

Jaeger 3rd edition  
problem 15.39

Notes on the PSpice simulation of a differential pair for common-mode (cm) and differential-mode (dm) behaviors.

Draw one breakout transistor and edit its model to approximate the requirements of the problem. Then copy it. Set up the dm circuit (left hand side of schematic); then copy again and set up cm circuit (right side). Use "VSINE" signal sources for a transient simulation. Set their amplitudes to reasonable small signal values. The dm amplitude was set for 10 mV<sub>peak</sub>, 1 kHz, with zero offset. The cm amplitude was set for 1 V<sub>peak</sub>, 1 kHz, zero offset. Run probe to get time domain plots of the interesting voltages and currents. Verify that no appreciable distortion is occurring. If there is excessive distortion, lower the amplitudes and try again, just as you would in the lab.

The PSpice simulation results can be measured by using the cursors to read out peak-to-peak values of the signals observed. The results are:

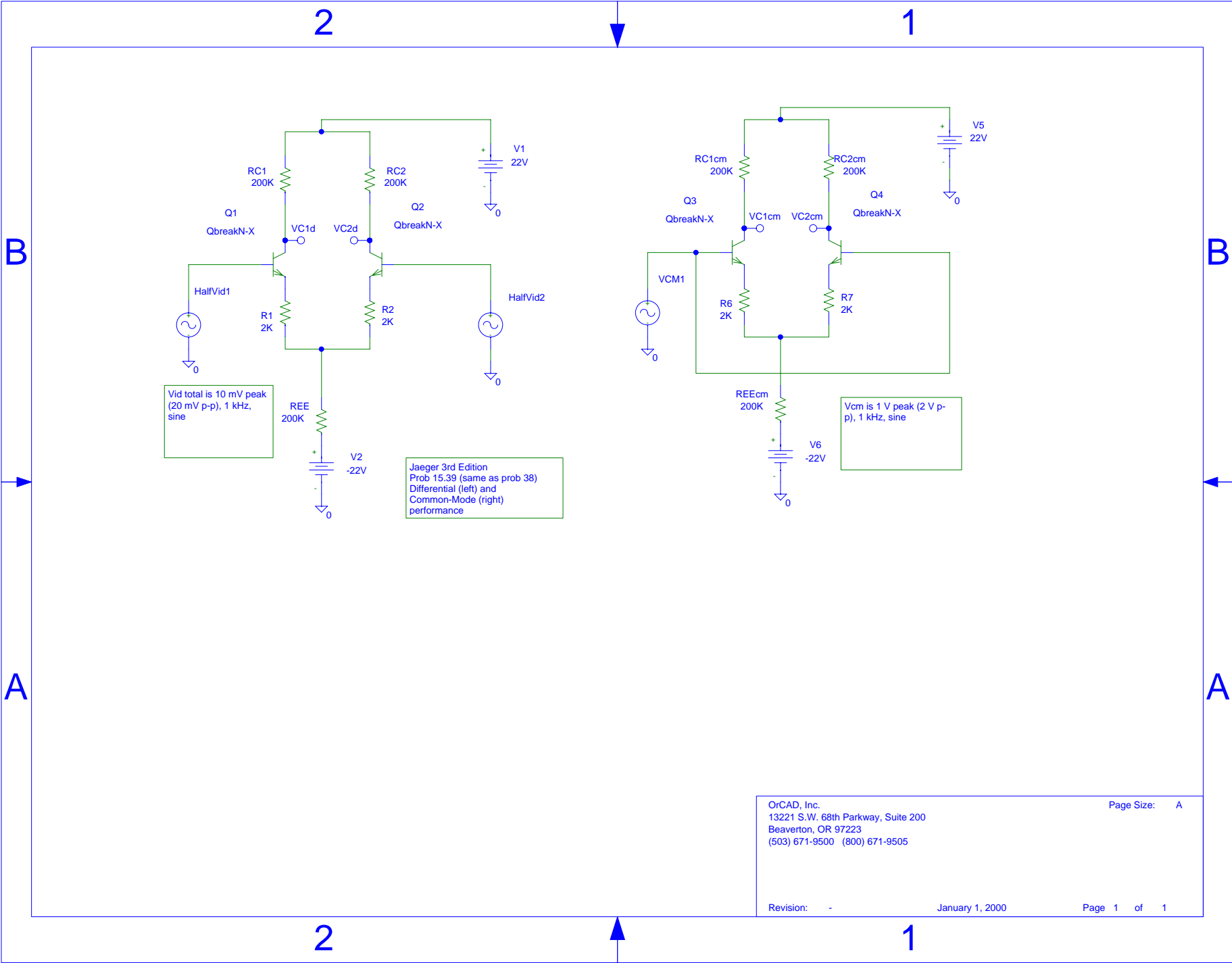
$$A_d = \frac{V_{C1,p-p}}{V_{d,p-p}} = \frac{800 \text{ mV}_{p-p}}{20 \text{ mV}_{p-p}} = \pm 40$$

$$R_{id} = \frac{V_{d,p-p}}{I(V_d)_{p-p}} = \frac{20 \text{ mV}_{p-p}}{26 \text{ nA}_{p-p}} = 770 \text{ k}\Omega$$

$$A_{cm} = \frac{V_{C1,p-p}}{V_{cm,p-p}} = -\frac{990 \text{ mV}_{p-p}}{2 \text{ V}_{p-p}} = -0.50$$

$$R_{icm} = \frac{V_{cm,p-p}}{I(V_{cm})_{p-p}} = \frac{2 \text{ V}_{p-p}}{66 \text{ nA}_{p-p}} = 30 \text{ M}\Omega$$

These values are in excellent agreement with those computed by hand in prob 15.38.

