Dioda-Dioda Khusus
(Special Purpose)
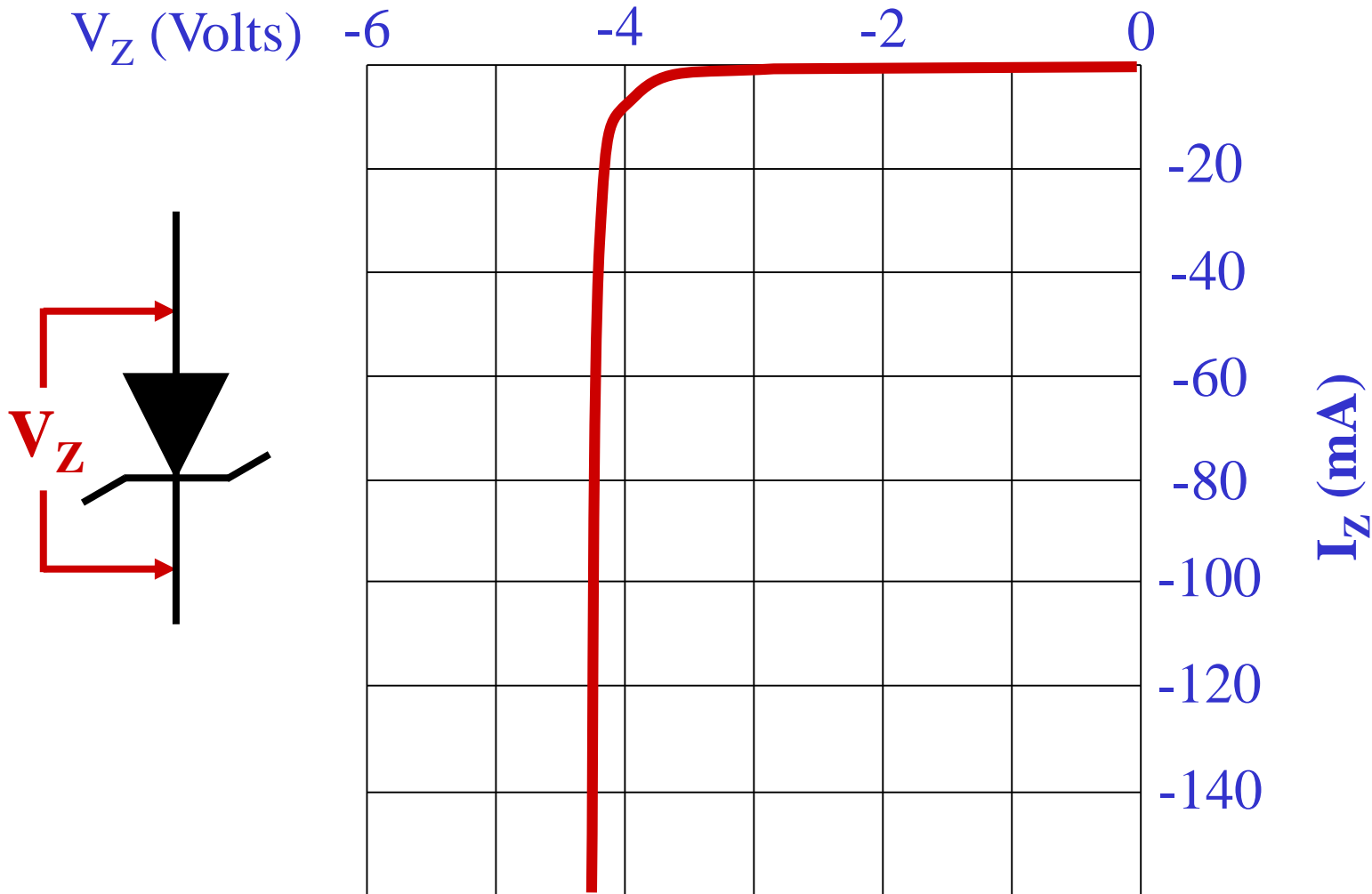
Elektronika
(TKE 4012)

Eka Maulana

Pokok Bahasan

- Dioda Zener
- Dioda Zener - Regulator
- Dioda Zener Pendekatan kedua
- LED (Light Emitting Diode)
- Devais Optoelektronik
- Dioda Scottky
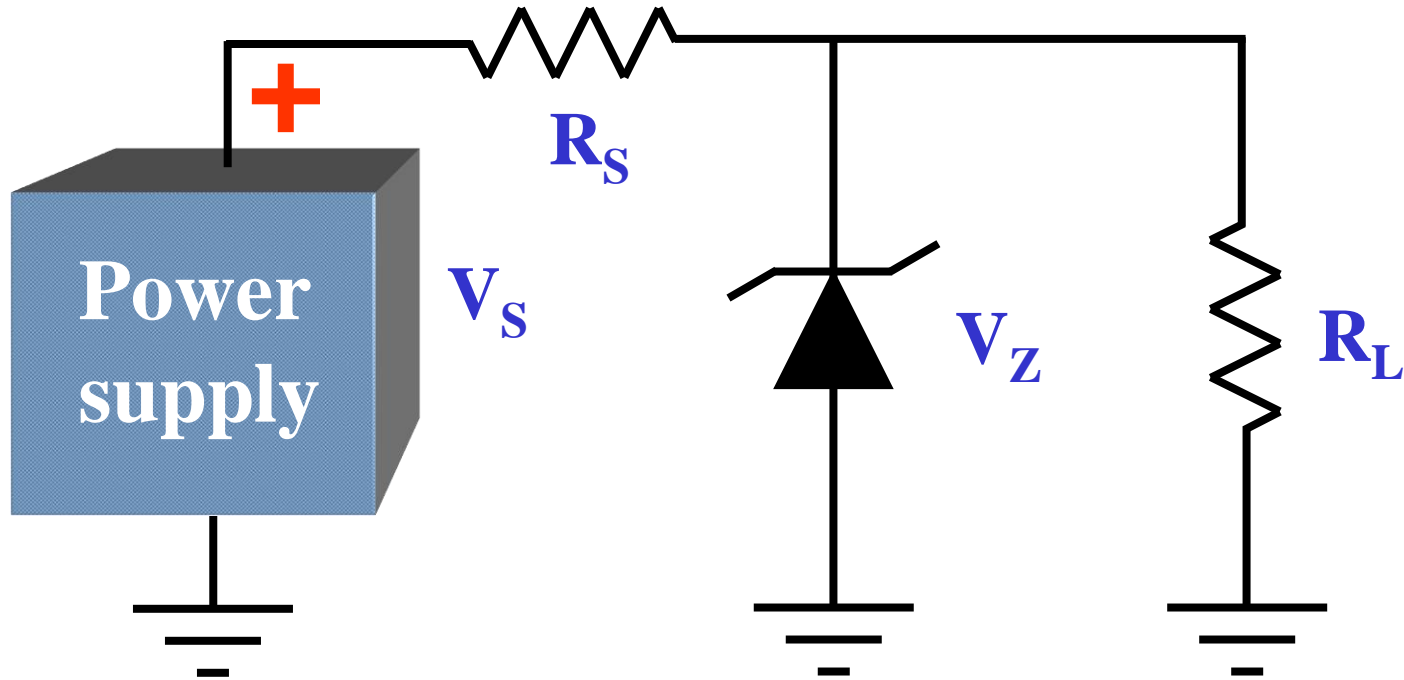- Dioda Varactor
- Jenis Dioda Lain

