E-MOSFET

MOSFET DC BIASING

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TOPIC OUTLINE

E-MOSFET Construction

Regions of Operation

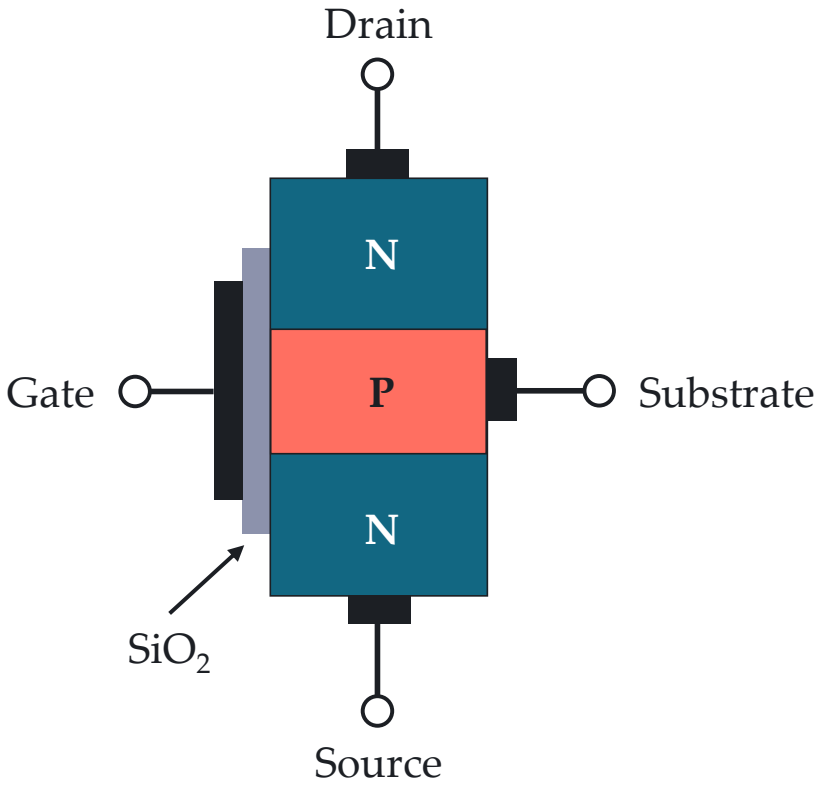
E-MOSFET DC Biasing

E-MOSFET CONSTRUCTION

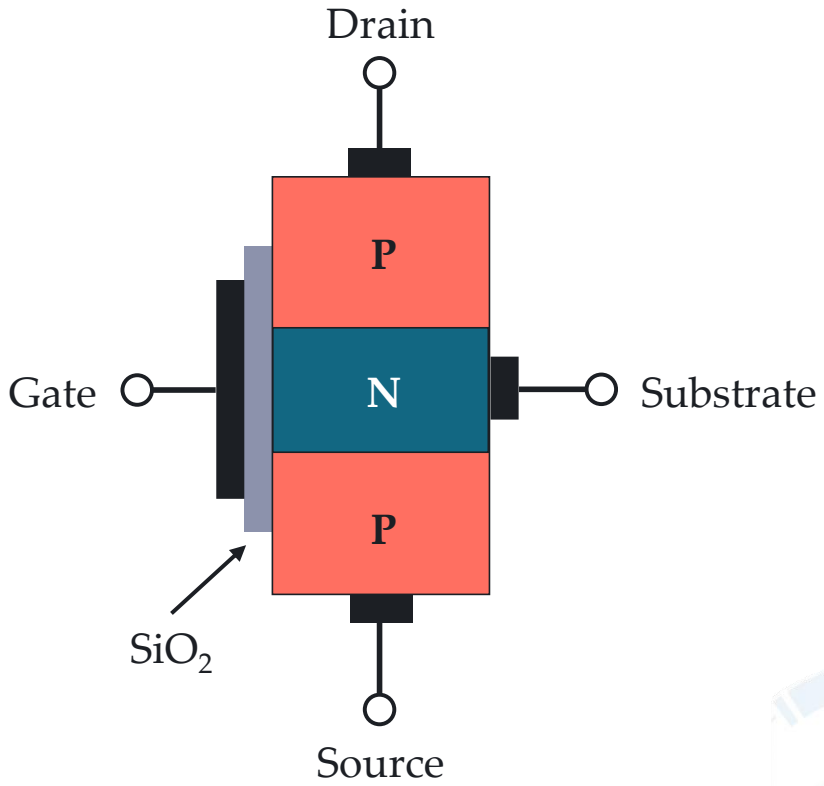
