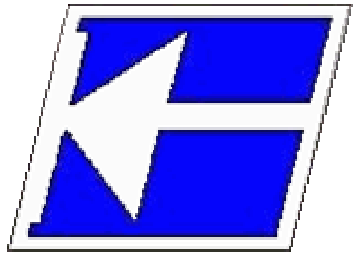
Centro Federal de Educação Tecnológica de Santa Catarina
Departamento de Eletrônica

Eletrônica Básica e Projetos Eletrônicos



Componentes eletrônicos

Clóvis Antônio Petry, professor.

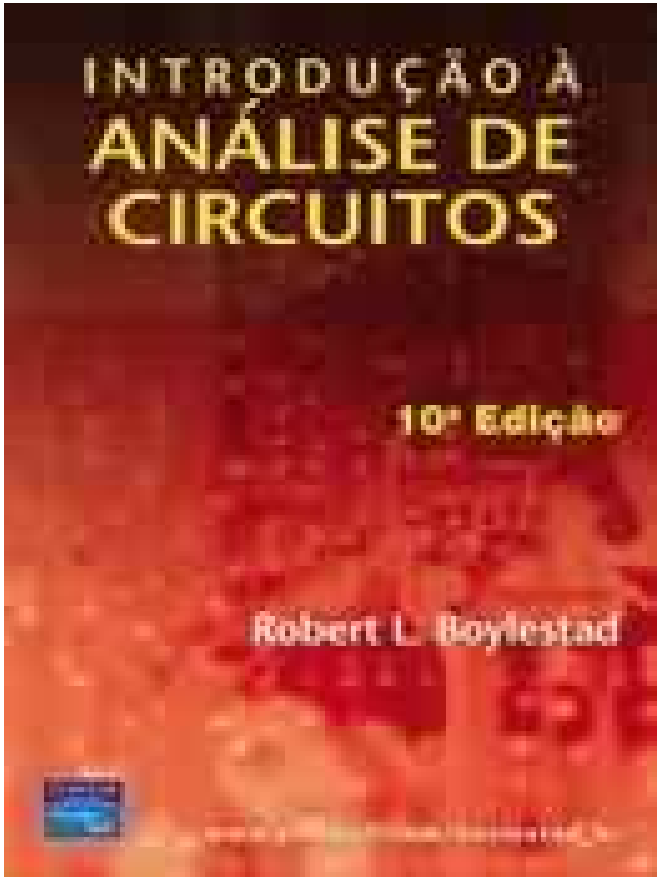
Florianópolis, abril de 2007.

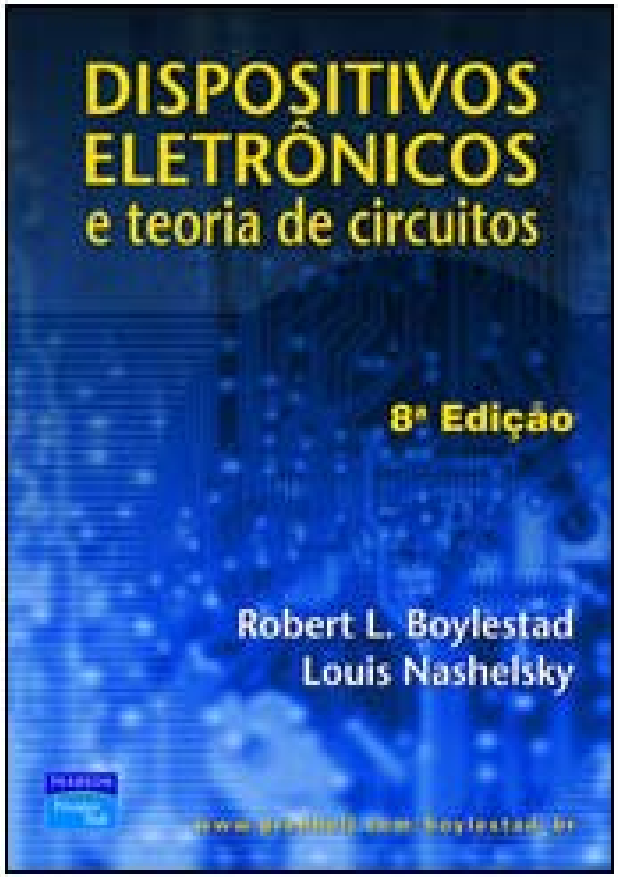
Nesta aula

Seqüência de conteúdos:

1. Resistores;
2. Termistores;
3. LDRs;
4. Varistores;
5. Capacitores;
6. LEDs;
7. Varicap;
8. Fotodiodos;
9. Fototransistores;
10. Optoacopladores;
11. Células solares.