(Varistor, current-regulator, Step Recovery, Back diode, Tunnel Diode)

Kurva Karakteristik V-I Zener

Zener dioperasikan pada daerah breakdown saat dioda dibias mundur
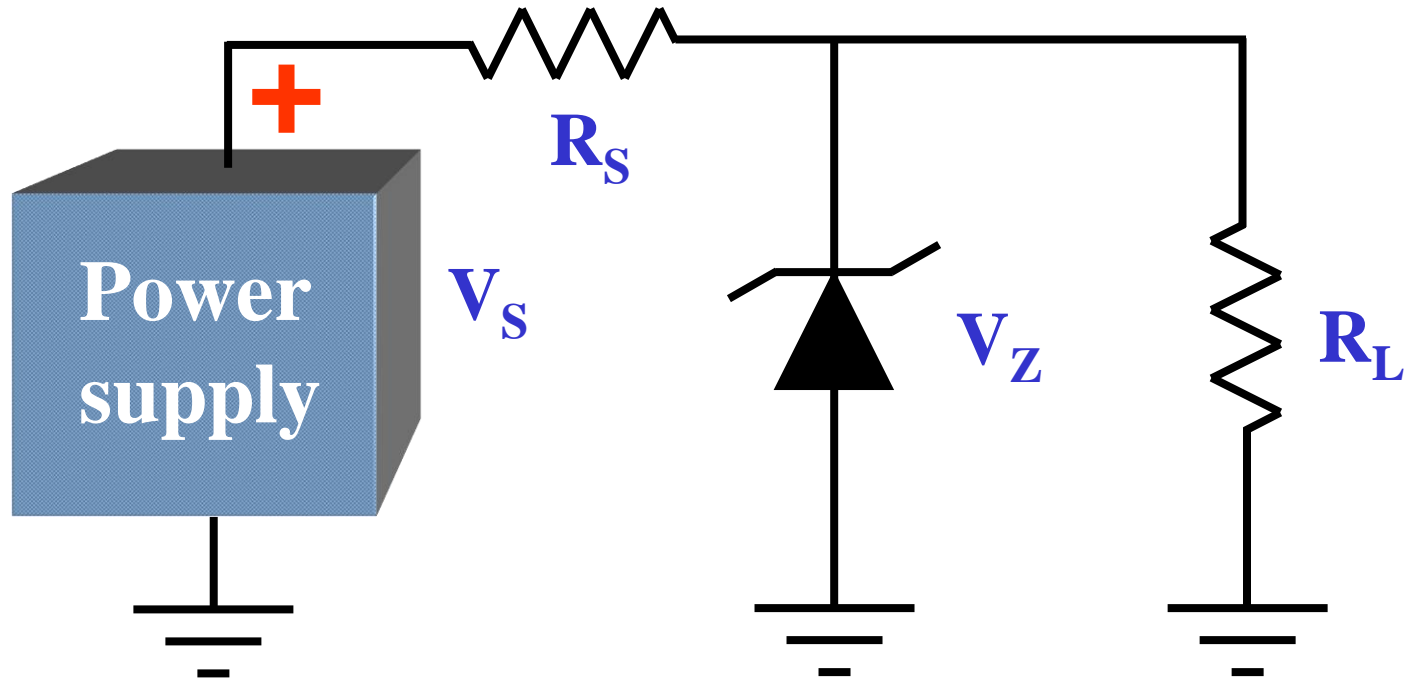
Voltage Regulator – Dioda Zener

Ketika tegangan thevenin yang menghadap dioda zener lebih besar dari pada tegangan zener, maka rangkaian bersungsi sebagai regulator tegangan.

$$V_{TH} = \frac{R_L}{R_S + R_L} V_S$$
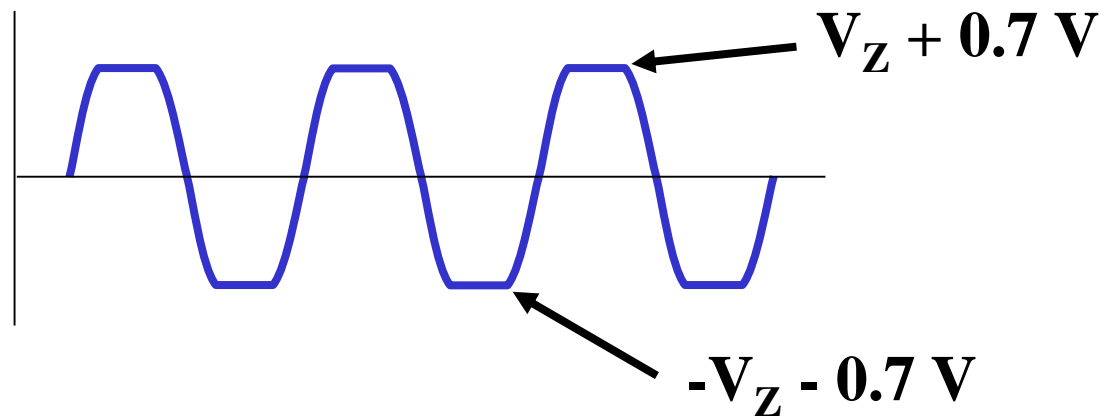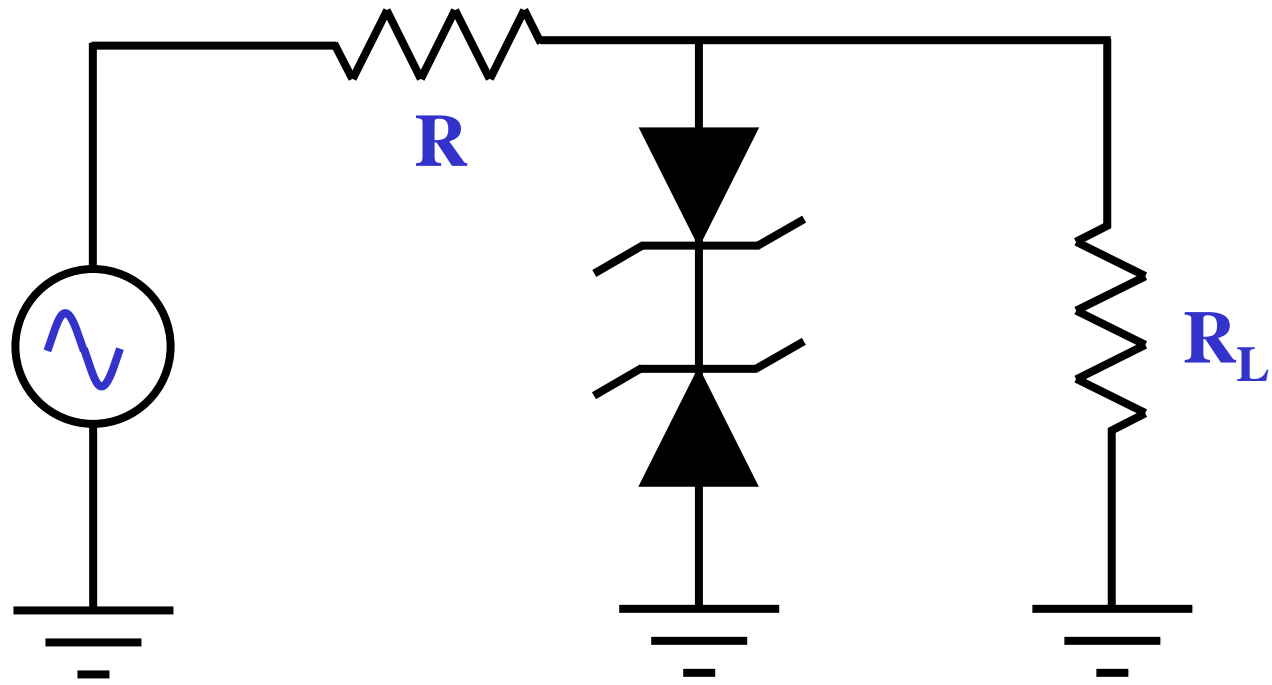
Voltage Regulator – Dioda Zener

