LECTURE 13

- Review of Midterm results
- Review of Load-line method
- Extension of Load-line method to 3-terminal devices
- Further discussion of “bad” circuits, that is circuits that violate KCL, KVL, or lead to infinite currents or voltages.

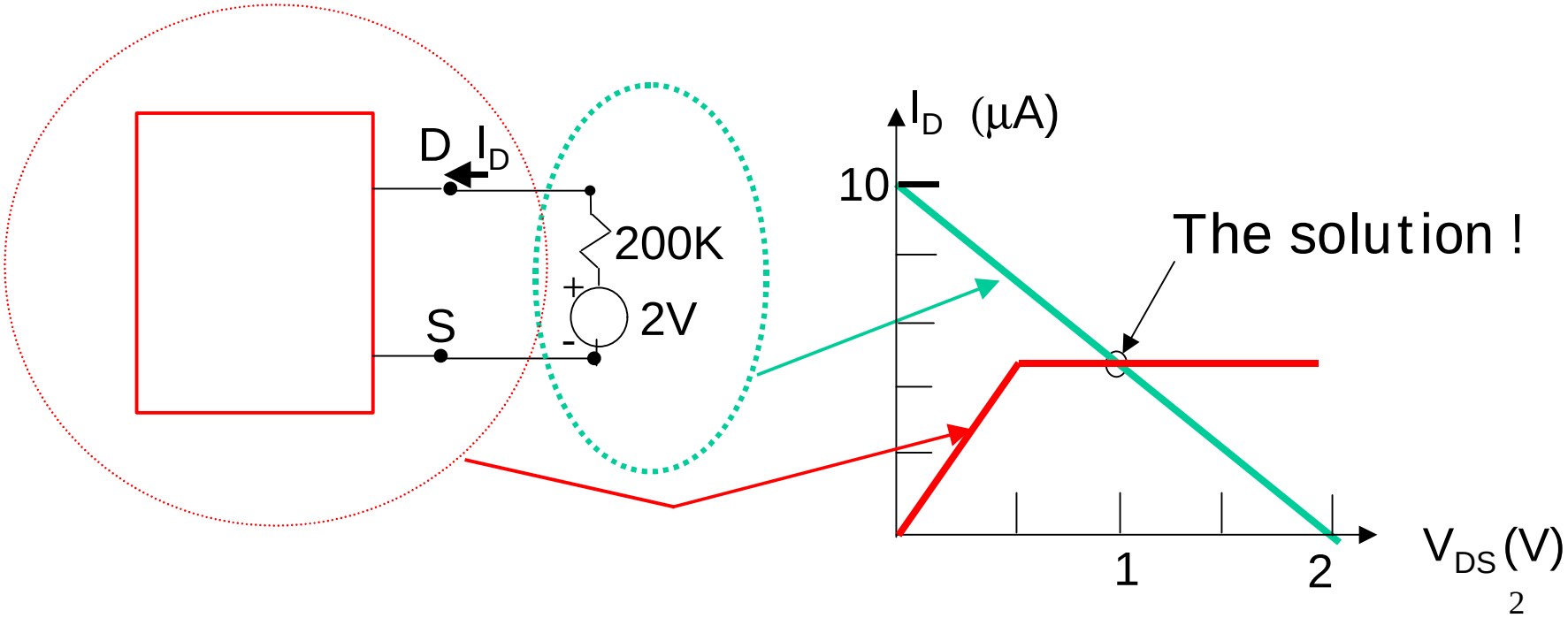
Graphical solutions for nonlinear devices

Given the graphical properties of two terminal non-linear circuit (i.e. the graph of a two terminal device)

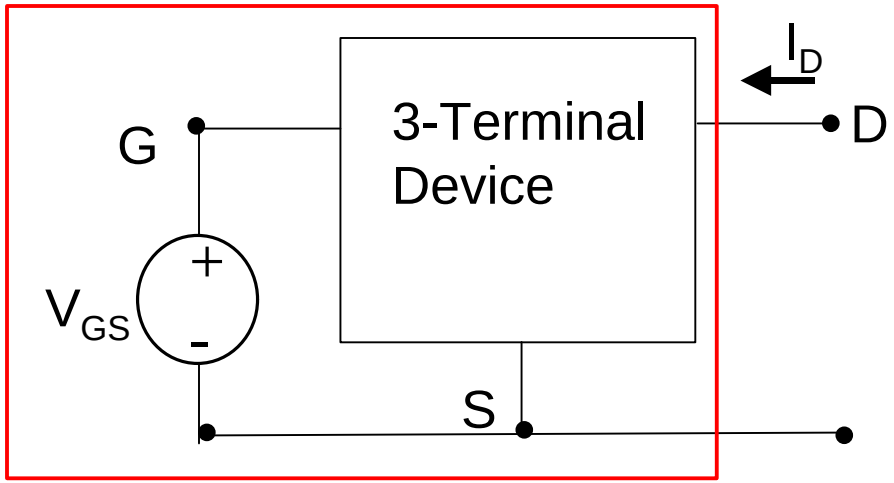
And have this connected to a linear (Thevenin circuit)