CONSTRUCTION

E-MOSFET

Enhancement Mode Metal-Oxide Semiconductor Field-Effect Transistor



N-Channel

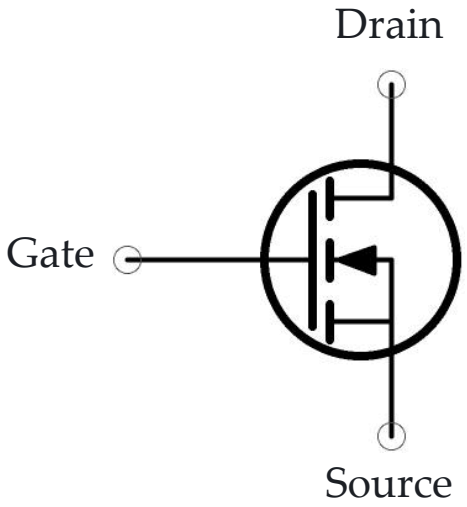


P-Channel

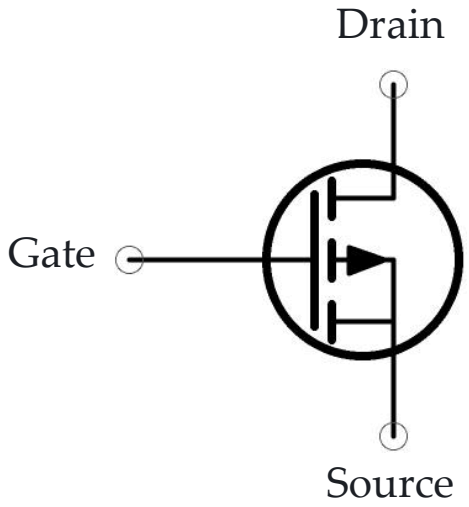
SCHEMATIC SYMBOL

E-MOSFET

Enhancement Mode Metal-Oxide Semiconductor Field-Effect Transistor