$$R_S$$

$$V_S$$

$$V_Z$$

$$R_L$$

:: Zener conducting:

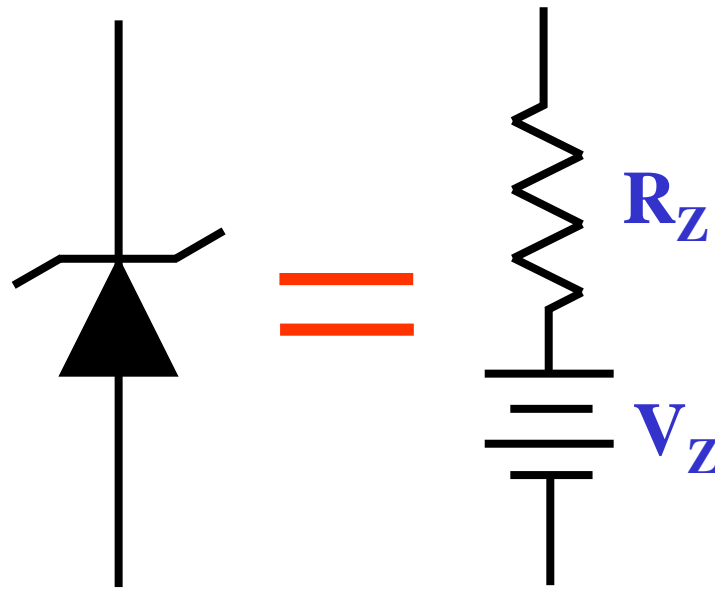$$I_S = \frac{V_S - V_Z}{R_S} \qquad I_L = \frac{V_Z}{R_L} \qquad I_Z = I_S - I_L$$