Bibliografia



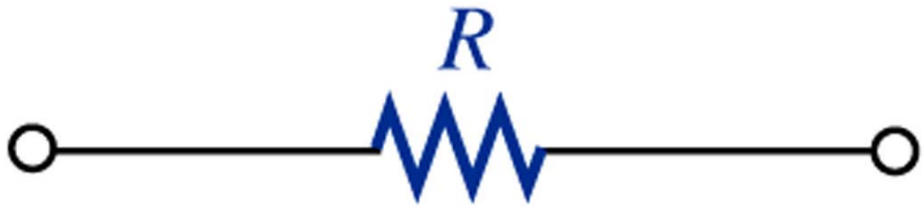


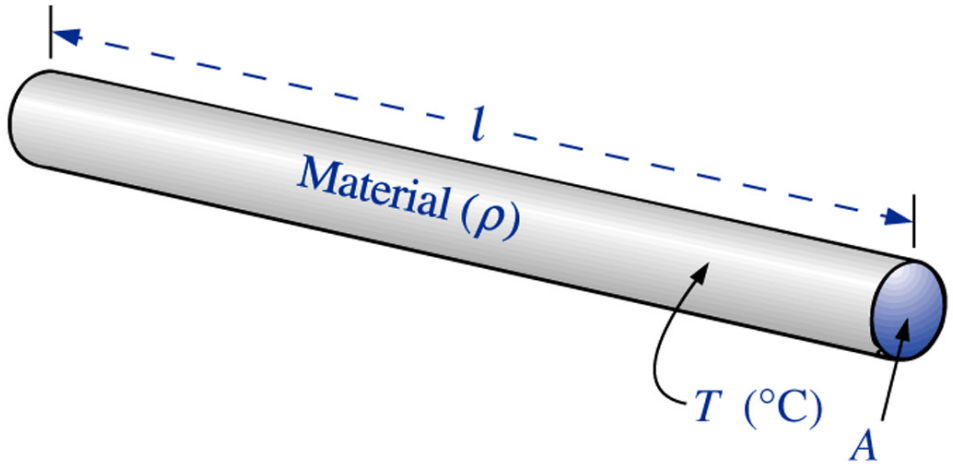
www.cefetsc.edu.br/~petry

Resistores

Resistência depende de:

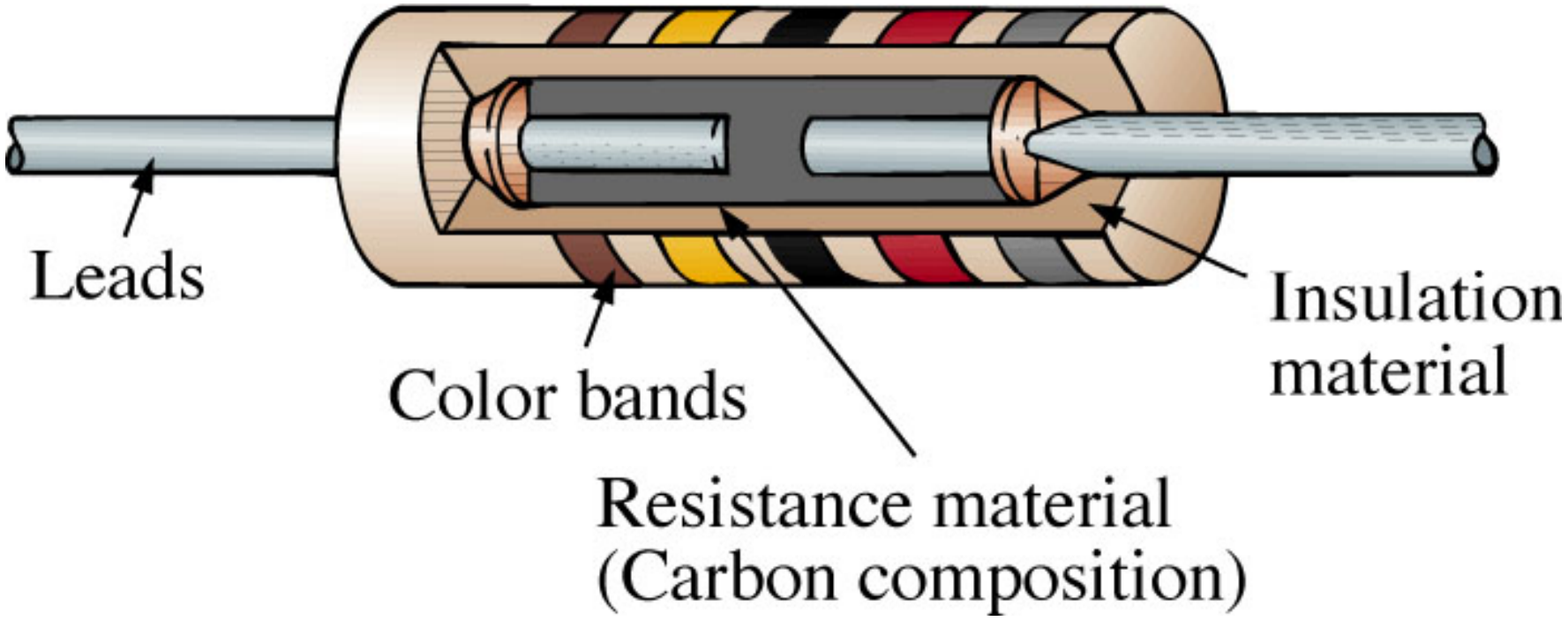
- Material;
- Comprimento;
- Área da seção reta;
- Temperatura.





