

E_T-MOSFET

MOSFET DC BIASING

prepared by:

Gyro A. Madrona

Electronics Engineer

TOPIC OUTLINE

E-MOSFET Construction

Regions of Operation

E-MOSFET DC Biasing

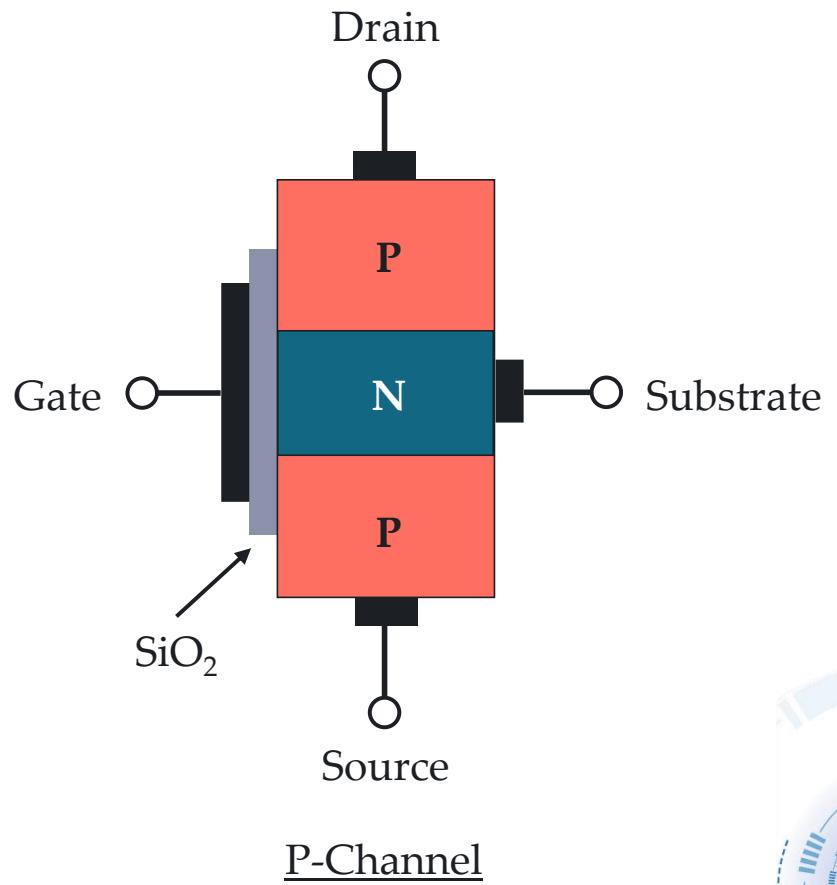
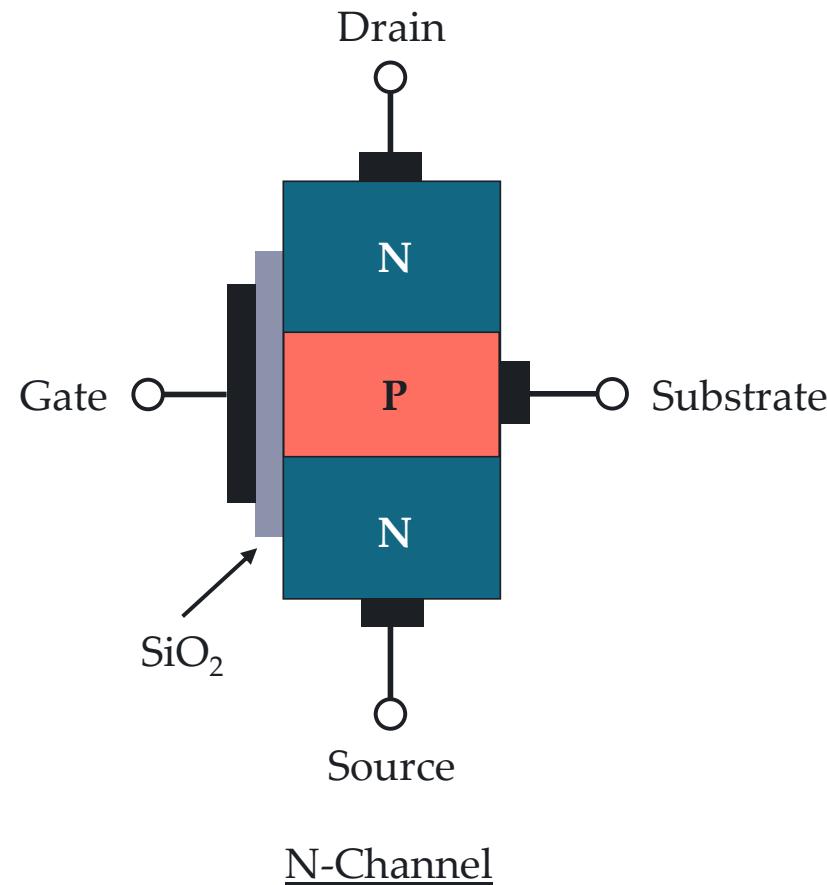