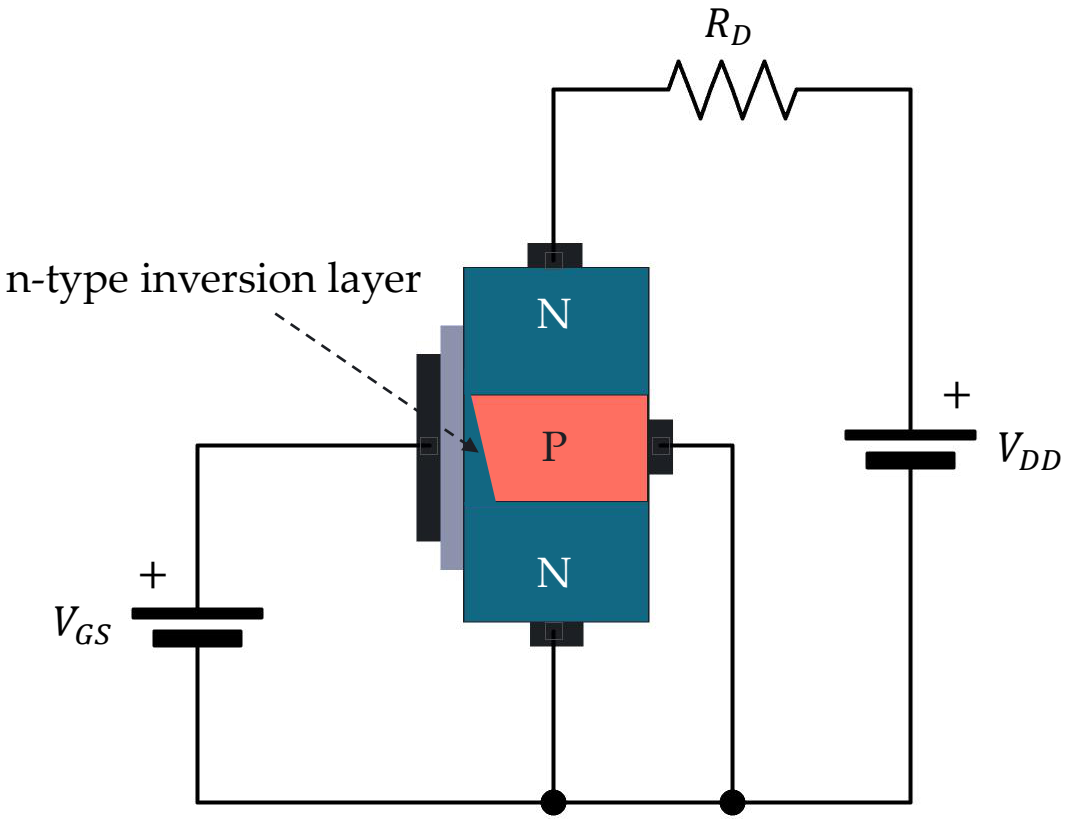
N-Channel



P-Channel

REGIONS OF OPERATION

N-TYPE INVERSION LAYER



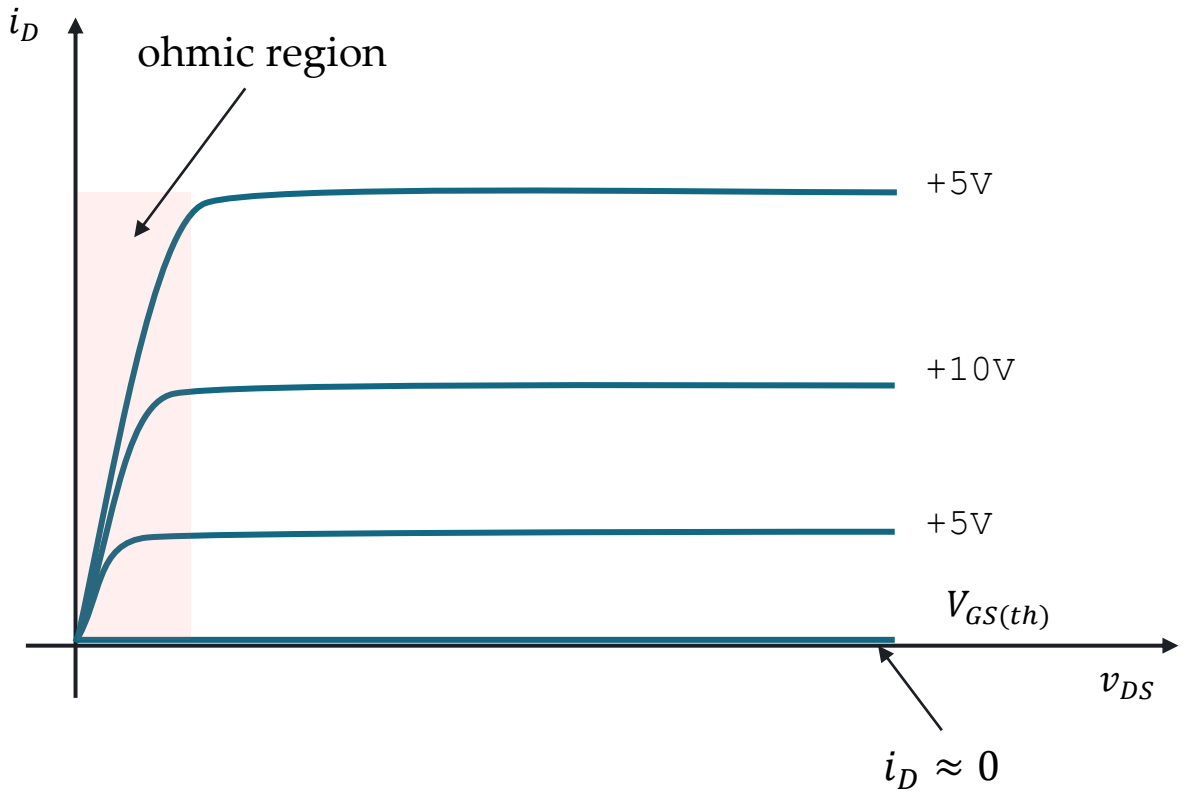
E-MOSFET is **normally off**

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).

