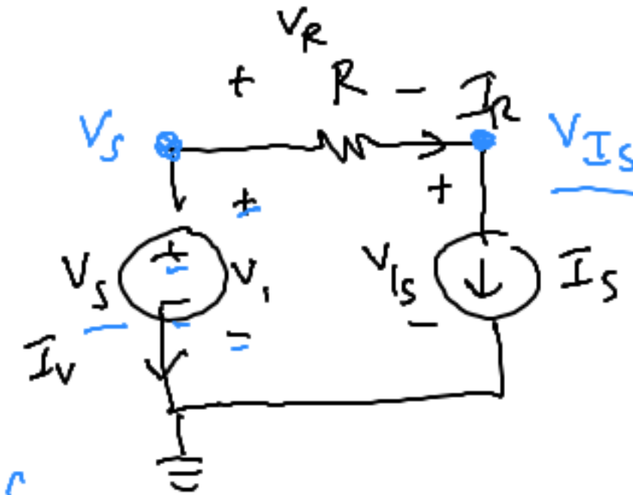
EECS DIS 3D

① Power: Example of a case where sources can **absorb** power ←

② How to model 2-D touchscreens
→ How to translate physical models into a schematic

③ If time: Resistor equivalence (Practice)

Objective: Find power of each element



$V_S = 5V$
$R = 5\Omega$
$I_S = \frac{1}{2}A$

KVL

$-V_1 + V_R + V_{I_S} = 0$

$V_{I_S} = V_1 - V_R$

$= V_S - I_R R = V_S - I_S R$

$5V - \frac{1}{2}A \; 5\Omega$

✓ $I_R = I_S$? (KCL) at node top right

$V_{I_S} = 2.5V$ ✓

$V_R = 2.5V$

$V_1 = 5V$

$I_S = \frac{1}{2}A$

$I_R = \frac{1}{2}A$

$I_V = -\frac{1}{2}A$

↓ (KCL @ left node: $I_V + I_R = 0$)

$P_{V_S} = -2.5W$ $(V_1)(I_V)$

$P_R = 1.25W$ $(V_R)(I_R)$

$P_{I_S} = 1.25W > 0$ $(V_{I_S})(I_S)$

2D Touchscreen: How to translate physical models to circuit diagram

(a)

$R = \rho \frac{L}{A}$ ←

↑ resistivity

Rx ←

Ry ←

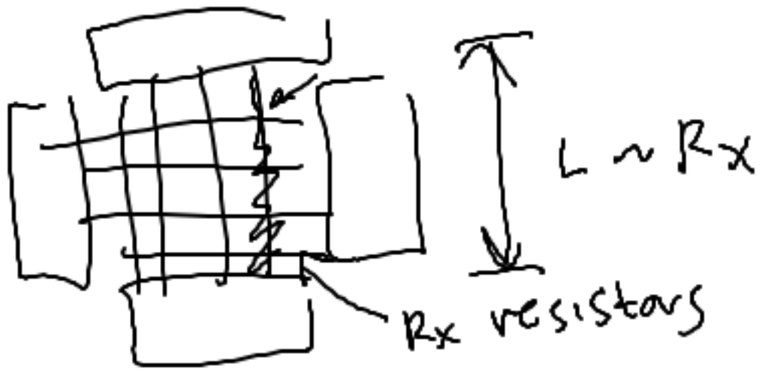
Does Rx go **vertically** or horizontally?

