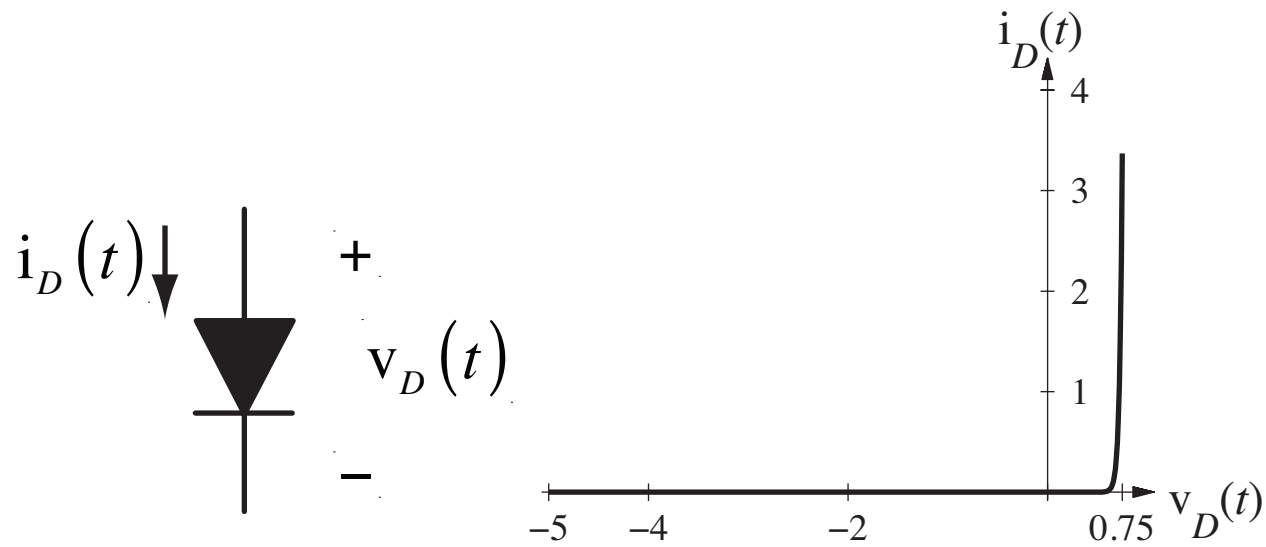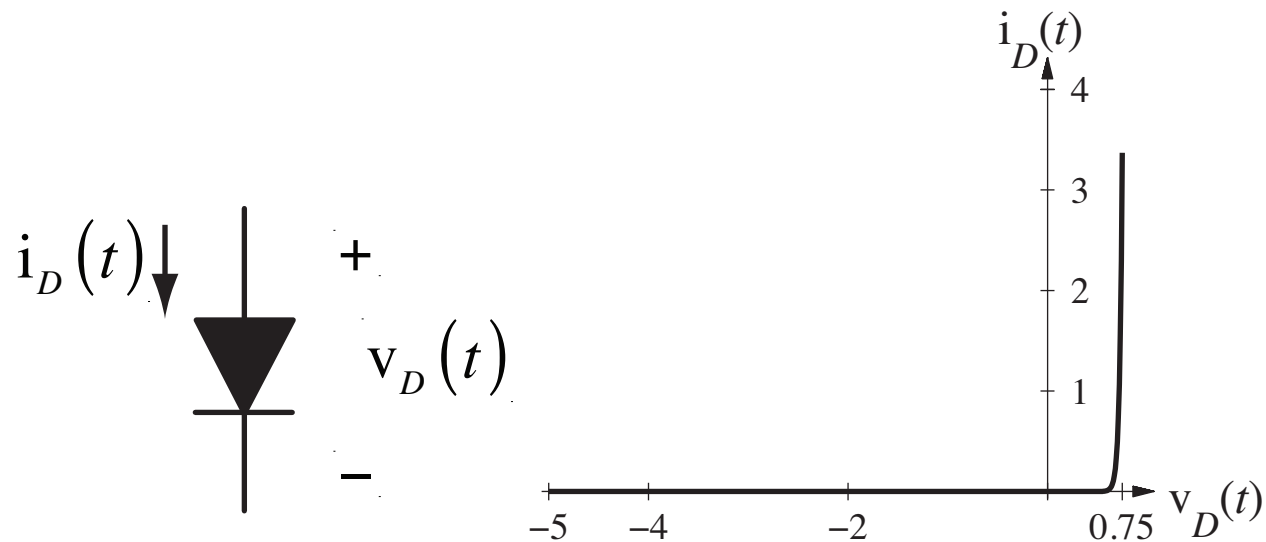# Diodes