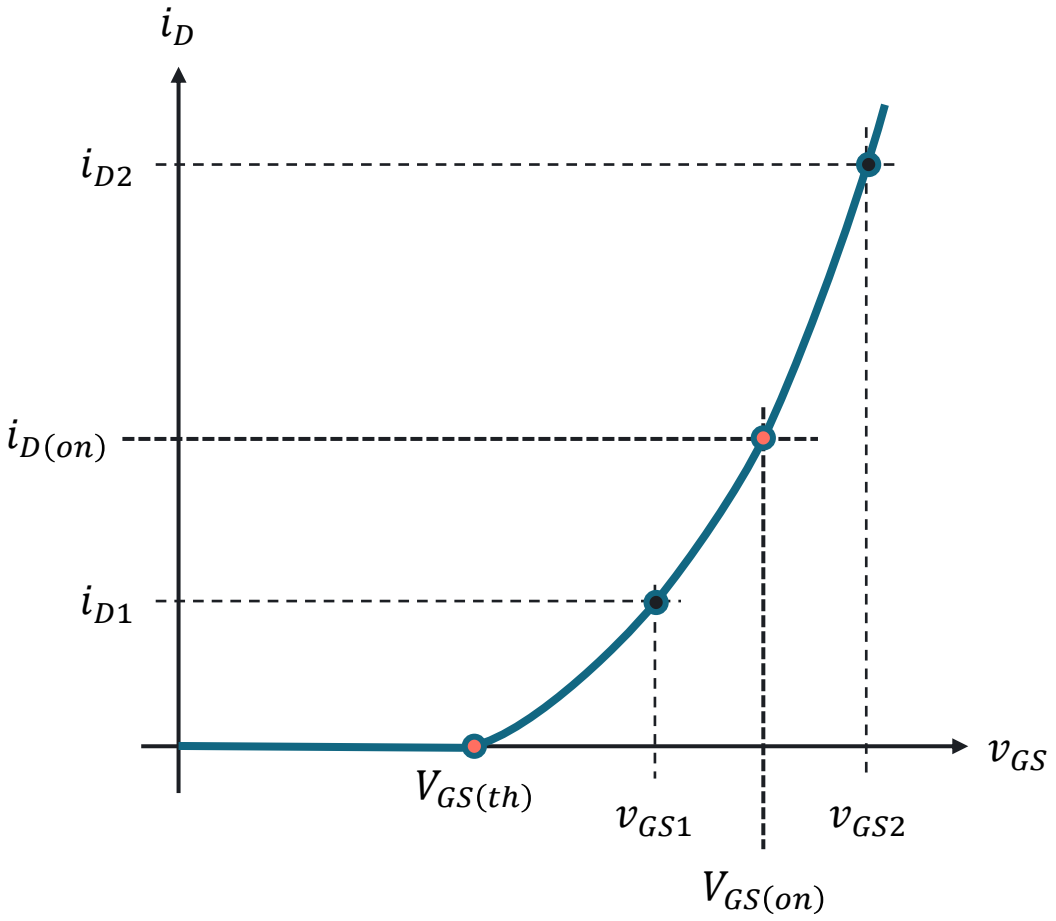
DRAIN CURVE



E-MOSFET is mainly use 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



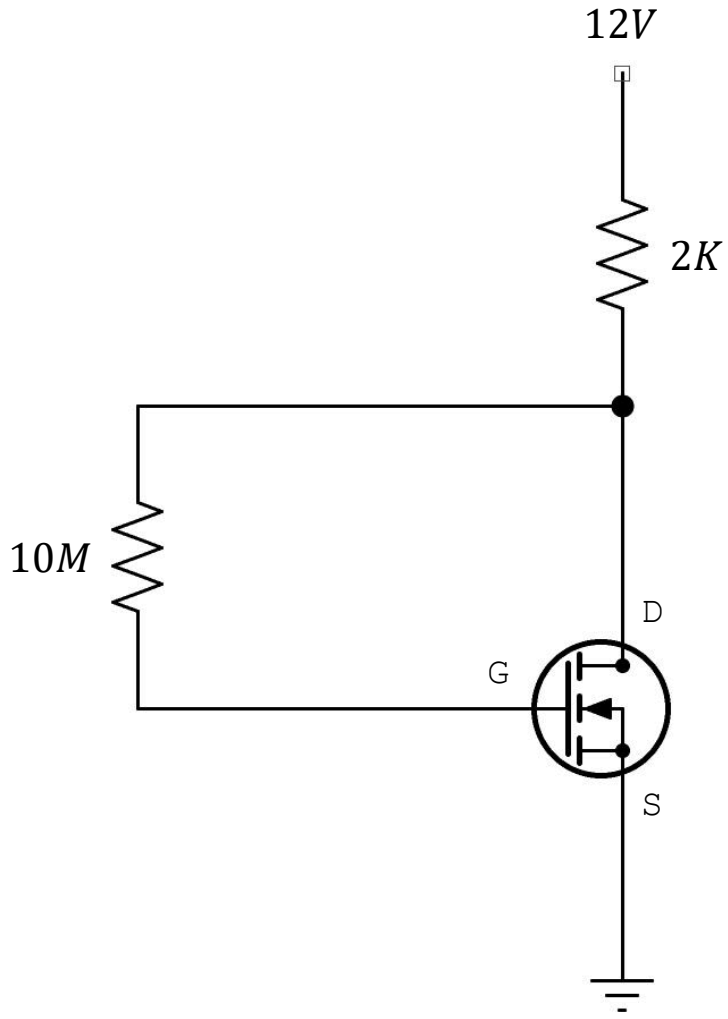
Drain current

$$i_D = k\left(v_{GS} - V_{GS(TH)}\right)^2$$

