ [1]
$= (50\mu)/\{(100\mu/2)(0.8-0.4)^2\}$
$= 6.25$ [1]

$V_{GS1} = V_{GS2} = 0.8$ V [1]

$(W/L)_1 = I_{REF} / \{(k'_n/2)(V_{GS1} - V_{TN})^2\}$ [1]
$= (120\mu)/\{(100\mu/2)(0.8-0.4)^2\}$
$= 15.0$ [1]

$V_{GS3} = V^+ - V_{GS1} - V^- = 2.5 - 0.8 - 0 = 1.7$ V [1]

$(W/L)_3 = I_{REF} / \{(k'_n/2)(V_{GS3} - V_{TN})^2\}$ [1]
$= (120\mu)/\{(100\mu/2)(1.7-0.4)^2\}$
$= 1.42$ [1]

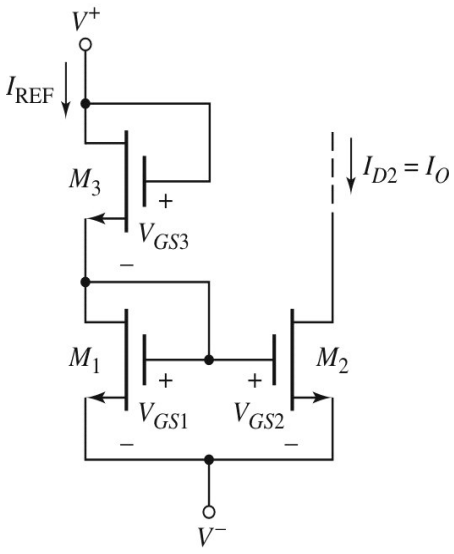

Figure 1