Ry → **horizontally**

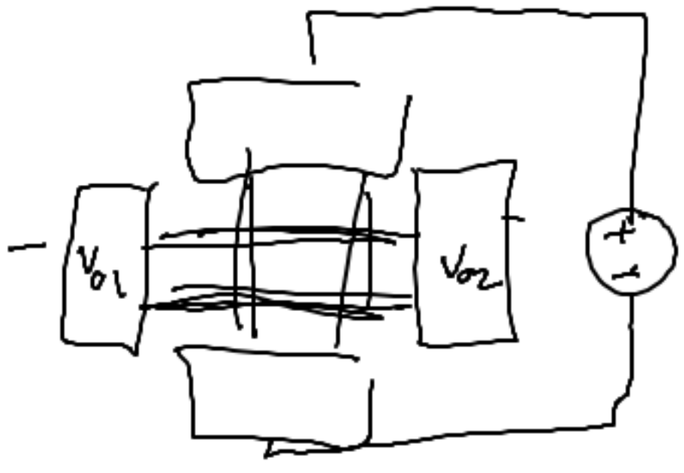
ρ_x, ρ_y

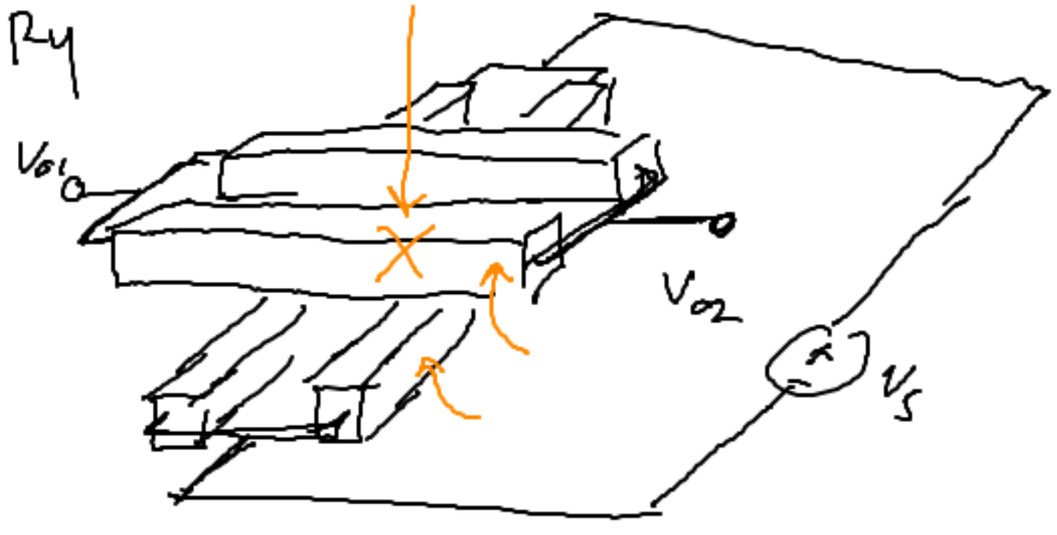
$R_x = \rho_x \frac{L}{A}$

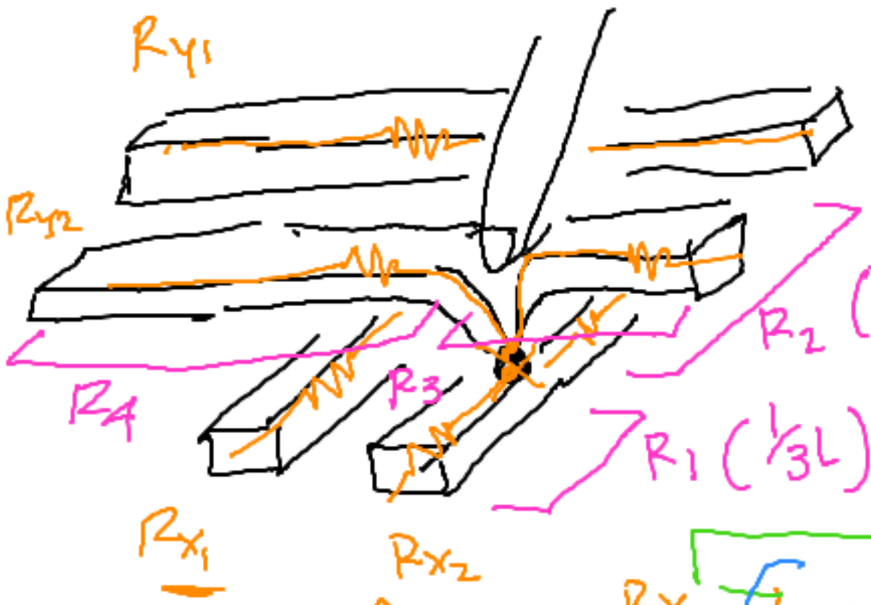
$R_y = \rho_y \frac{W}{A}$ ⇐



(b)