Diode V-I Relationship

$$i_D(t) = I_{dss}\left(e^{-v_D(t)/V_{th}} - 1\right)$$

Diode V-I Relationship

If $v_D(t) > 0$ the diode is **forward biased**.
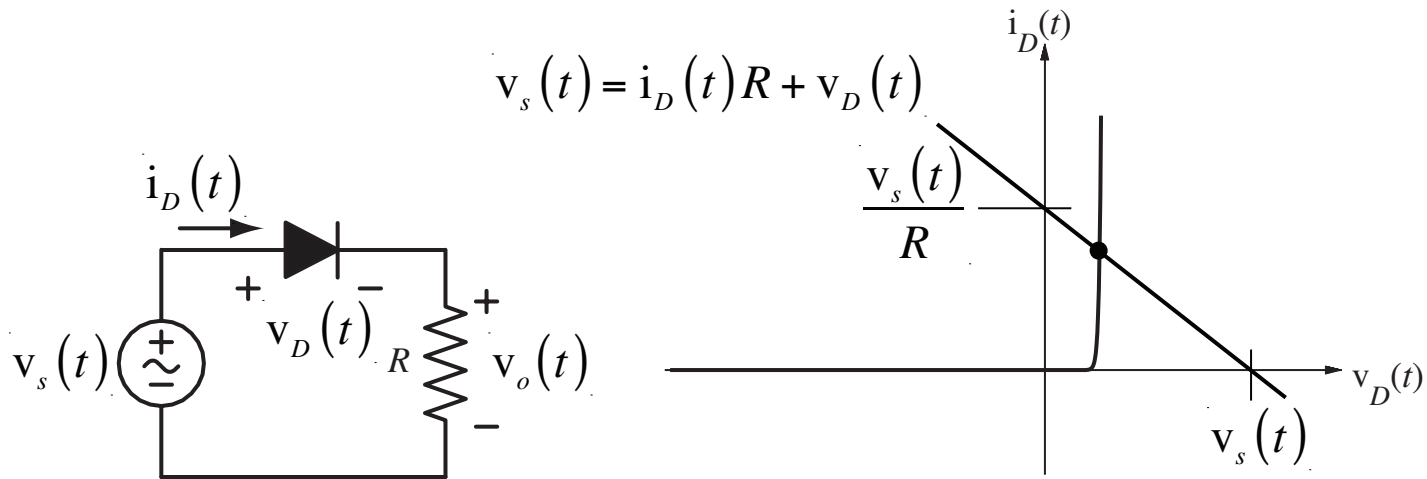
If $v_D(t) < 0$ the diode is **reverse biased**.
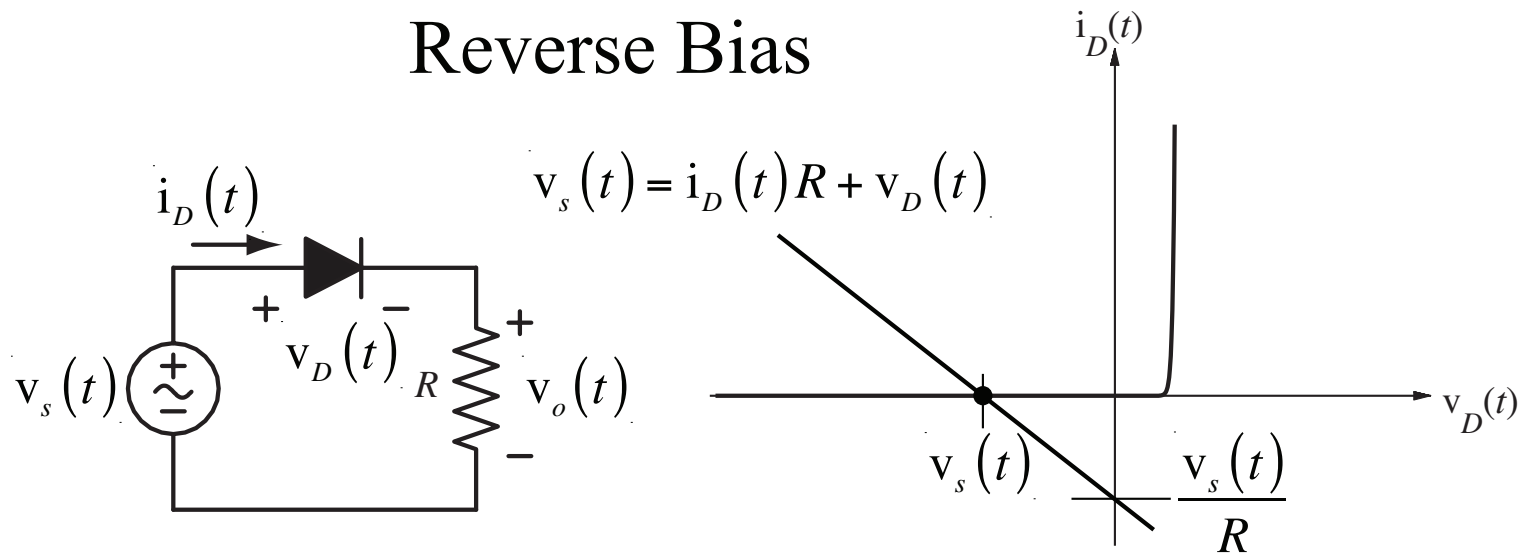
If $v_D(t) = 0$ the diode is **zero biased**.