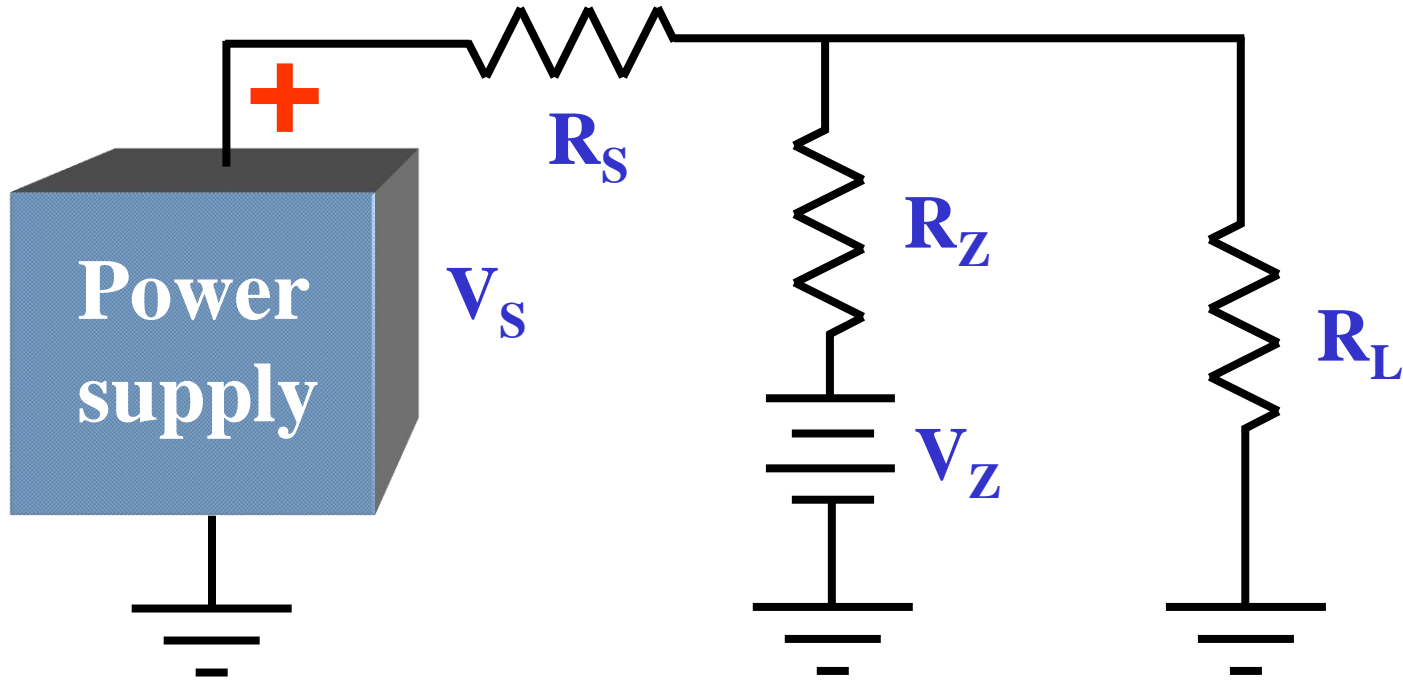# Dioda Zener – Rangkaian Waveshaping

Dioda Zener
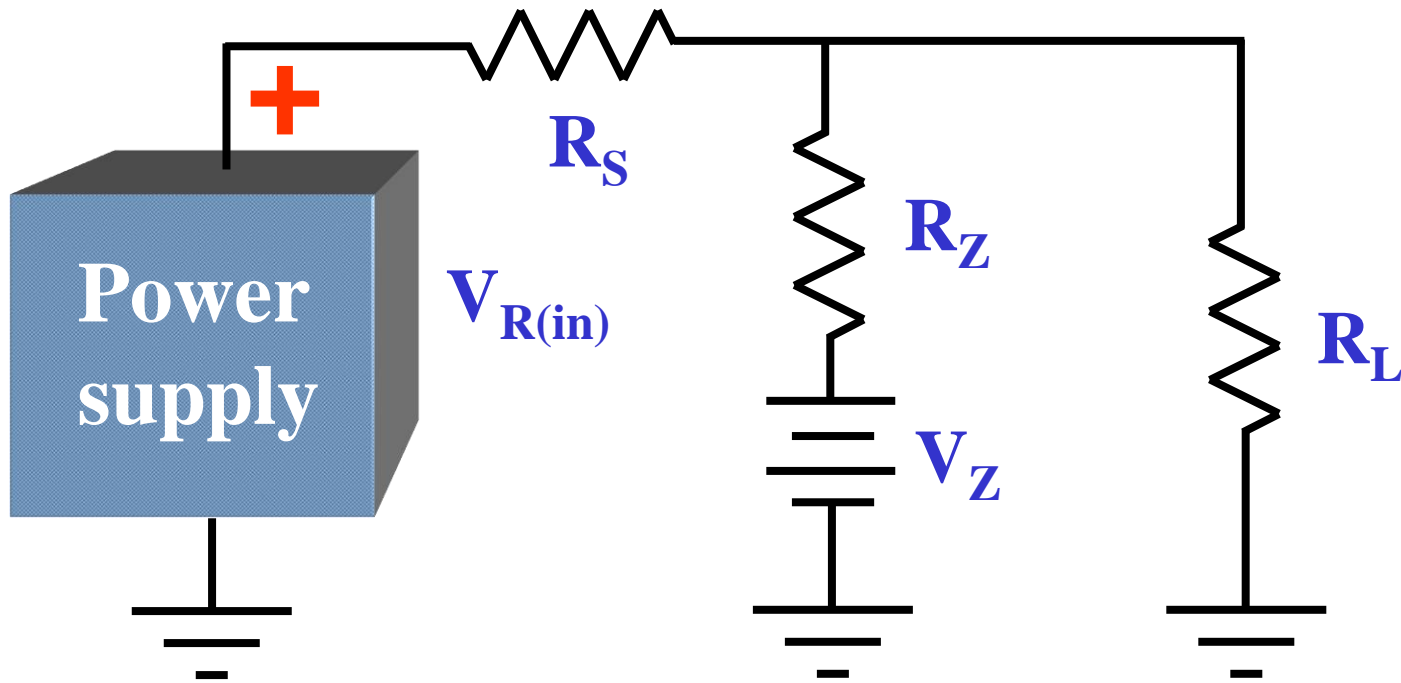# Pendekatan Kedua

Penerapan Zener Pendekatan Kedua

Deviasi tegangan beban dari kasus ideal:

$$\Delta V_L = I_Z R_Z$$

Regulator Zener juga mengurangi Ripple Tegangan

Asusmsikan R_L dan $R_S >> R_Z$:
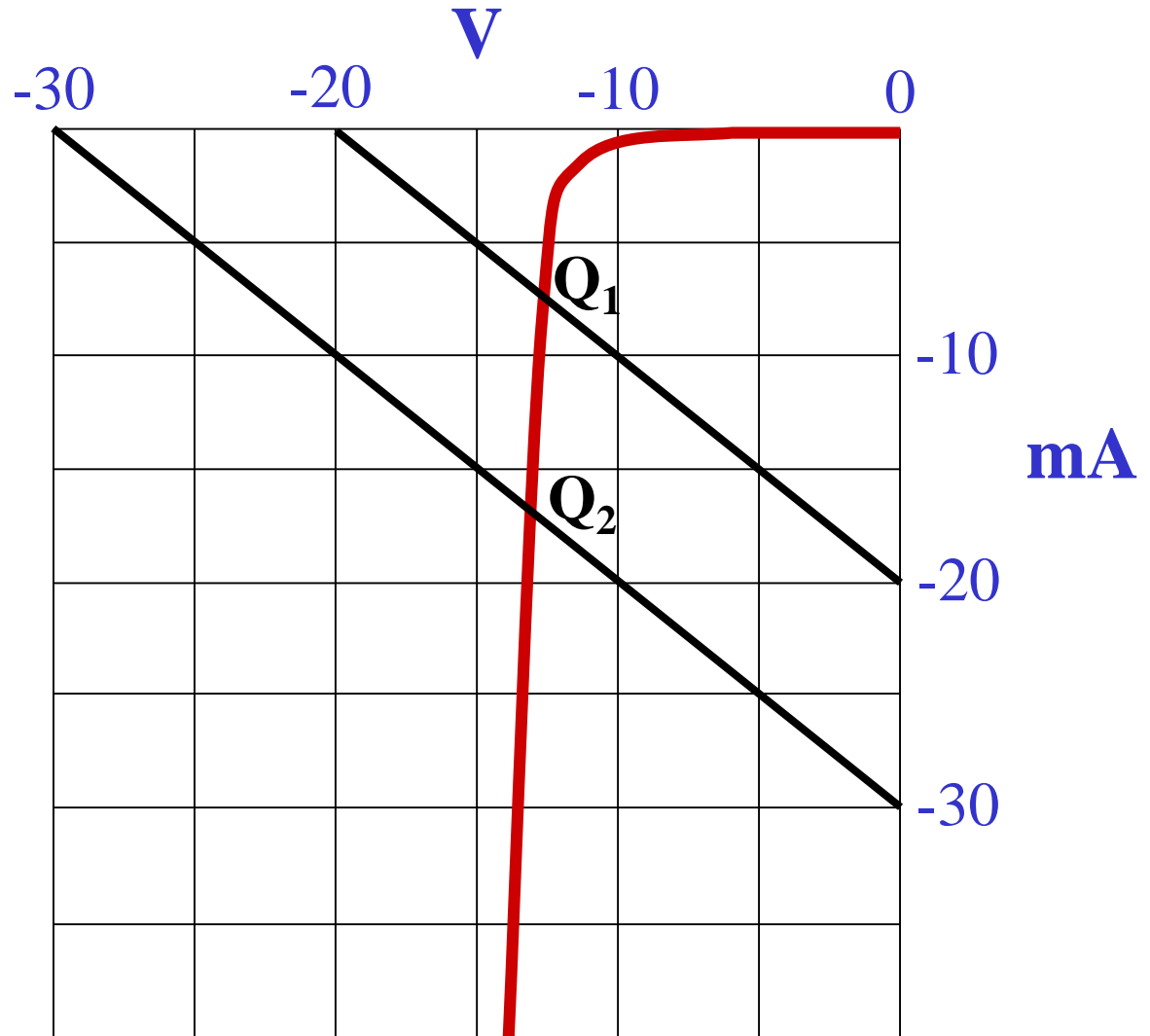
$$V_{R(out)} \cong \frac{R_Z}{R_S} V_{R(in)}$$

