Electronics Diodes

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Diode

- an electronic device which passes current in one direction only
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- an electronic device which passes current in one direction only
- diode starts to allow current in the forward direction when the voltage reaches around 0.6V

Reverse breakdown voltage
Diode

- an electronic device which passes current in one direction only
- diode starts to allow current in the forward direction when the voltage reaches around 0.6V
- If the voltage gets high enough in the reverse direction, the diode will conduct; "reverse breakdown voltage"
Negative pressure; no flow possible
No pressure; resistance to flow is large
Small pressure; resistance to flow decreases
Medium pressure; resistance to flow still decreasing
High pressure; resistance to flow small
Very high pressure; resistance almost zero
Diode symbol and physical appearance
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Signal diodes (one type)
- Signal diodes (another type)
• Power diodes (one type)
- Power diodes (another type)
"off" \quad V \lessapprox 0.7

I small; changes slowly
Diodes

Zener diodes

LEDs

\[ V \approx 0.7 \]

\( I \) large; almost independent of \( V \)
|V| < $V_z$

reverse breakdown

forward bias

$I$ small; changes slowly
Diodes

Zener diodes

LEDs

Forward bias

Reverse breakdown

$V_z$

$I$ large; almost independent of $V$
Diodes

Zener diodes

LEDs

$V_D \approx 0.7$

$V_o \approx V_s - 0.7$

(assuming $V_s \gtrsim 0.7$)

Forward biased diode in a voltage divider
Forward biased diode in a voltage divider

\[ V_o \approx 0.7 \]

(assuming \( V_s \gtrsim 0.7 \))

\[ V_D \approx 0.7 \]
Diodes

Zener diodes

LEDs

\[ V_o \approx V_s \]

(assuming \( V_s > 0 \))

\[ I \approx 0 \]

Reverse biased diode in a voltage divider
Reverse biased diode in a voltage divider

\[ V_o \approx 0 \]

(assuming \( V_s > 0 \))

\[ I \approx 0 \]
One common use of diodes is for **rectification**, by putting diodes in a bridge circuit.
Here’s the basic bridge.
The output is taken between A and B.
For one half of the cycle, these two diodes shown in green are forward biased, so they’re on. (The others are off.)
For the other half of the cycle, the other two diodes shown in green are forward biased, so they’re on. (The others are off.)
For both parts of the cycle, A is positive relative to B.
LEDs are a special case; they light up above a certain voltage. The voltage depends on the colour.
The LED lights up when current flows from the anode to the cathode.
You must use a resistor to limit the current.
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Without a resistor, the LED will probably be destroyed.
The resistor can go before or after the LED.
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Reverse-biased, the LED won’t light up.
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Zener diodes

One of the ways to produce a stable reference voltage, such as for an ADC or a DAC, is to use a Zener diode.
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\[ V_{in} \quad R \quad V_{out} \]
Zener diodes

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Parameters
Parameters

- Zener voltage
Parameters

- Zener voltage
- required current
Parameters

- Zener voltage
- required current
- temperature sensitivity
Parameters

- Zener voltage
- required current
- temperature sensitivity
- variation with current (ac resistance)