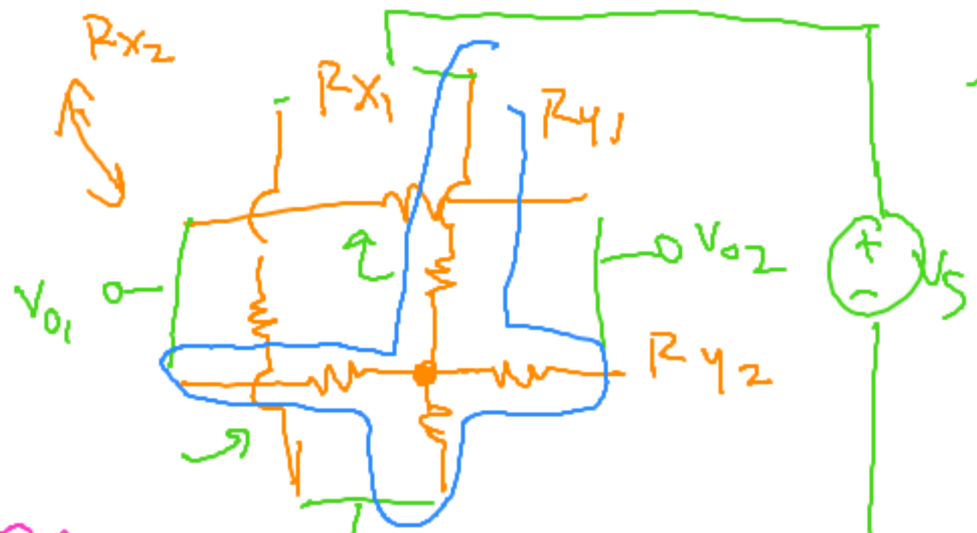


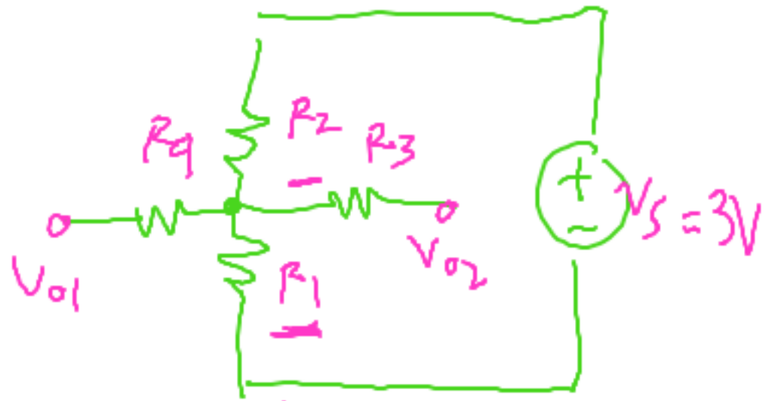


R_{y1} – not affected, single R_y

R_{x1} – not affected, single R_x

R_{y2}, R_{x2} – break up into two





$R_x = R_y = 2k\Omega$

R_{y1} – doesn't matter
no current

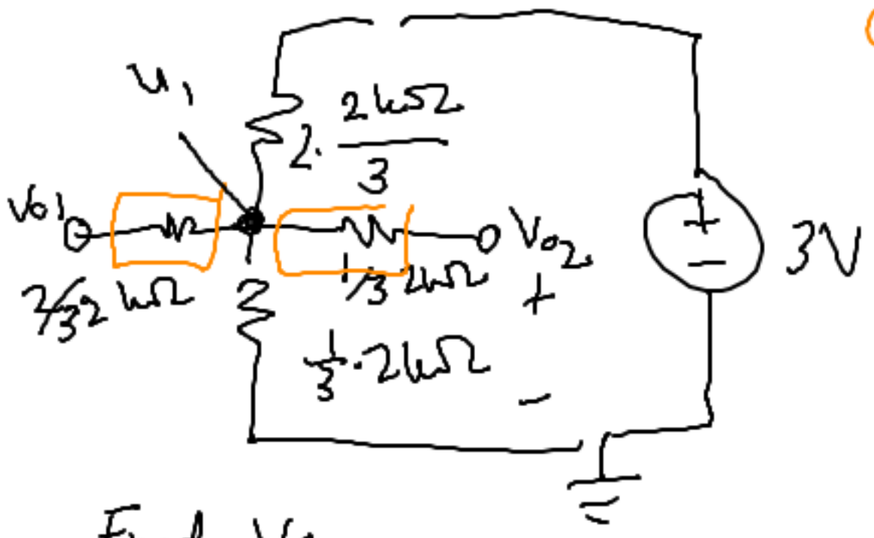
R_{x1} – doesn't matter
→ doesn't change voltage drop