Zener diode ratings

- Maximum power $= P_{Z(max)} = V_Z I_{Z(max)}$

- Available tolerances: 20, 10 and 5 percent

- Zener resistance, R_{ZT}, increases at the knee of the characteristic curve

- A derating factor such as 3.2 mW per degree for temperatures above 50 degrees Celsius is typical.
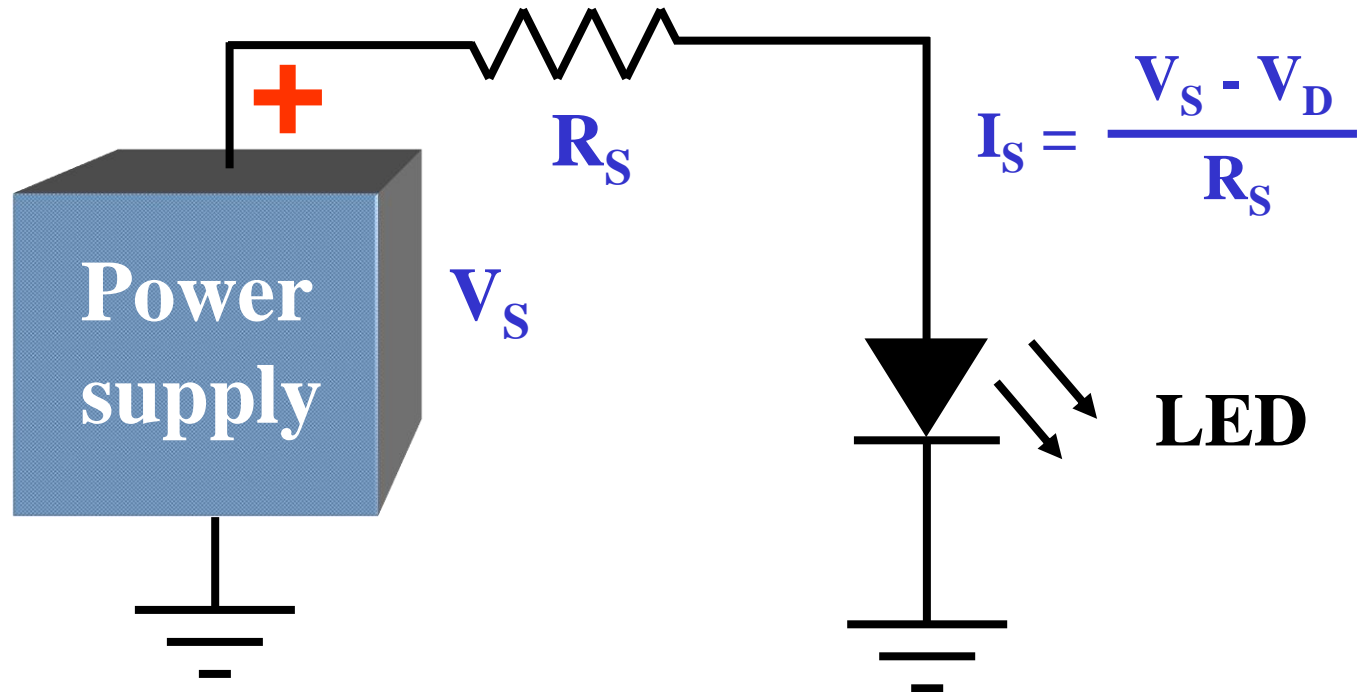
Load Line

1 kΩ

R$_S$

V$_S$
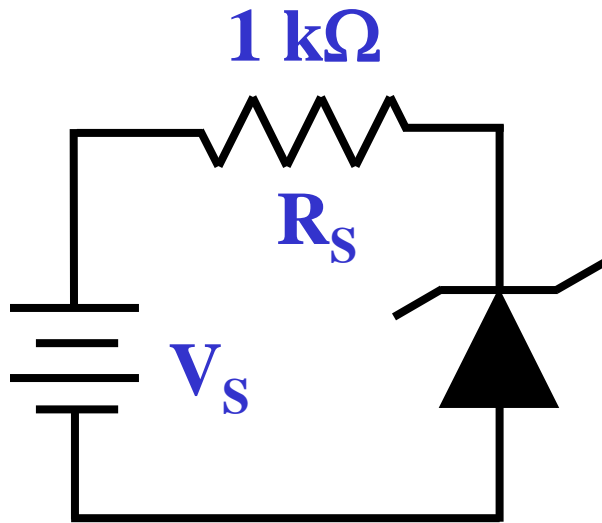
V$_S$ = 20 V-30 V

ketika V$_S$ divariasikan antara 20-30 volts, maka didapatkan V$_Z$ dengan:

Solusi Grafik - Load line

LED (Light Emitting Diode)

$$I_S = \frac{V_S - V_D}{R_S}$$
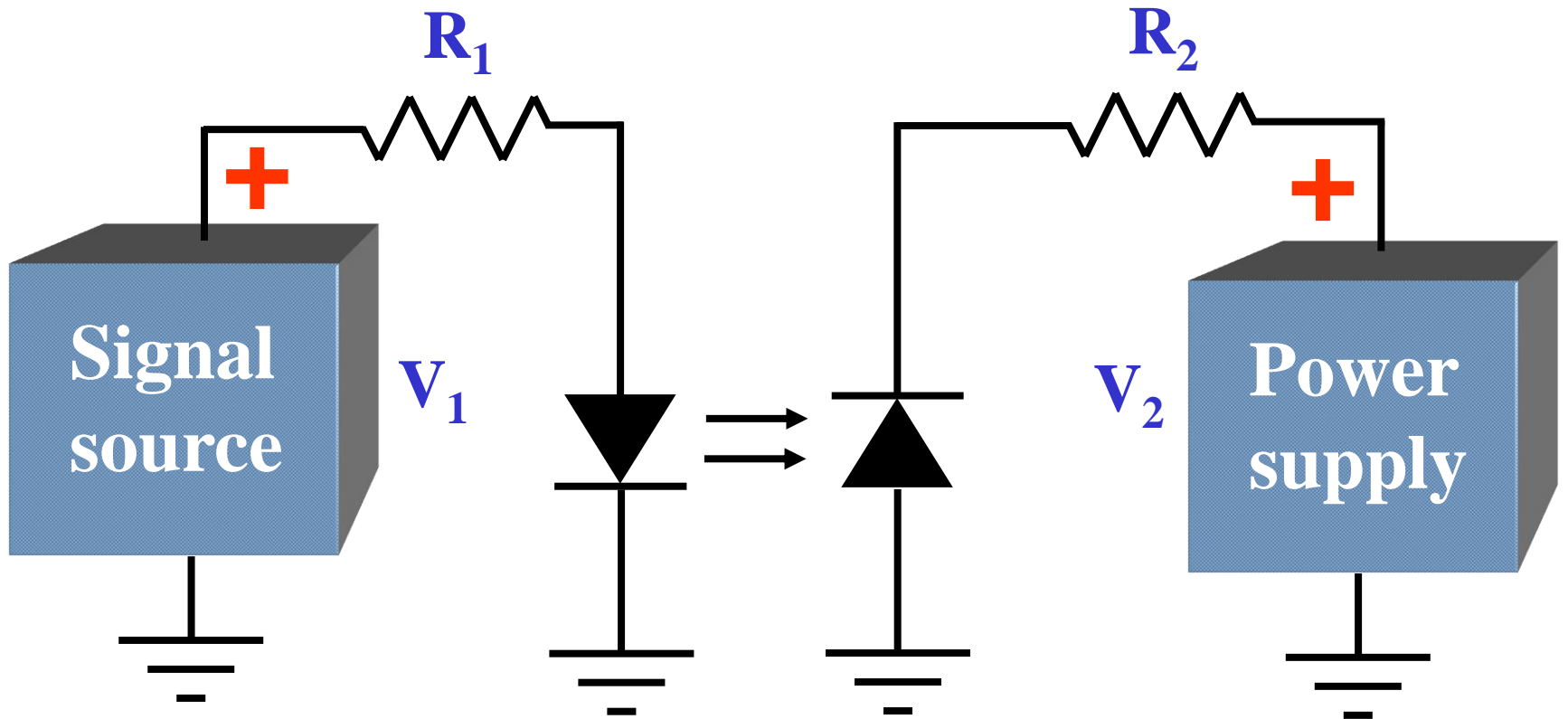
Power supply V_S R_S LED

