JFET Physical Operation

Dr. José Ernesto Rayas Sánchez

Some figures of this presentation were taken from the instructional resources of the following textbooks:

A. R. Hambley, *Electronics: A Top-Down Approach to Computer-Aided Circuit Design*. Englewood Cliffs, NJ: Prentice Hall, 2000.

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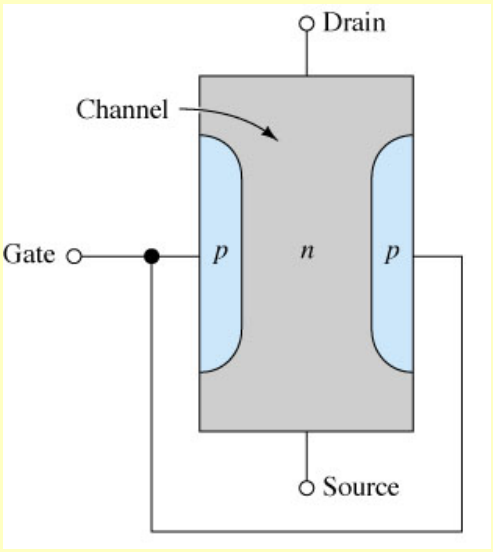
Outline

- JFET physical structure
- JFET symbols
- JFET physical operation
- I-V characteristics

JFET Physical Structure (Simplified)



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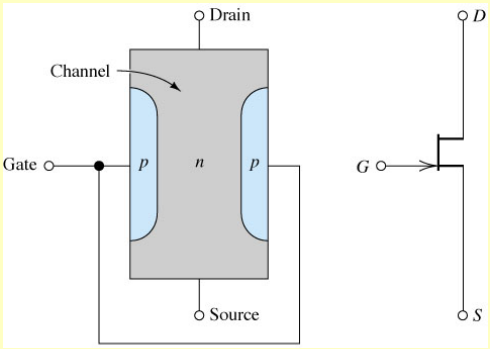
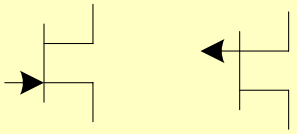
JFET Symbols





n channel p channel

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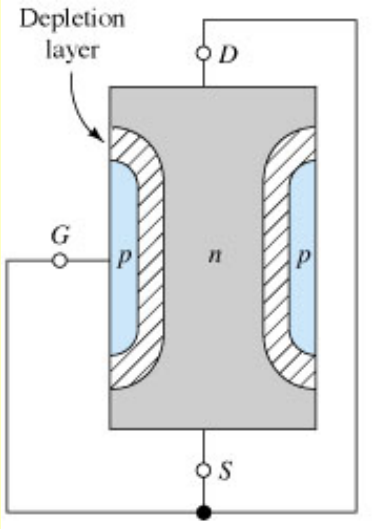
JFET Operation ($v_{GS} = 0$, $v_{DS} = 0$)



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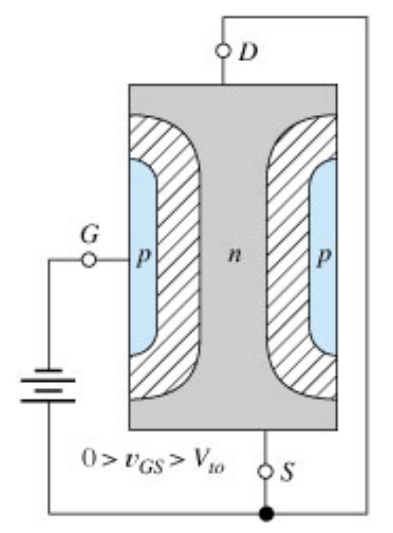
JFET Operation ($0 > v_{GS} > V_P$, $v_{DS} = 0$)



$V_{to} = V_P < 0\text{V}$

Pinch-off voltage

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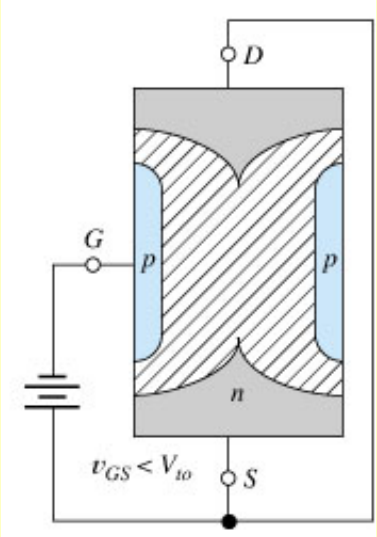
JFET Operation ($v_{GS} < V_P$, $v_{DS} = 0$)



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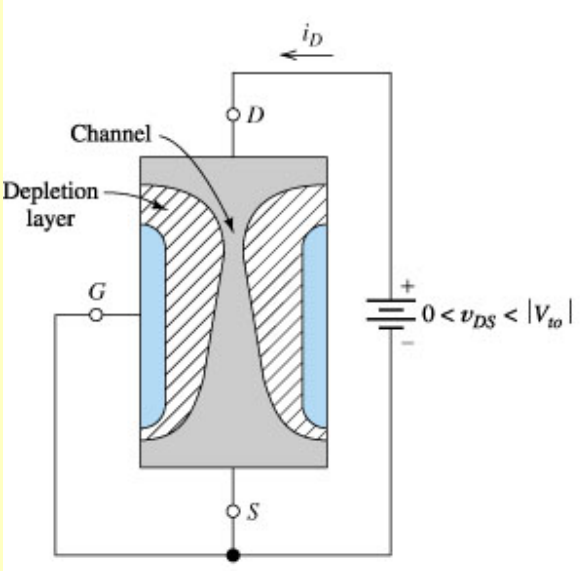
JFET Operation ($v_{GS} = 0$, $0 < v_{DS} < |V_P|$)