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

E-MOSFET DC BIASING

EXERCISE



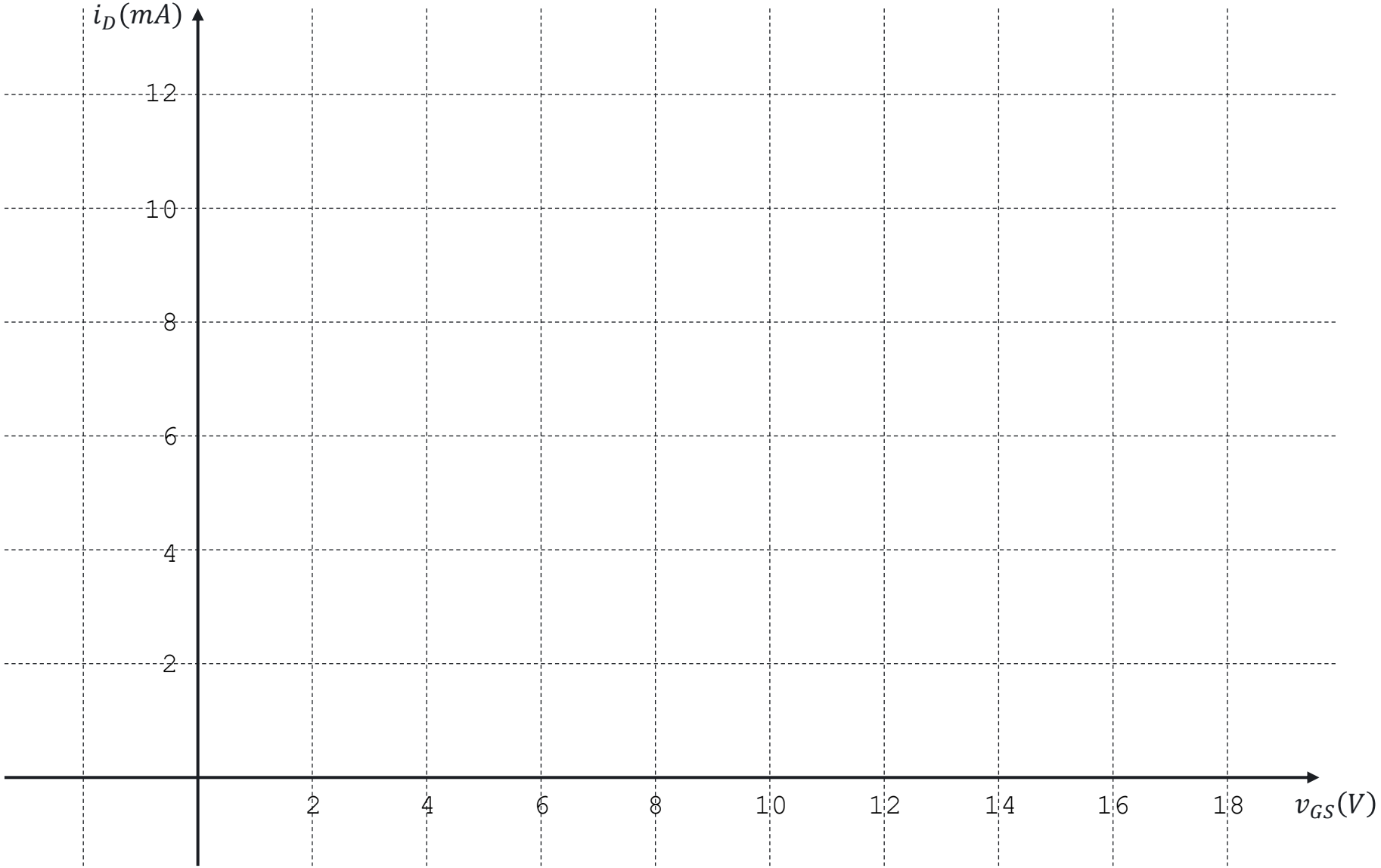
$i_{D(on)} = 6\ mA$

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