E-MOSFET CONSTRUCTION

CONSTRUCTION

E-MOSFET

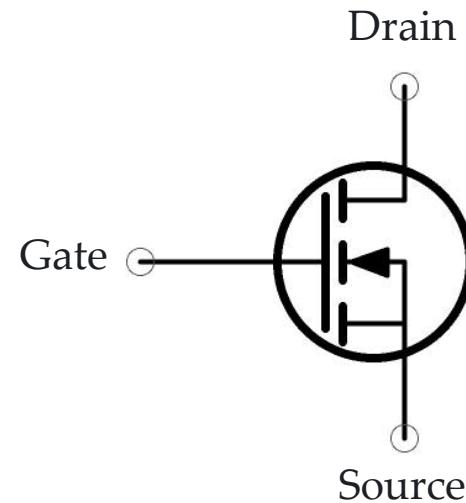
Enhancement Mode Metal-Oxide Semiconductor Field-Effect Transistor



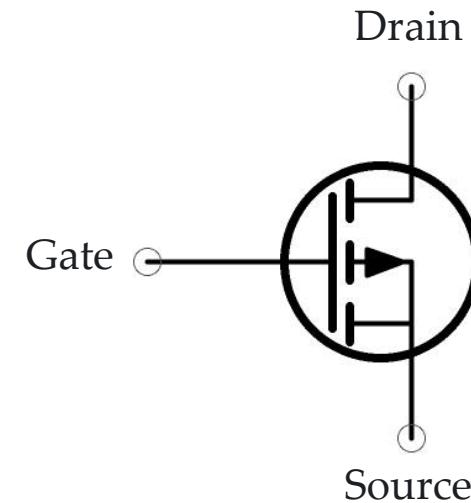
SCHEMATIC SYMBOL

E-MOSFET

Enhancement Mode Metal-Oxide Semiconductor Field-Effect Transistor



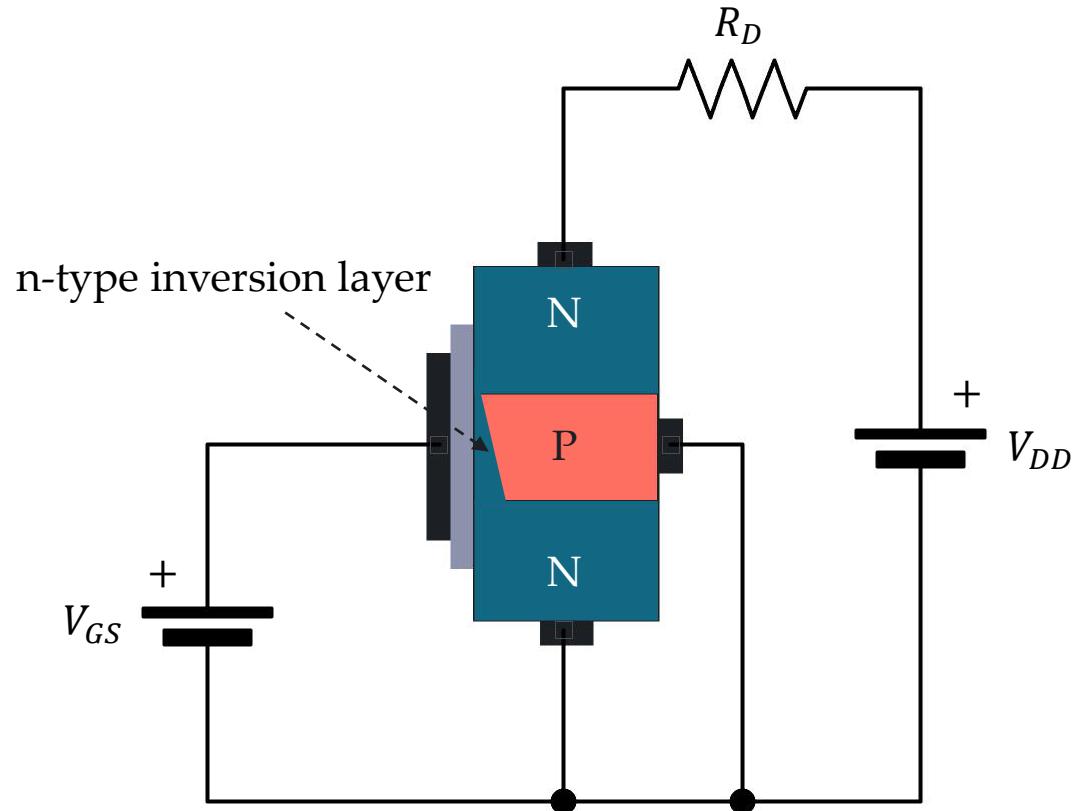
N-Channel