$$R_1 = \rho_x \frac{1/3}{A} = \frac{1}{3} R_x$$

$$R_2 = \rho_x \frac{2/3 L}{A} = \frac{2}{3} R_x$$

$$R_3 = \rho_y \frac{1/3 W}{A} = \frac{1}{3} R_y$$

$$R_4 = \rho_y \frac{2/3 W}{A} = \frac{2}{3} R_y$$



Find V_{o2}

Current through these?

→ No current

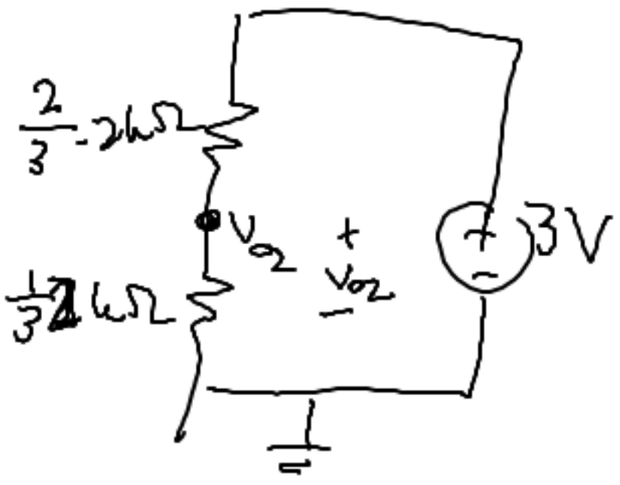
→ Open circuits (no path from V_{o1}, V_{o2} to other location)

$v_1 - V_{o_2} = IR$ $\left(R = \frac{1}{3}\cdot 2k\Omega\right)$

$I = 0$ (right $\frac{1}{3}$ 2kΩ resistor is a Dangling resistor)

$v_1 - V_{o_2} = 0$

$v_1 = V_{o_2}$



$$V_{o_2} = \frac{R_{bot}}{R_{bot} + R_{top}} V_S$$

$$= \frac{\frac{1}{3}\ 2k\Omega}{\frac{1}{3}2k\Omega + \frac{2}{3}2k\Omega}\ 3V$$

$$= \frac{1}{3}\ 3V = 1V \checkmark$$

If you touch @ a diff. location, schematic the same?

No: diff. touch point → different lengths, different resistors involved connected in different ways

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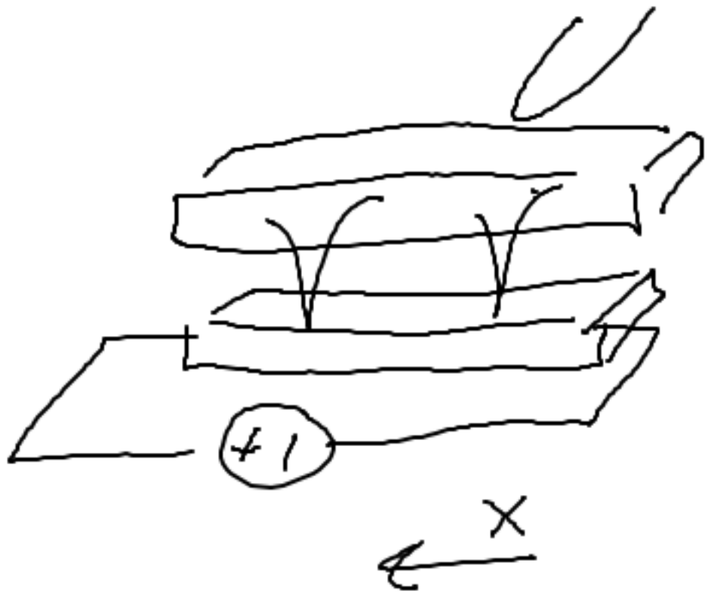
1D - vs - 2D touchscreen (Extra)



Q: What is the difference between 1-D TS & 2-D TS if both give us a voltage divider?

2D touchscreens are just 1D along X, 1D along Y, rapidly switch between to measure (x, y) before our finger is lifted