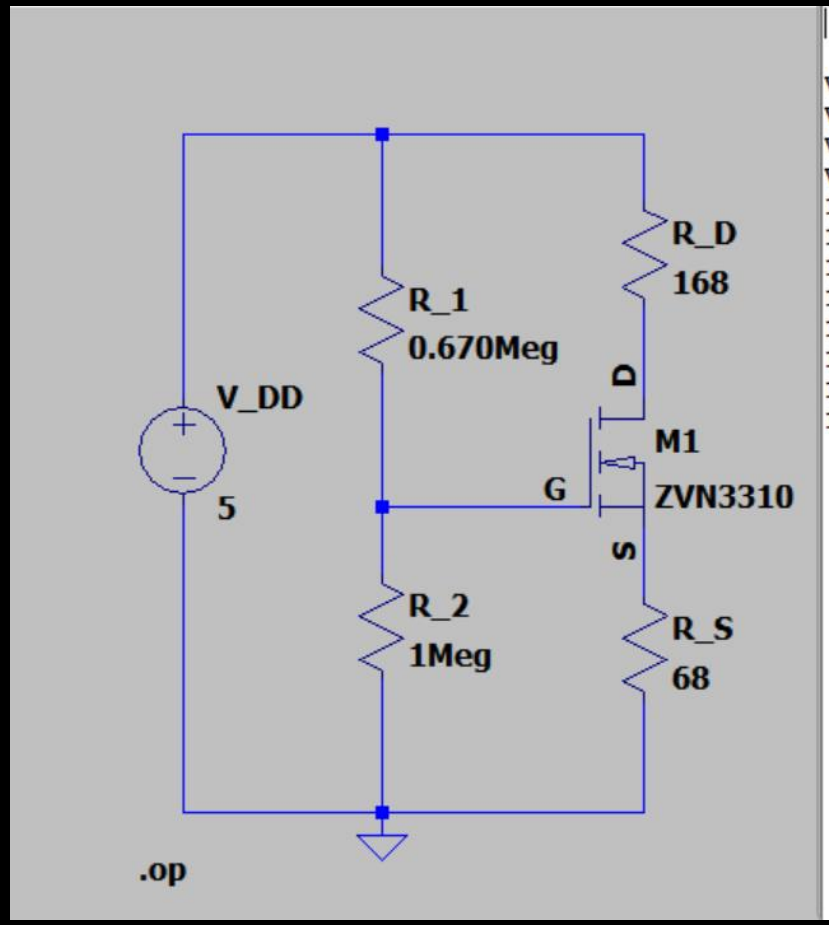
Exercise 13

- Two equations always apply to this circuit:
  - $I_D(R_D + R_S) = V_{DD} - V_{DS}$
  - $\frac{R_2}{R_1+R_2} V_{DD} = V_{GS} + I_D R_S$
- While changing the resistors, V_{GS} should stay from 1.8 to 2.4; $V_{DD} = 5V$. Also, according to the available resistors, we have $R_1 = 0.67M\Omega$, $R_2 = 1M\Omega$ and $R_D = 168\Omega$.
- Ideally, V_{DS} should be larger than $1V$ so it's guaranteed to stay in the "safe zone".

Exercise 13

- After simplifying things further, we have:
  - $2 + I_D R_S = 2.994$
  - $I_D(168 + R_S) = 5 - V_{DS}$
- One solution would be letting $R_S = 68\Omega$. Then we have
  - $I_D = 14.62mA$
  - $V_{DS} = 1.550V$