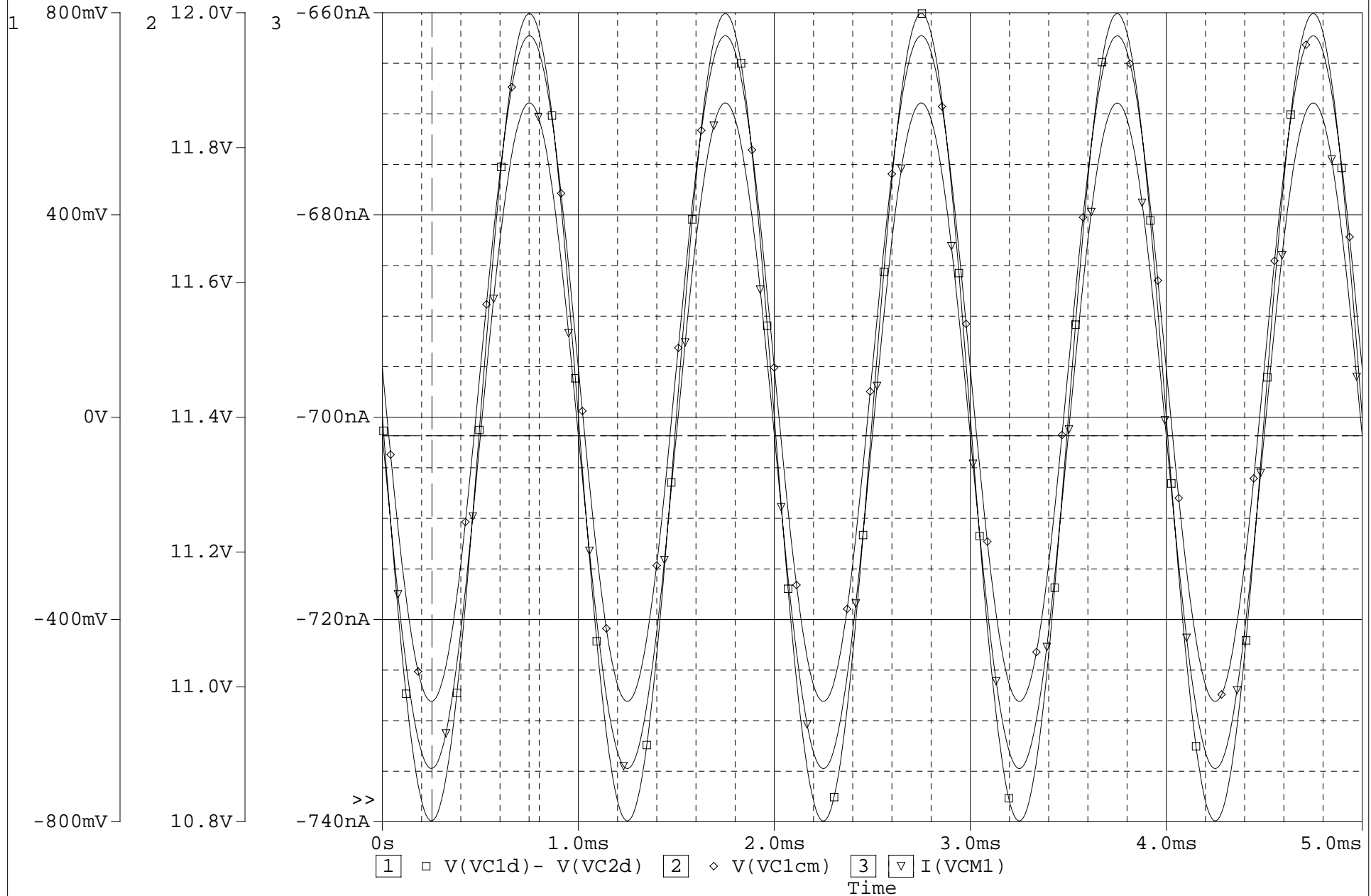


Vid total is 10 mV peak  
(20 mV p-p), 1 kHz,  
sine

Jaeger 3rd Edition  
Prob 15.39 (same as prob 38)  
Differential (left) and  
Common-Mode (right)  
performance

Vcm is 1 V peak (2 V p-  
p), 1 kHz, sine

(A) prob1539.dat



A1: (748.252u, -701.830n) A2: (252.815u, -701.830n) DIFF(A): (495.437u, 0.000)