Voltage drop LED *(tipical)* **= 1,5 – 2,5 volt**

Photodioda
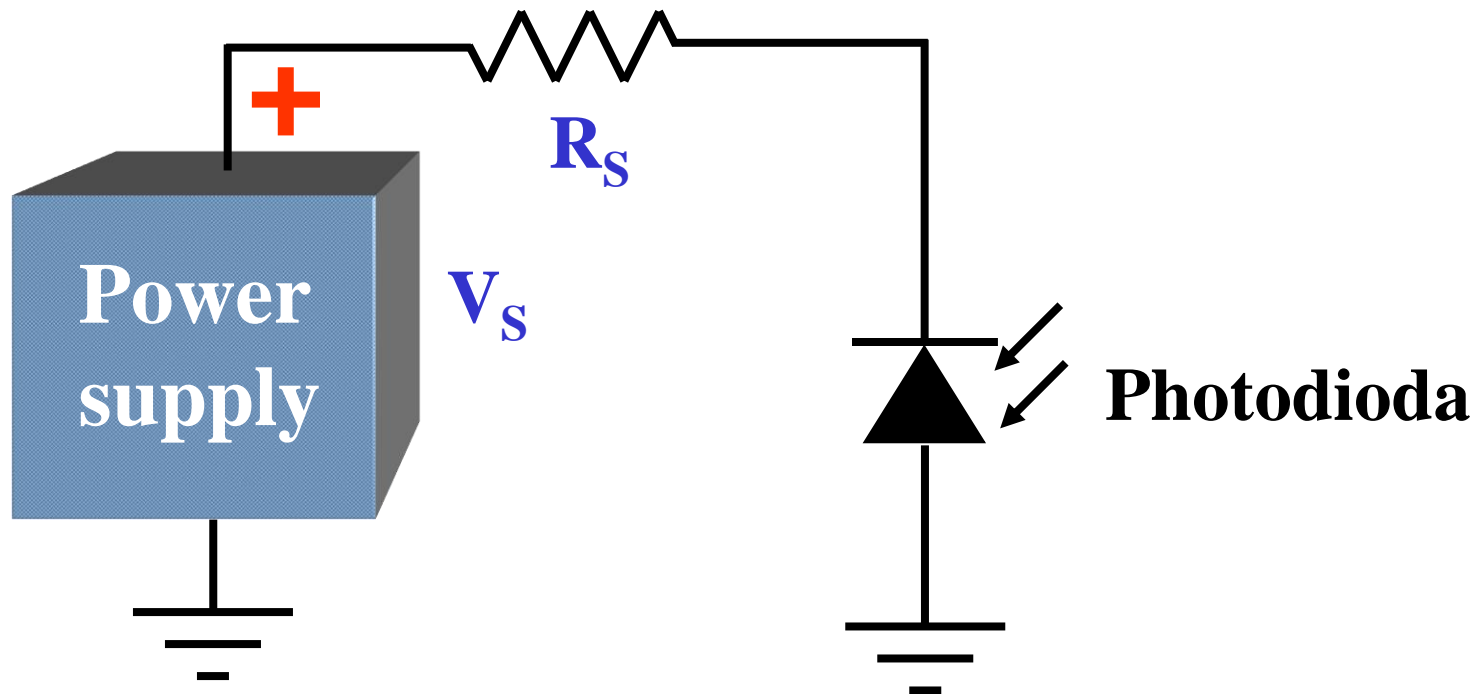
Photodioda berkerja pada reverse bias
dan aktif (menghantar) jika dipicu cahaya

Optocoupler

R_1

R_2

+

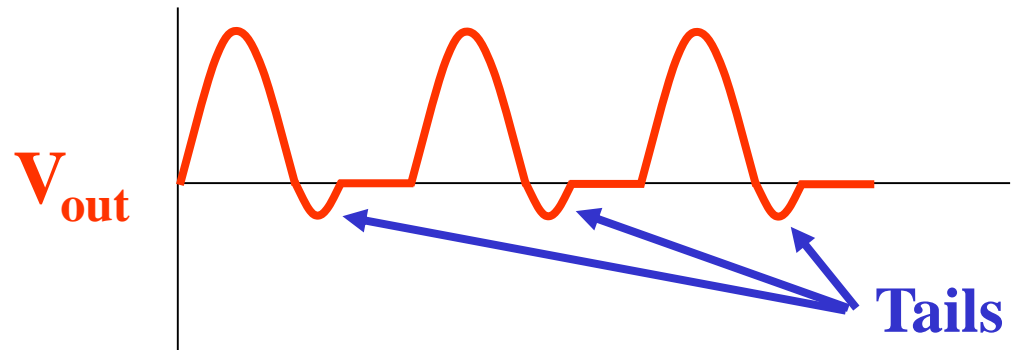**+**

Signal source

V_1

V_2

Power supply

Optocoupler : kombinasi LED and photodioda.

High-frequency rectification

V_{in}

V_{out}

V_{in}
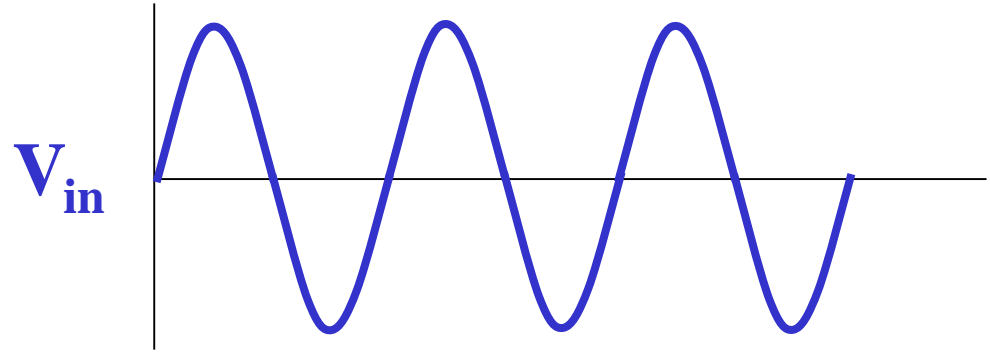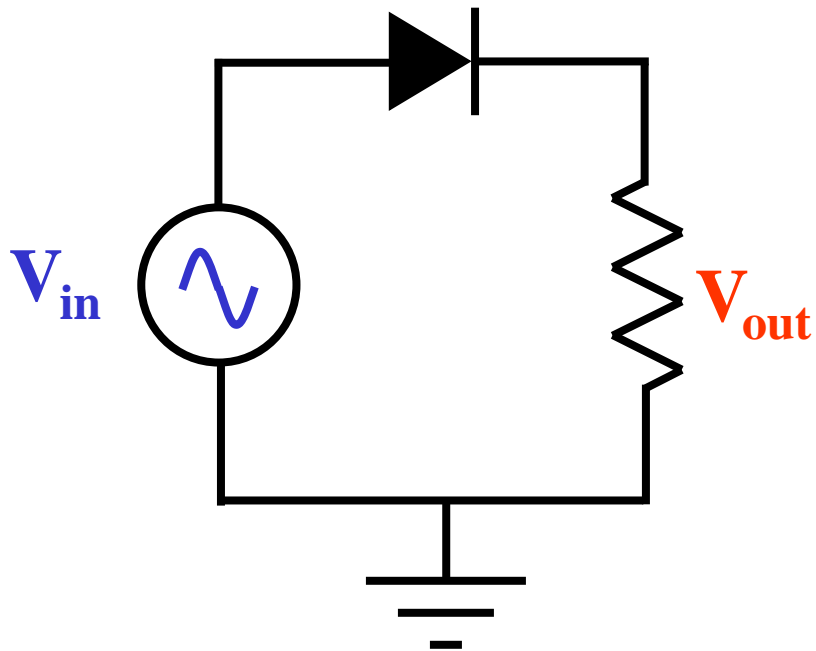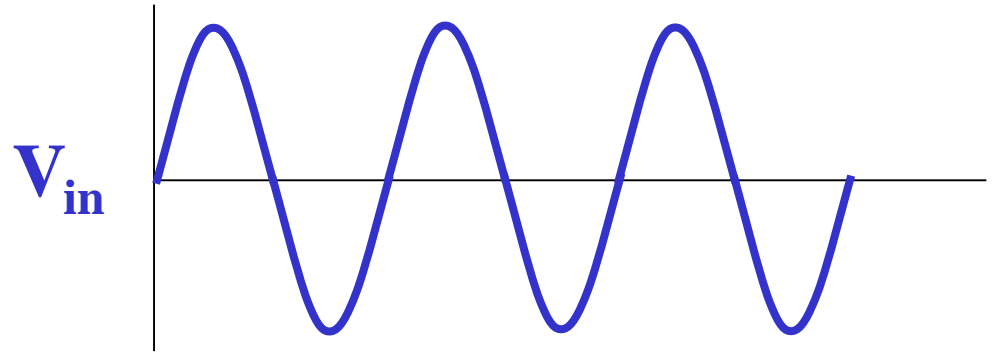
Pada frekuensi tinggi, penyimpanan muatan dapat menyebabkan performansi yang rendah