P-Channel

REGIONS OF OPERATION

N-TYPE INVERSION LAYER



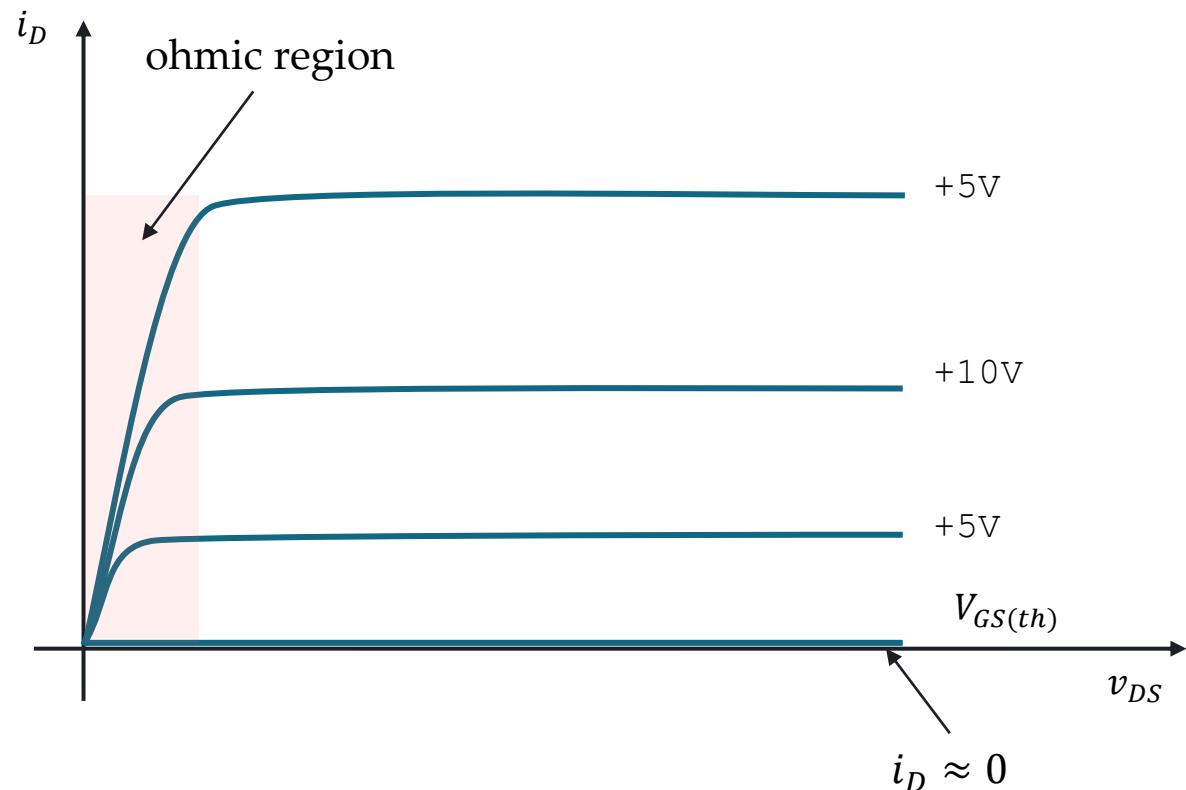
E-MOSFET is normally off

N-type inversion layer

A thin conducting layer near the silicon dioxide.

The minimum voltage that creates the n-type inversion layer is called the threshold voltage $V_{GS(th)}$ (1 to 3V for small-signal devices).