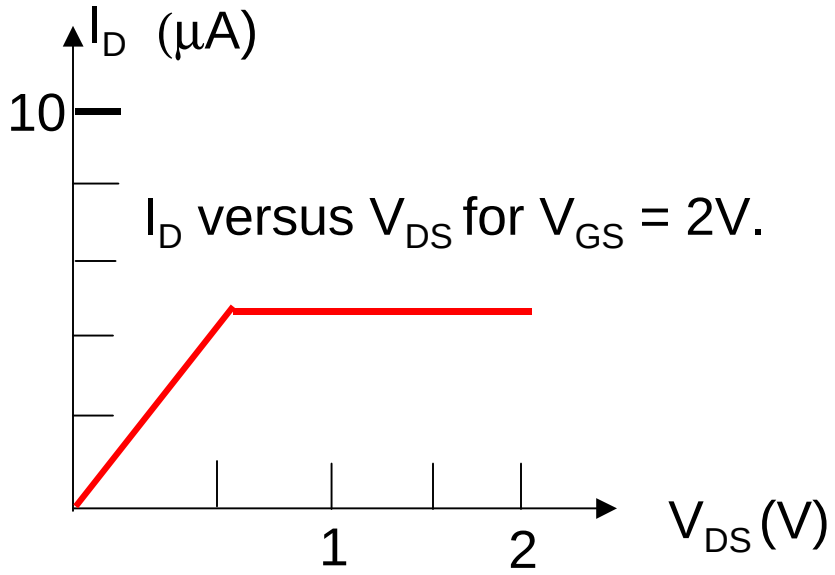
Which can also be graphed on the same axes

Application of KCL, KVL gives circuit solution



Three-Terminal Device Graphs





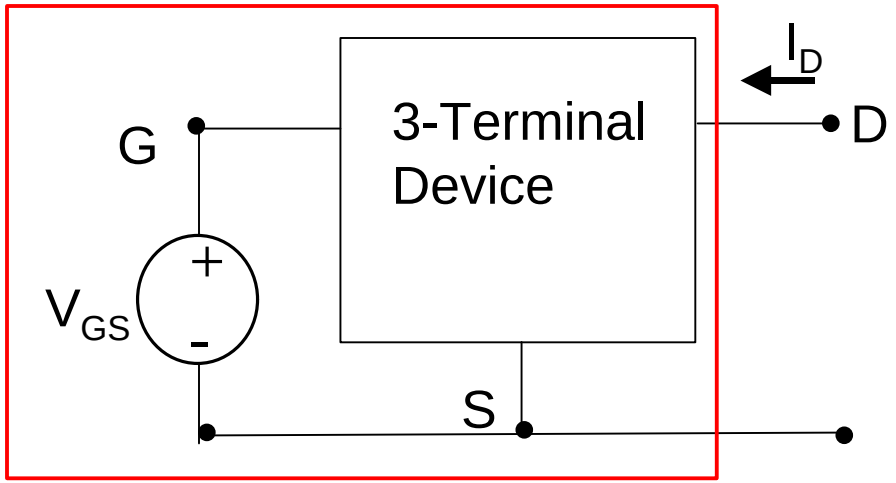
Concept of 3-Terminal Device Graphs:

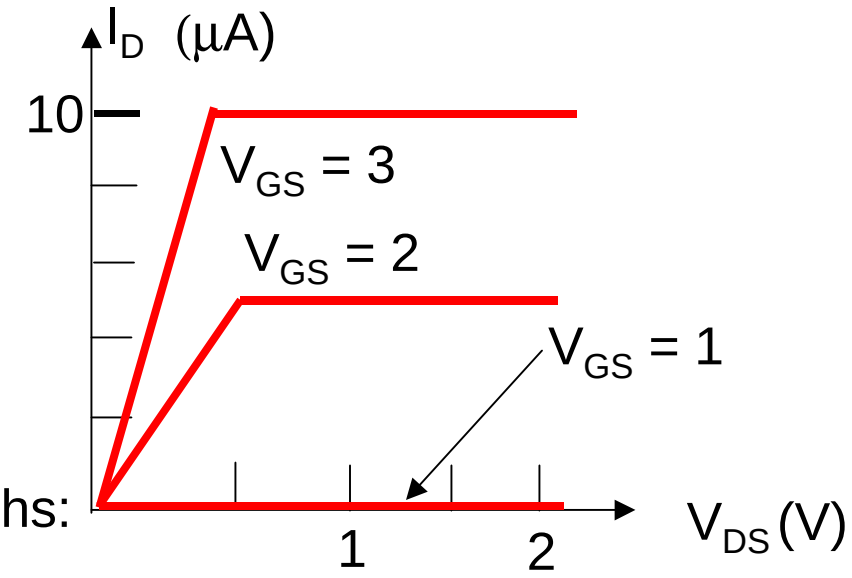
We set a voltage (or current) at one set of terminals (here we will apply a fixed V_{GS} of 2V)

and conceptually draw a box around the device with only two terminals emerging

So we can again plot the two-terminal characteristic (here I_D versus V_{DS}).