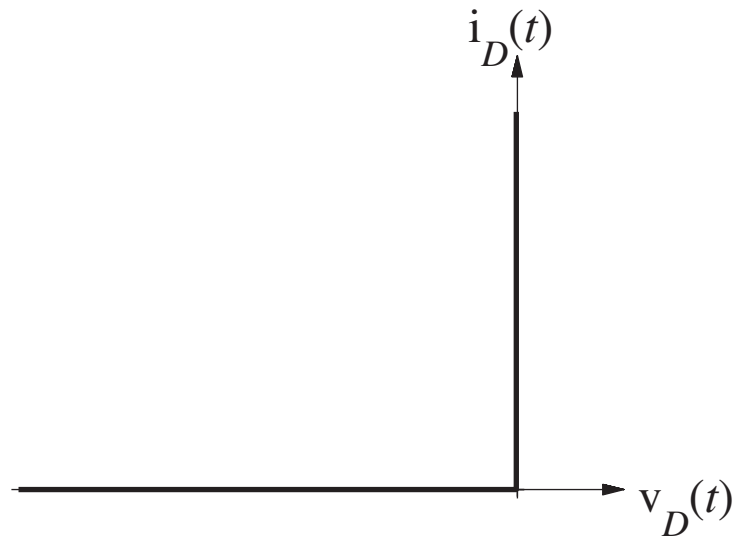# Graphical Diode Circuit Analysis

Forward Bias

$$v_s(t) = i_D(t)R + v_D(t)$$

Reverse Bias
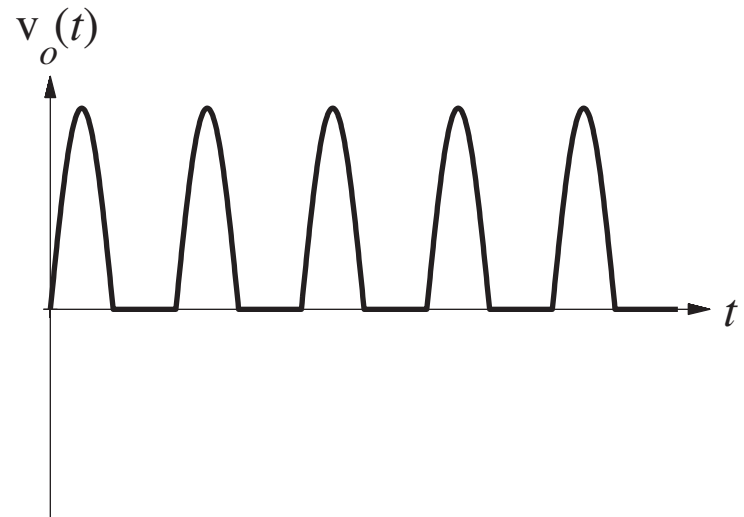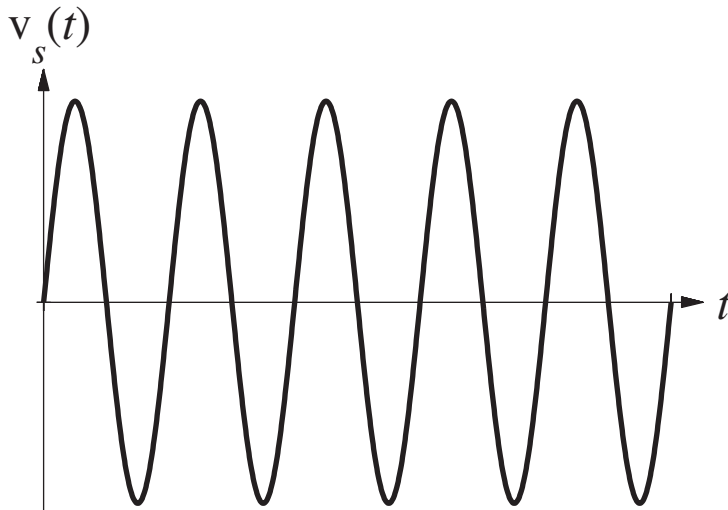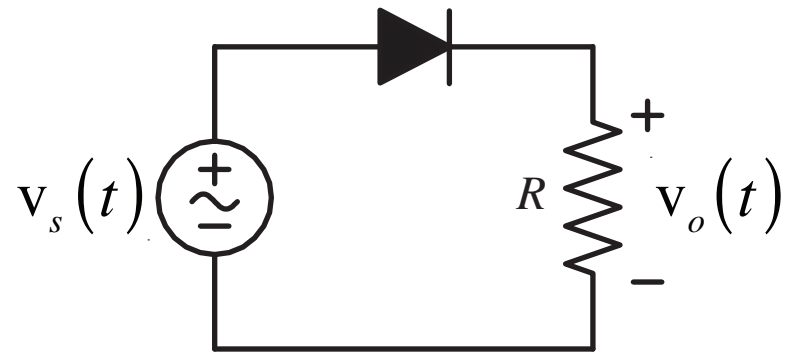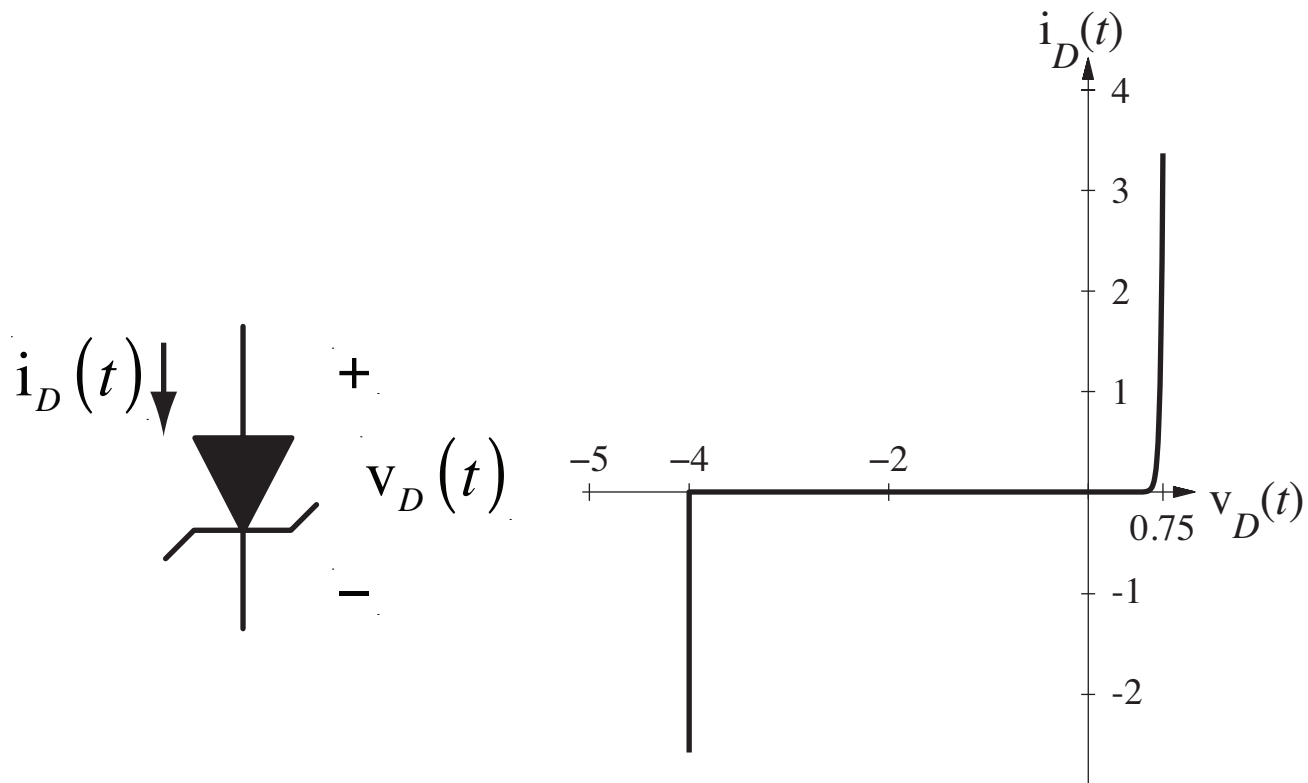
$$v_s(t) = i_D(t)R + v_D(t)$$

The Ideal Diode

In some designs we can ignore the small forward bias voltage of 0.6-0.7 volts and approximate the diode as **ideal**. Then the diode is always in one of two possible states; the voltage $v_D(t)$ is zero (forward bias), or the current $i_D(t)$ is zero (reverse bias).

$i_D(t)$

$v_D(t)$

The Half-Wave Rectifier

Zener Diodes

Zener diodes are designed to "break down" at a specific reverse bias voltage (4 V in this illustration).

Graphical Diode Circuit Analysis

Reverse Bias

$$v_s(t) = i_D(t)R + v_D(t)$$