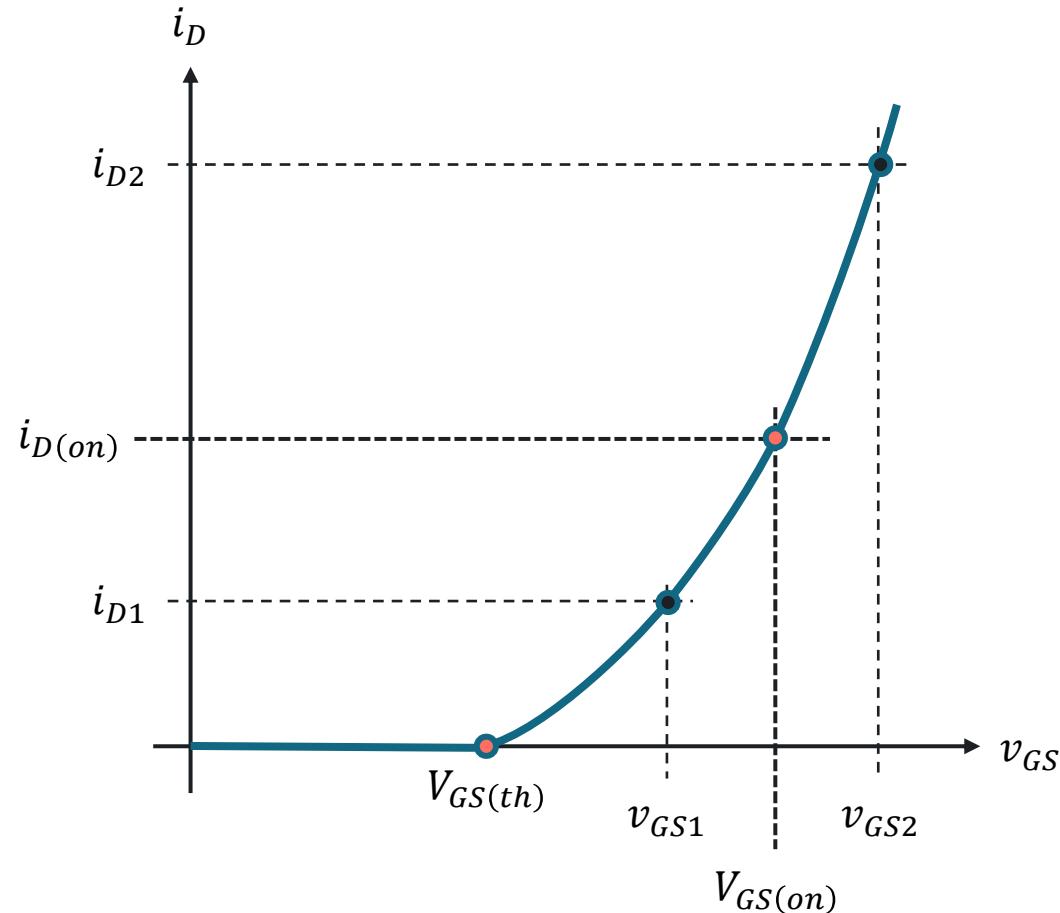
DRAIN CURVE



E-MOSFET is mainly used to operate in the **ohmic region** (switching device).

When v_{GS} is less than $v_{GS(th)}$, the drain current is approximately zero.