Three-Terminal Parametric Graphs





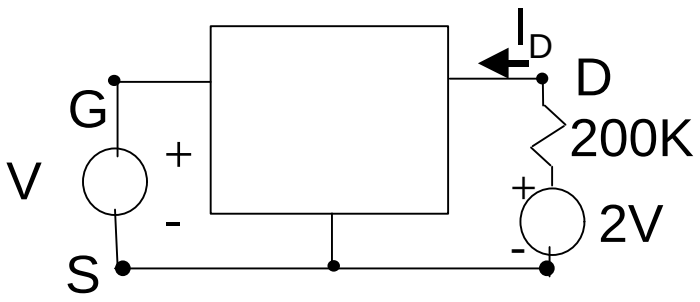
Concept of 3-Terminal Parametric Graphs:

We set a voltage (or current) at one set of terminals (here we will apply a fixed V_{GS})

and conceptually draw a box around the device with only two terminals emerging so we can again plot the two-terminal characteristic (here I_D versus V_{DS}).

But we can do this for a variety of values of V_{GS} with the result that we get a family of curves.

Graphical Solutions for 3-Terminal Devices

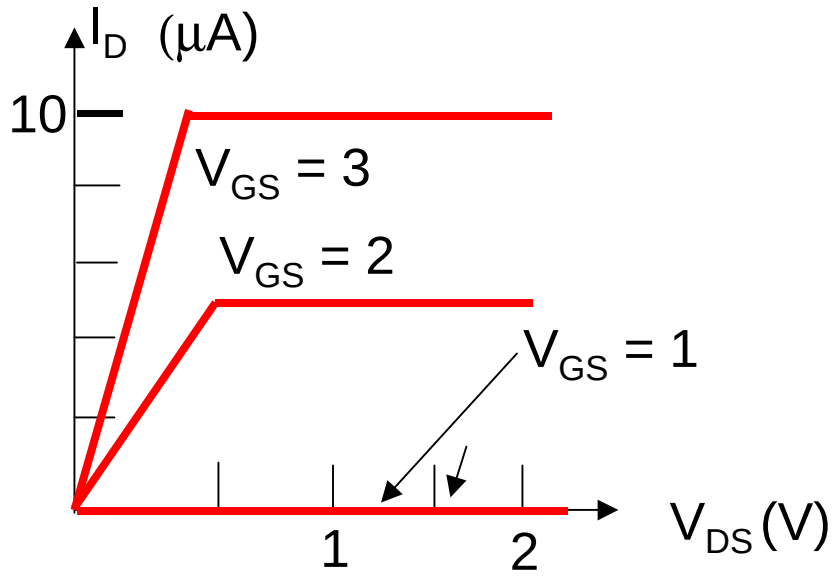


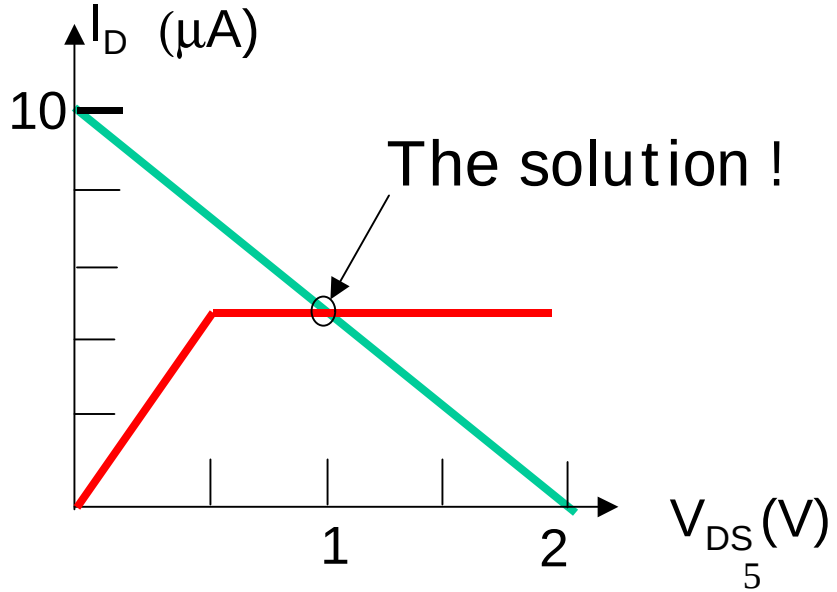
We can only find a solution for one input (V_{GS}) at at time:

First select V_{GS} (e.g. 2V) and draw I_D vs V_{DS} for the 3-Terminal device.

Now draw I_D vs V_{DS} for the 2V - 200KΩ Thevenin source.

The only point on the I vs V plane which obeys KCL and KVL is $I_D = 5\mu A$ at $V_{DS} = 1V$.





Review of "BAD" Circuits

What are "BAD" circuits:

1) Circuits which disobey KVL

2) Circuits which disobey KCL

3) Circuits which lead to infinite currents or voltages

(for example capacitors switched to a short or a fixed V or to another C)

See blackboard examples