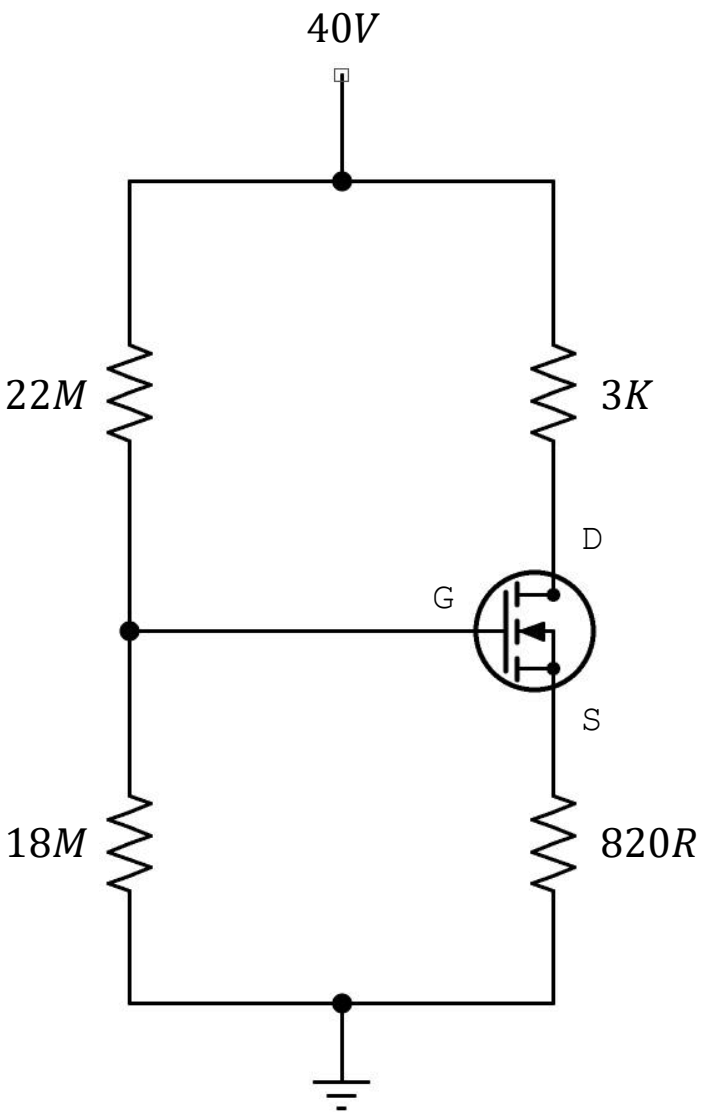
$v_{GS(TH)} = 3\ V$

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

TRANSFER CHARACTERISTICS



EXERCISE



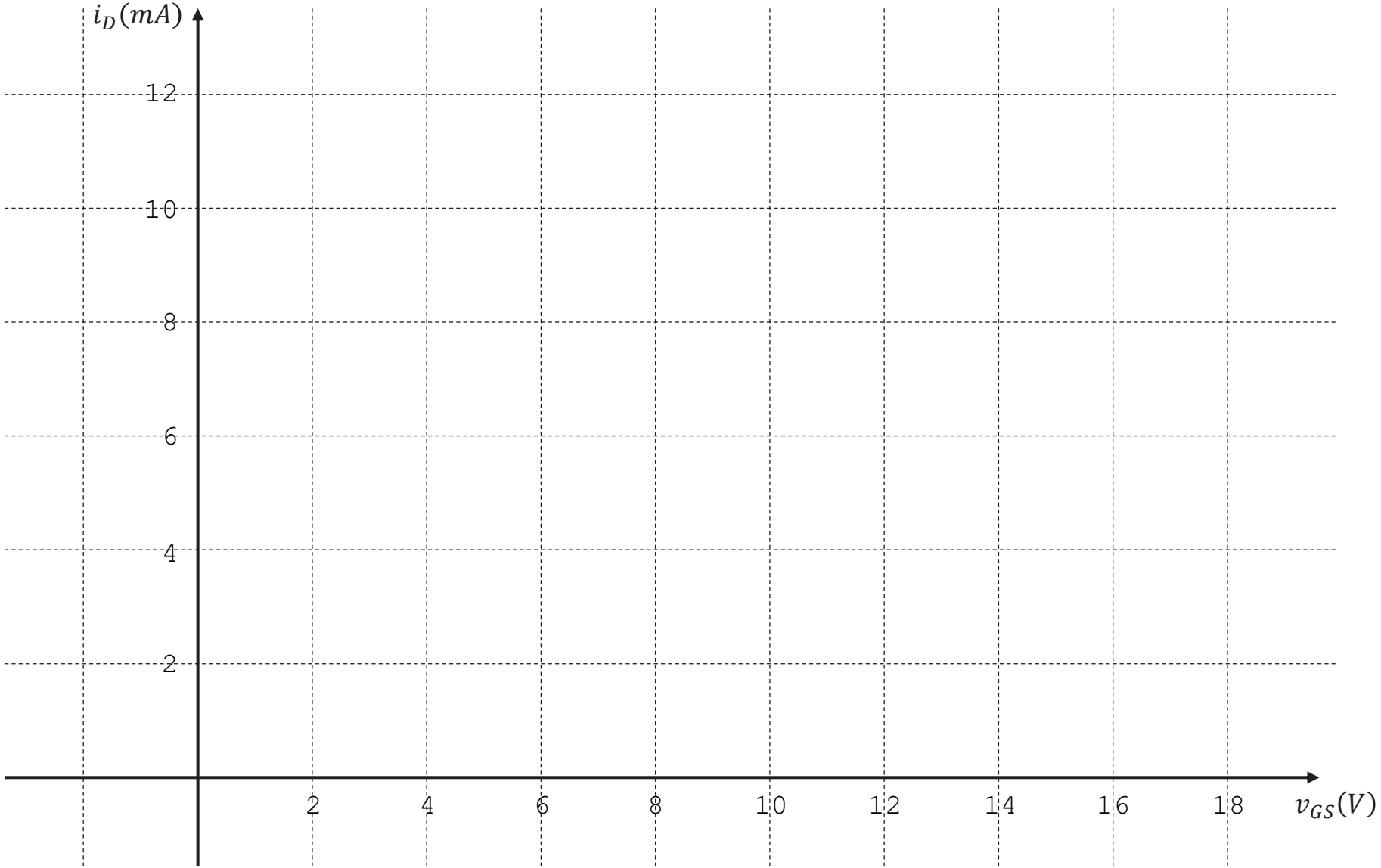
$i_{D(on)} = 3\ mA$

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

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

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 $v_{GS} = 8\ V$ and $v_{GS} = 15\ V$.

TRANSFER CHARACTERISTICS



LABORATORY