V_{out}

Tails

Hot-carrier rectifier
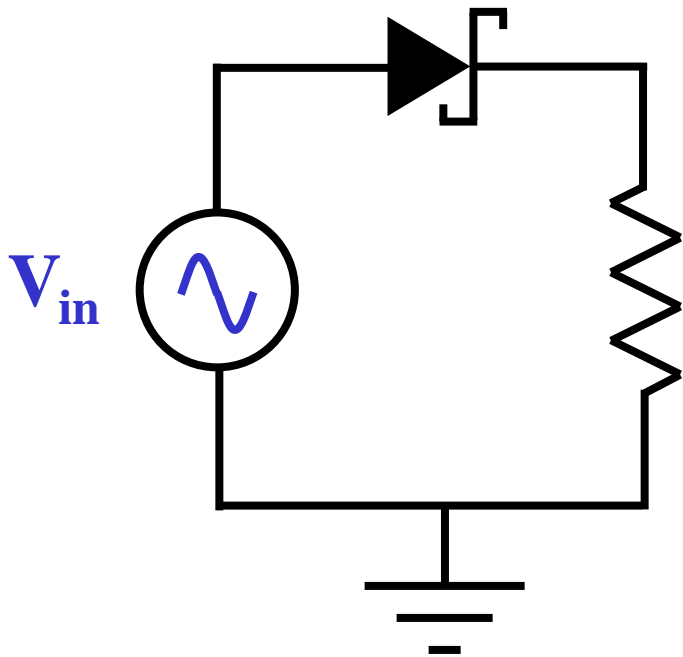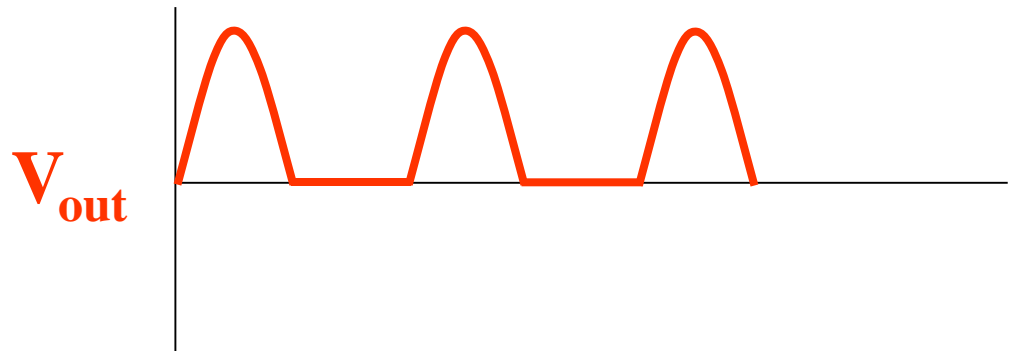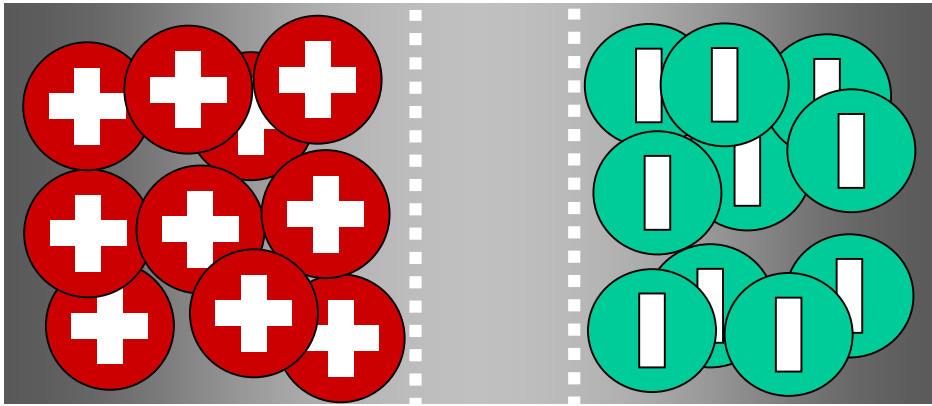
**Less reverse bias
(more capacitance)**
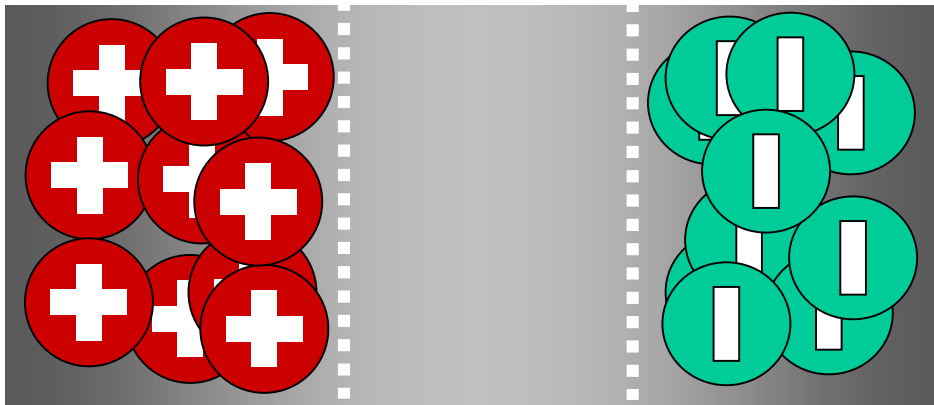
**More reverse bias
(less capacitance)**
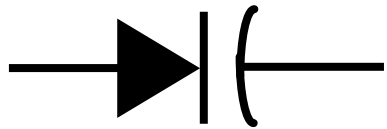
Varactor symbol

A varistor diode can be used to protect line-operated equipment from voltage surges.