Exercise 13



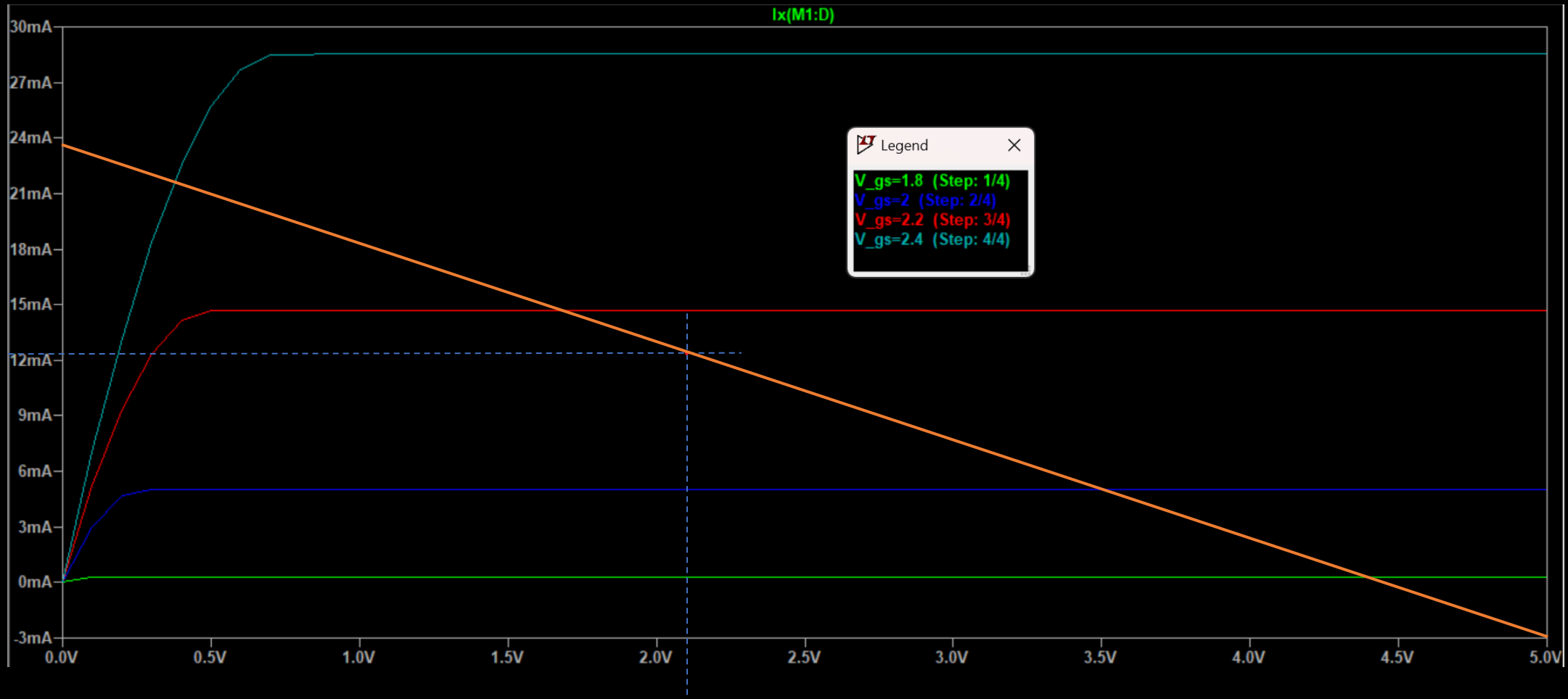

```
        --- Operating Point ---

V(d):           2.93484         voltage
V(s):           0.8359          voltage
V(g):           2.99401         voltage
V(n001):        5               voltage
I(R_s):         0.0122926       device_current
I(R_d):         0.0122926       device_current
I(R_1):         2.99401e-06     device_current
I(R_2):         2.99401e-06     device_current
I(V_dd):        -0.0122956      device_current
Ix(m1:3):       0.0122926       subckt_current
Ix(m1:4):       0               subckt_current
Ix(m1:5):       -0.0122926      subckt_current
```

Exercise 13

- Operating Point:
  - $V_{DS} = 2.09894V$
  - $I_D = 12.2926mA$

Exercise 13: Revision Acceptable



Exercise 13

- At time of submission, the circuit was unable to be built due to lack of equipment (ZVN3310 MOS FET)