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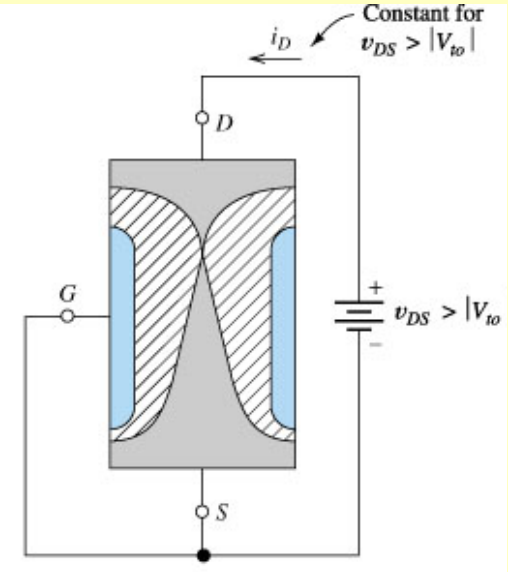
JFET Operation ($v_{GS} = 0$, $v_{DS} > |V_P|$)



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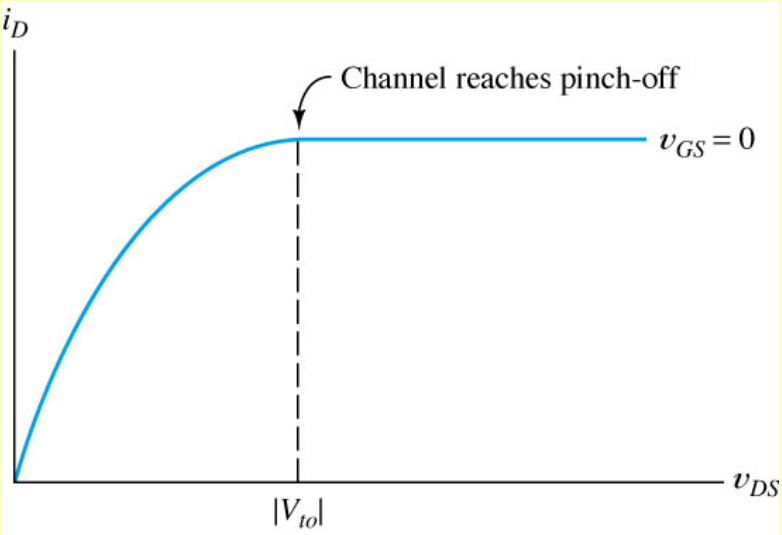
i_{DS} VS v_{DS} when $v_{GS} = 0$



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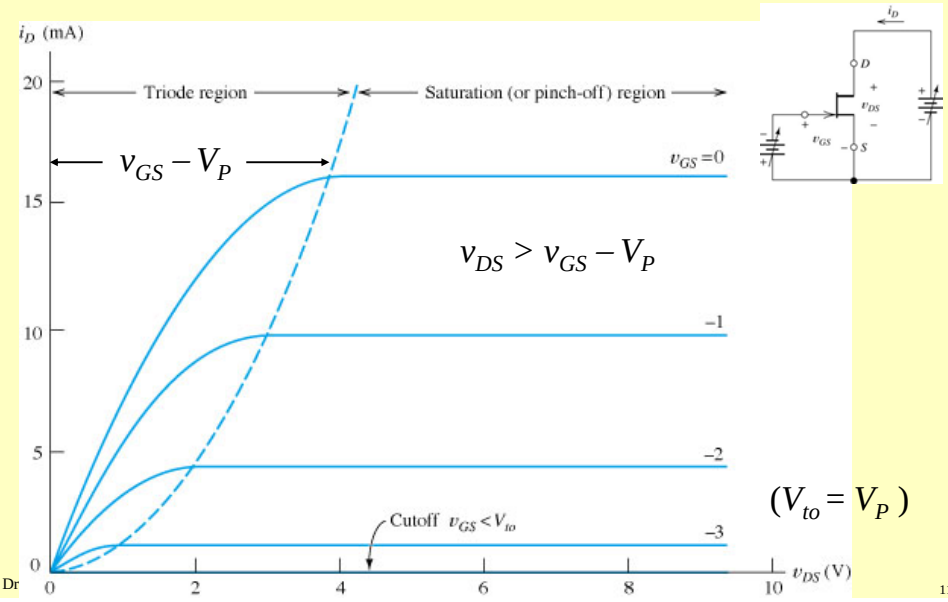
I-V Characteristics of a JFET



$(V_{to} = V_P)$

Transconductance of a JFET

$$i_{DS} = I_{DSS}\left(1 - \frac{v_{GS}}{V_P}\right)^2 = K(v_{GS} - V_t)^2$$

$$K = \frac{I_{DSS}}{V_t^2} \qquad (V_t = V_P)$$

$(I_{DSS} = 18\text{mA}, V_P = -3\text{V})$