Third SPICE Exercise

Fundamentals Of Electronics - a.a. 2018-2019 - University of Padua (Italy)

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Contents

Chapter 1

Differential amplifier with MOS current source

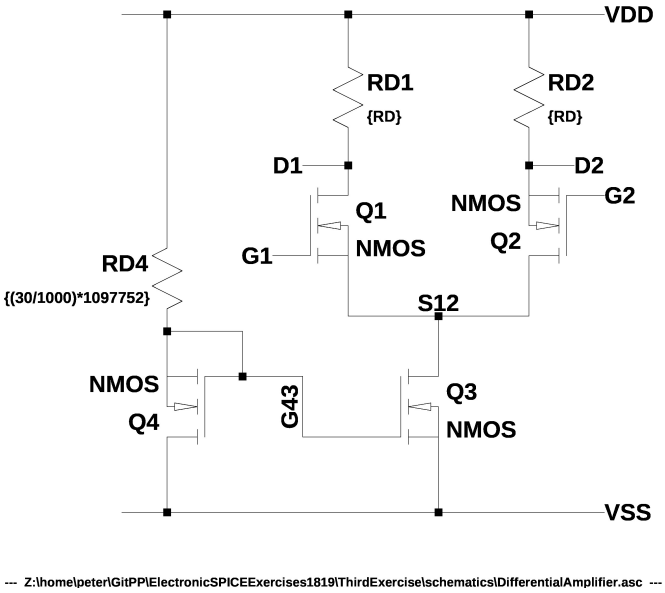

Figure 1.1: Differential amplifier with MOS current source

1.1 SPICE Operating Point analysis

```
* Differential Amplifier
********************************************************************************
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********************************************************************************

* Parameters
.param Vt = 0.5V
.param unCox = 200u
.param lambda = 0

.param W12 = 1.25u
```

```
.param L12 = 0.25u

.param W34 = 4.00u
.param L34 = 0.20u

.param RD = 20k

* NMOS model
.model NMOS NMOS VT0 = Vt KP = unCox LAMBDA = lambda

* Resistances
RD1 DDN D1  {RD}
RD2 DDN D2  {RD}
RD4 DDN G43 {(30/1000)*1097752}

* Transistors
MQ1 D1  G1  S12 S12 NMOS W=W12 L=L12
MQ2 S12 G2  D2  D2  NMOS W=W12 L=L12
MQ3 S12 G43 SSN SSN NMOS W=W34 L=L34
MQ4 SSN G43 G43 G43 NMOS W=W34 L=L34

* Voltage sources
VDD DDN 0 +3
VSS SSN 0 -3

* Initial conditions
.ic V(G1) = 0
.ic V(G2) = 0

* Analysis
.op

.END
```

```
      --- Operating Point ---

V(ddn):   3          voltage
V(d1):    3          voltage
V(d2):    2.56218    voltage
V(g43):   -2.39538   voltage
V(g1):    0          voltage
V(s12):   2.00589    voltage
V(g2):    0          voltage
V(ssn):   -3         voltage
Id(Mq4):             -0.000163831     device_current
Ig(Mq4):             0                device_current
Ib(Mq4):             0.00014194       device_current
Is(Mq4):             2.18912e-005     device_current
Id(Mq3):             2.18913e-005     device_current
Ig(Mq3):             0                device_current
Ib(Mq3):             -5.01589e-012    device_current
Is(Mq3):             -2.18912e-005    device_current
Id(Mq2):             -2.19023e-005    device_current
Ig(Mq2):             0                device_current
Ib(Mq2):             2.19023e-005     device_current
Is(Mq2):             5.56285e-013     device_current
Id(Mq1):             1.99822e-012     device_current
Ig(Mq1):             0                device_current
Ib(Mq1):             -1.00411e-012    device_current
Is(Mq1):             -9.9411e-013     device_current
I(Rd4):   0.000163831      device_current
```

```
I(Rd2):   2.18913e-005     device_current
I(Rd1):   1.99822e-012     device_current
I(Vss):   0.000185722      device_current
I(Vdd):   -0.000185722     device_current
```