TRANSCONDUCTANCE CURVE



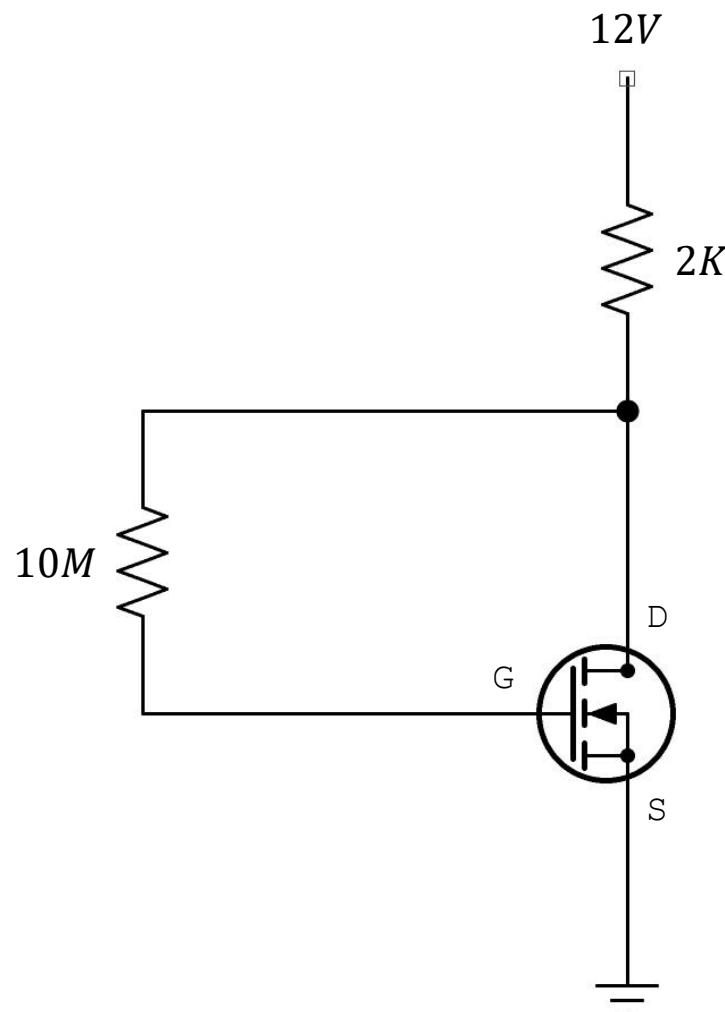
Drain current

$$i_D = k(v_{GS} - V_{GS(th)})^2$$

$$k = \frac{i_{D(on)}}{(v_{GS(on)} - V_{GS(th)})^2}$$

E_T-MOSFET DC BIASING

EXERCISE



$$i_{D(on)} = 6 \text{ mA}$$

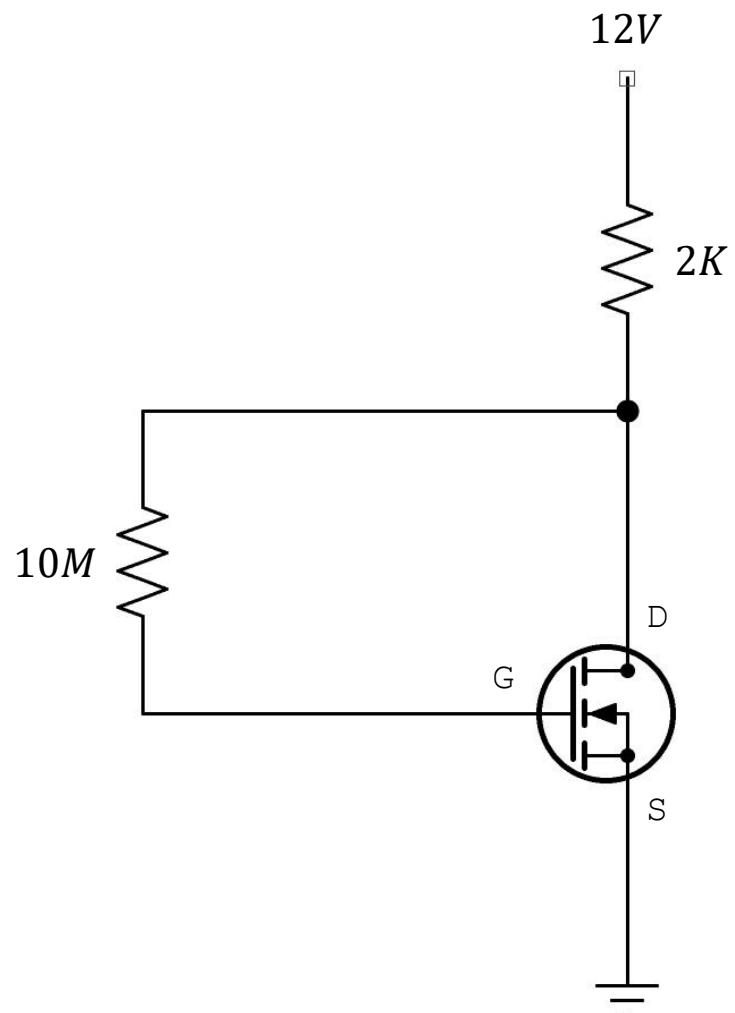
$$v_{GS(on)} = 8 \text{ V}$$

$$v_{GS(TH)} = 3 \text{ V}$$

For the given drain-feedback biasing arrangement, determine i_{DQ} and v_{DSQ} for the enhancement-type MOSFET. Sketch the transfer characteristics for $v_{GS} = 5\text{V}$ and $v_{GS} = 10\text{V}$.