Power supply

+

−

R_S

V_S

Current-regulator diode
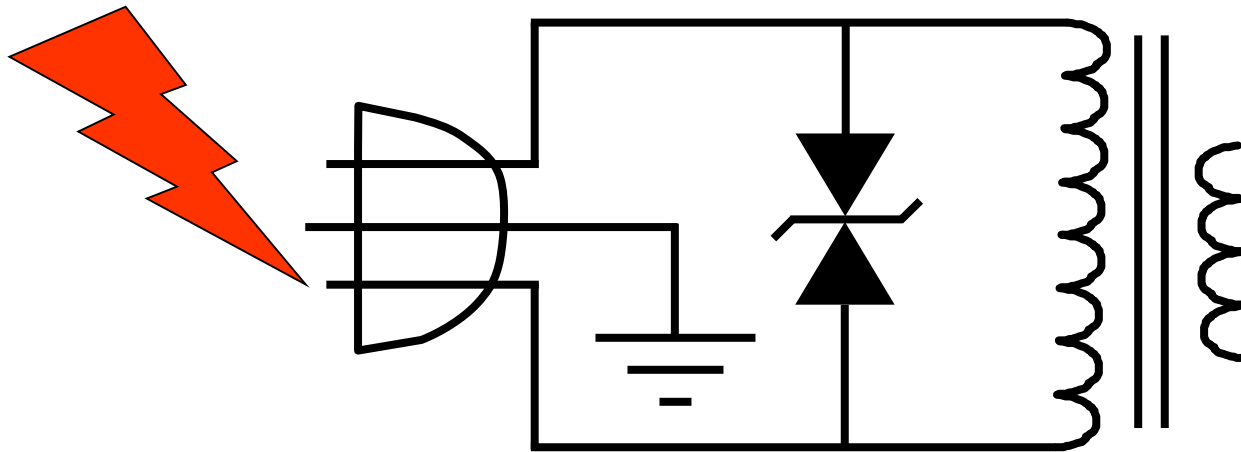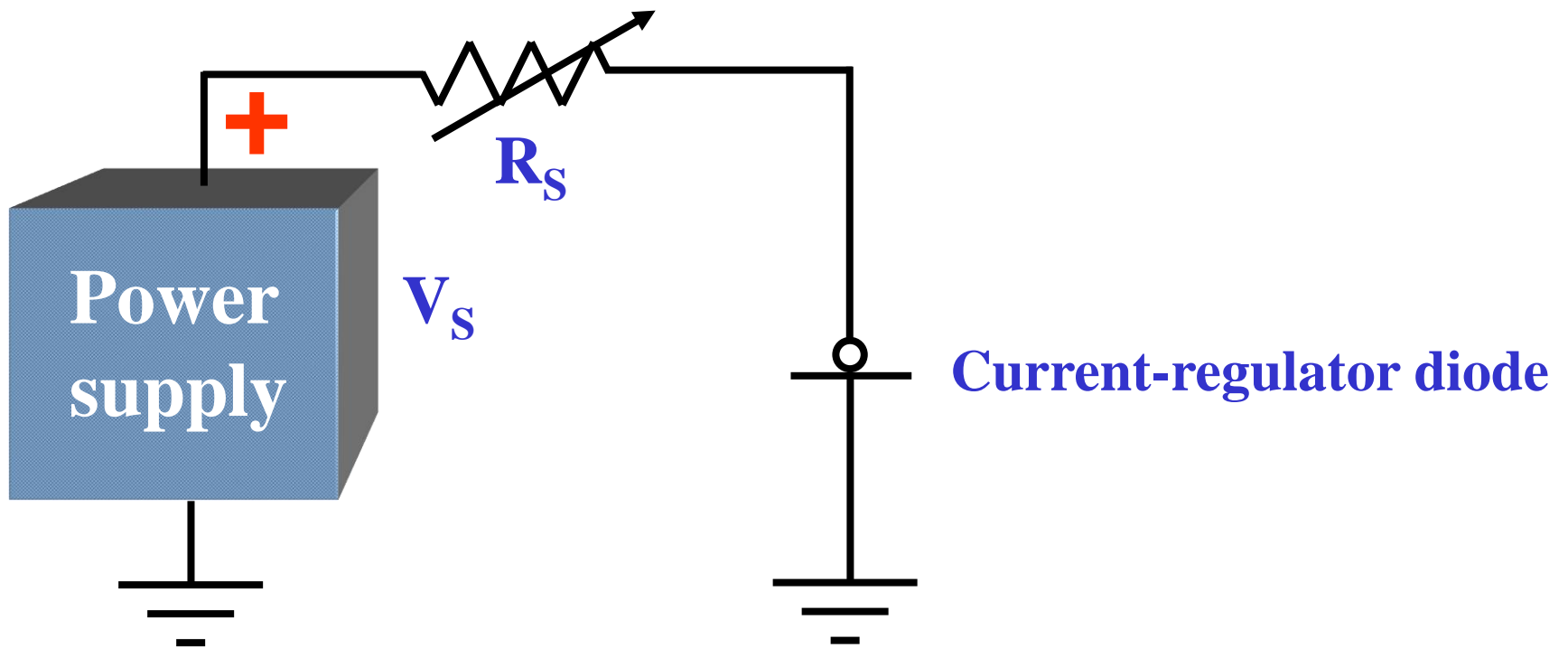
R_S can vary over a wide range and the current stays the same.

Other diode types

- **<u>Laser</u>: emits coherent light**

- **<u>Step-recovery</u>: snaps off when reverse biased**

- **<u>Back</u>: conducts better when reverse biased**

- **<u>Tunnel</u>: has a negative resistance region**

Other diode applications

- **Laser**: CD players, communications
- **Step-recovery**: Frequency multipliers
- **Back**: Small-signal rectifiers
- **Tunnel**: High-frequency oscillators

Special Purpose Devices

Device	Key Idea	Application
Zener diode	Operates in breakdown region	Voltage regulators
LED	Emits noncoherent light	DC or ac indicators, efficient light source
Seven-segment indicator	Can display numbers	Measuring instruments
Photodiode	Light produces minority carriers	Light detectors
Optocoupler	Combines LED and photodiode	Input/output isolators
Laser diode	Emits coherent light	CD/DVD players, broadband communications
Schottky diode	Has no charge storage	High-frequency rectifiers (300 MHz)
Varactor	Acts like variable capacitance	TV and receiver tuners
Varistor	Breaks down both ways	Line-spike protectors
Current-regulator diode	Holds current constant	Current regulators
Step-recovery diode	Snaps off during reverse conduction	Frequency multipliers
Back diode	Conducts better in reverse	Weak-signal rectifiers
Tunnel diode	Has a negative-resistance region	High-frequency oscillators
PIN diode	Controlled resistance	Microwave communications

Tugas

- Buat Rangkuman devais dioda-dioda khusus.

  (konsep dasar, fungsi dan aplikasinya)