An NMOS Enhancement FET is a FOUR terminal device!

Moreover, each terminal has a specific name:

1. Source (S)
2. Drain (D)
3. Gate (G)
4. Body (B)

Each terminal is associated with a metal electrode that is attached to the semiconductor device.

* The Body electrode is connected directly to the p-type substrate.
* Two heavily doped \( n \)-type “wells” are implanted into the \( p \)-type substrate. The Source and Drain electrodes are each connected to one of these \( n^+ \) wells.

* The region between these \( n^+ \) wells is called the channel. The channel has two important geometries—channel width \( W \), and channel length \( L \).

* Typical values for channel length \( L \) are 0.1 to 3 \( \mu \)m (1 \( \mu \)m is 0.001 millimeter!), while channel width \( W \) is typically 0.2 to 100 \( \mu \)m.

* The Gate electrode rests on top of the channel, but is not connected directly to it. Instead, the channel and gate electrode are separated by a thin (e.g., 2-5 nm) layer of Silicon Dioxide (\( SiO_2 \)).

* Silicon Dioxide is essentially glass! Glass is a very good insulator—thus, no current can flow from the gate into the MOSFET device!

* Thus, the Silicon Dioxide layer is sandwiched between the metal Gate electrode and the \( p \)-type channel. It is these three materials that give the MOSFET its name—Metal (Gate electrode) Oxide (\( SiO_2 \)) Semiconductor (\( p \)-type channel) FET.