EXERCISE

Solution



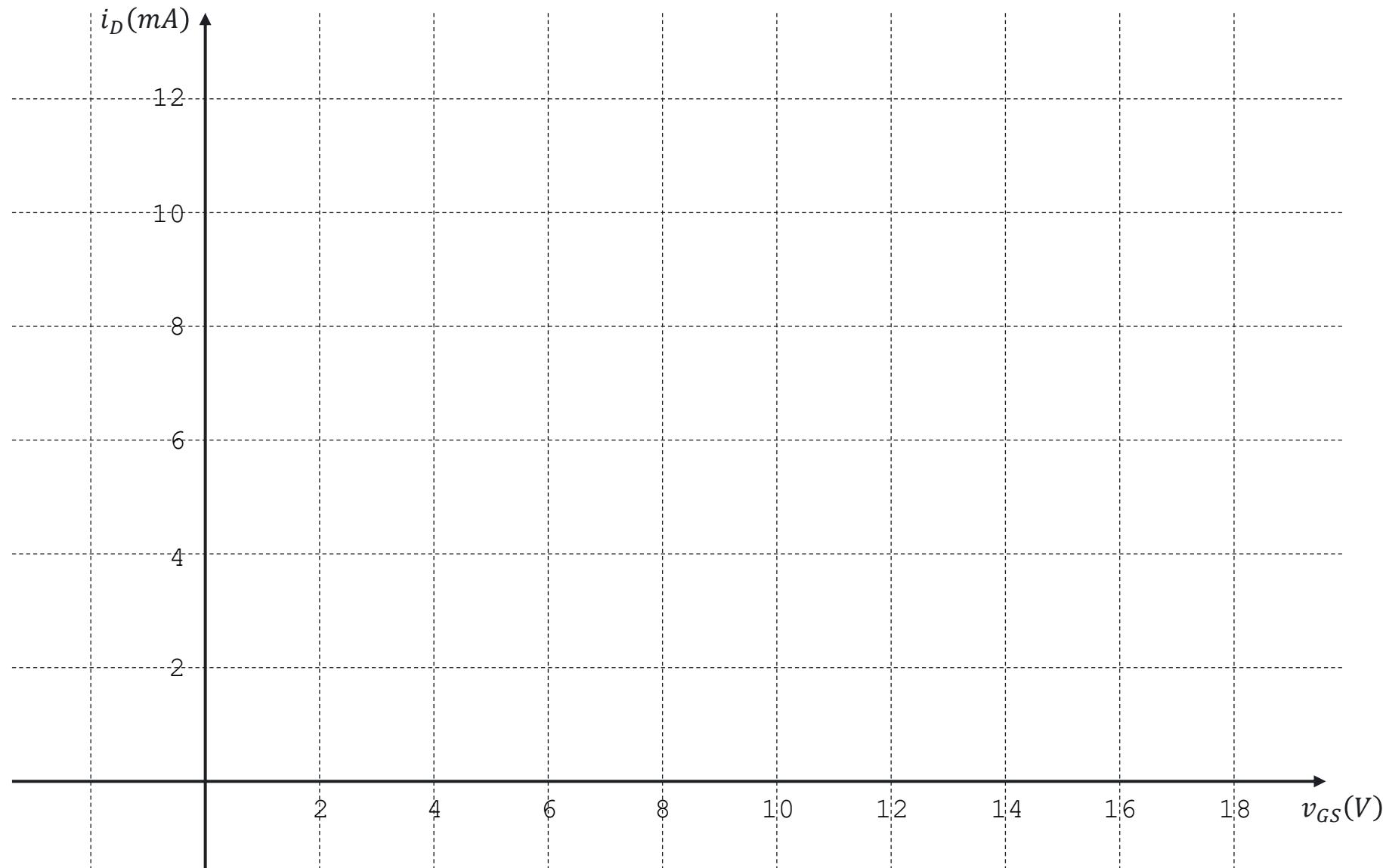
$$i_{D(on)} = 6 \text{ mA}$$

$$v_{GS(on)} = 8 \text{ V}$$

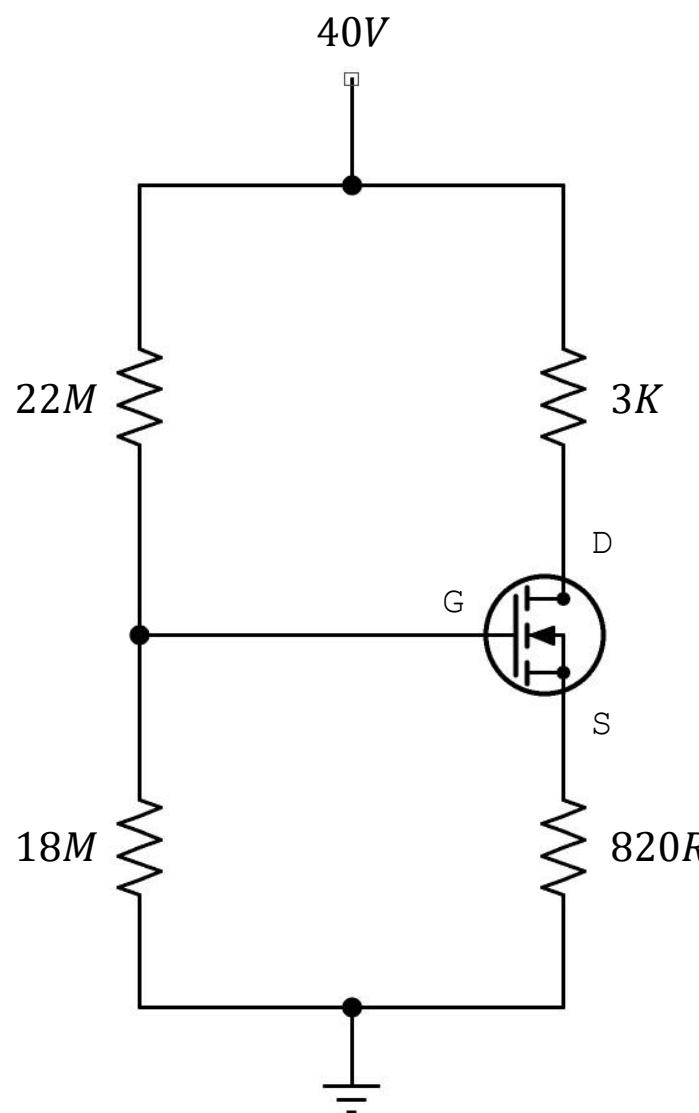
$$v_{GS(TH)} = 3 \text{ V}$$



TRANSFER CHARACTERISTICS



EXERCISE



$$i_{D(on)} = 3 \text{ mA}$$

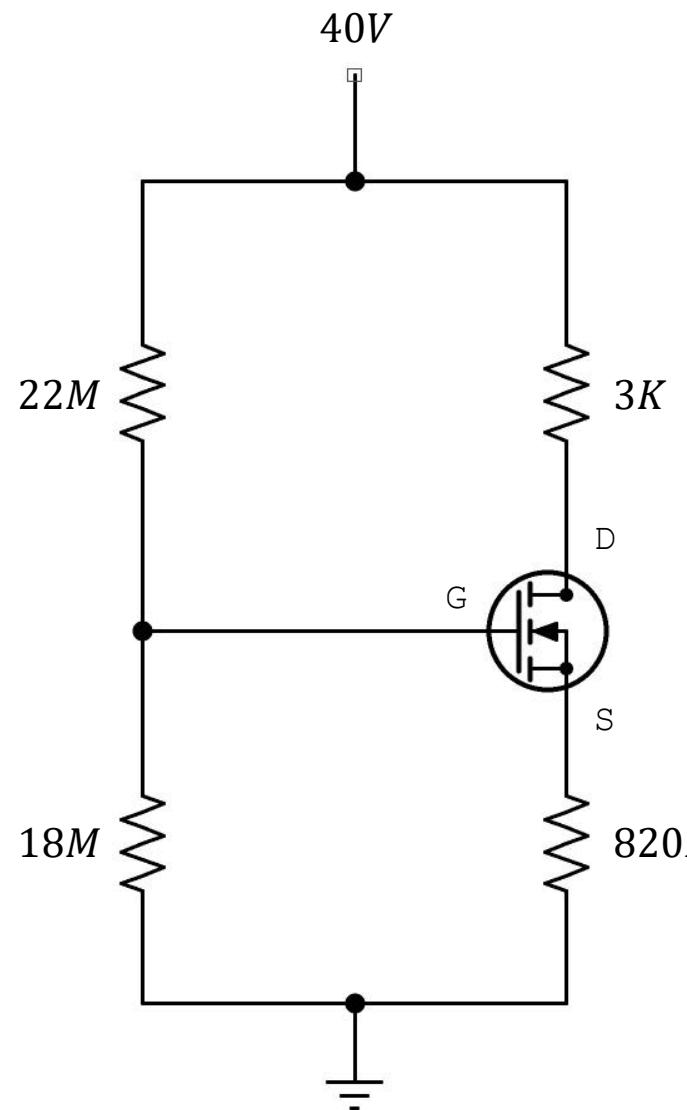
$$v_{GS(on)} = 10 \text{ V}$$

$$v_{GS(TH)} = 5 \text{ V}$$

For the given voltage-divider biasing arrangement, determine i_{DQ} , v_{GSQ} and v_{DSQ} for the enhancement-type MOSFET. Sketch the transfer characteristics for $v_{GS} = 8 \text{ V}$ and $v_{GS} = 15 \text{ V}$.



EXERCISE



Solution

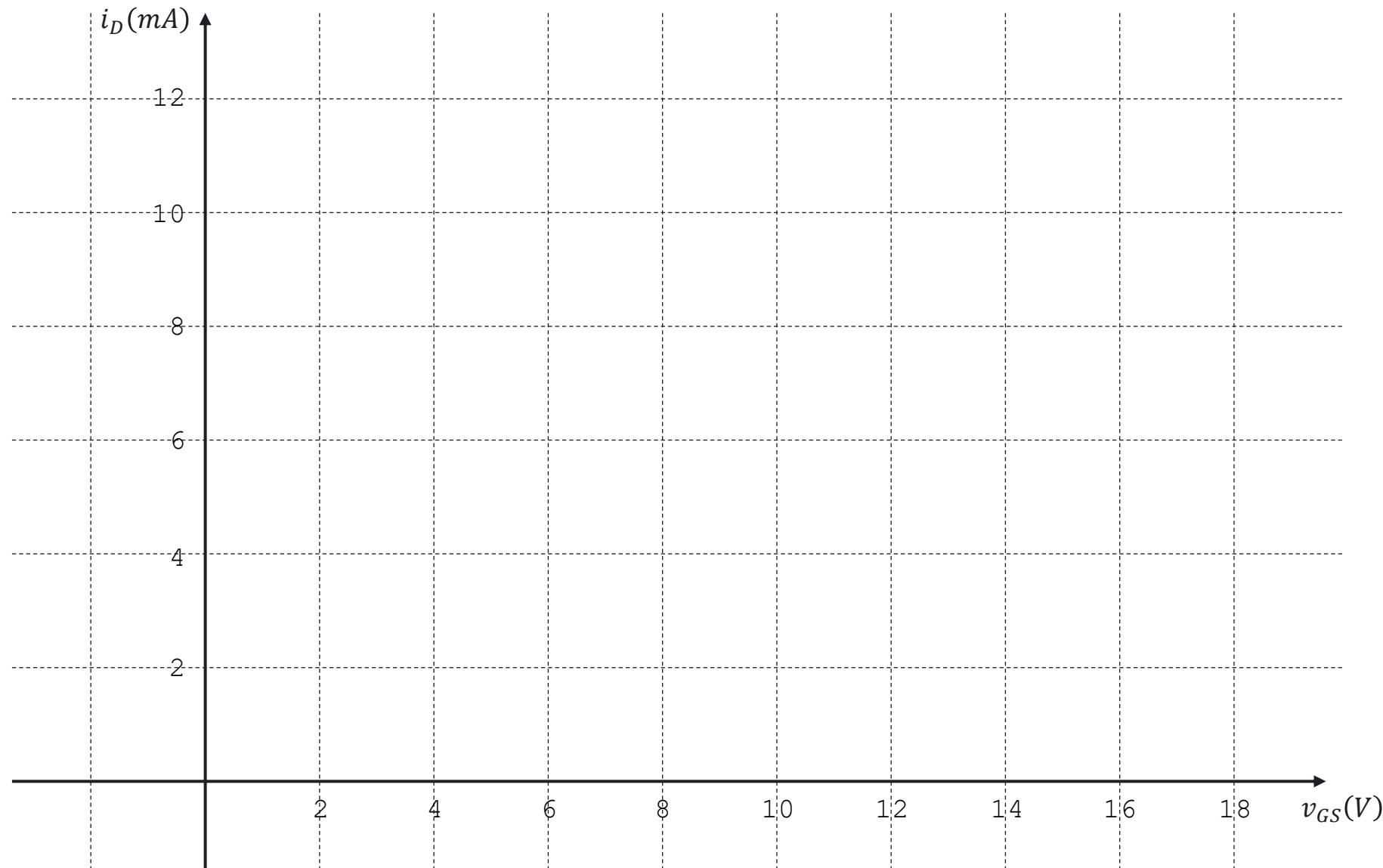
$$i_{D(on)} = 3 \text{ mA}$$

$$v_{GS(on)} = 10 \text{ V}$$

$$v_{GS(TH)} = 5 \text{ V}$$



TRANSFER CHARACTERISTICS



LABORATORY