Resistores

Tipos de resistores:

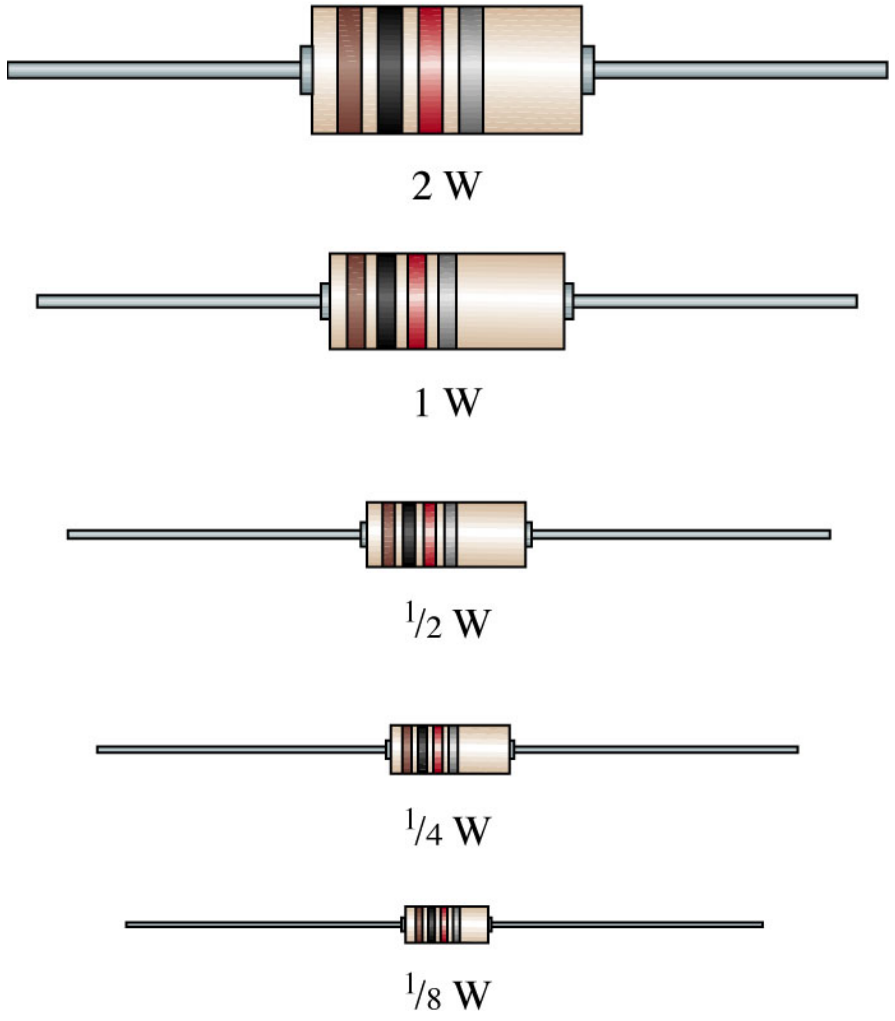


Resistor fixo de carbono.

Resistores

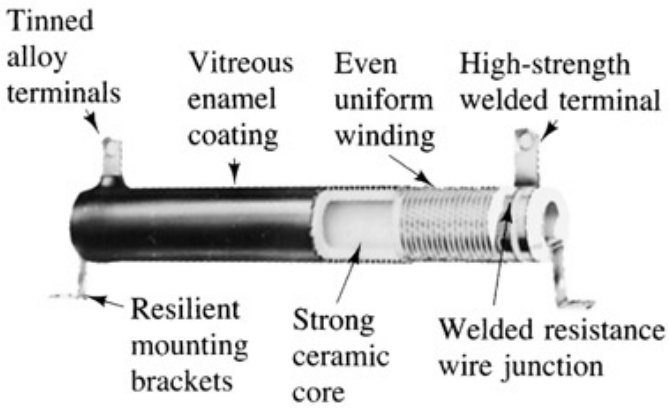
Tipos de resistores:

Resistores fixos de carbono com potências diferentes.



Resistores

Tipos de resistores:



(a) Vitreous-enameled wire-wound resistor
App: All types of equipment

Resistores de potência de fio.

(b) High-voltage cermet film resistors (on a high grade ceramic body).
App: For high-voltage applications up to 10 kV requiring high levels of stability.

Resistores para altas tensões.

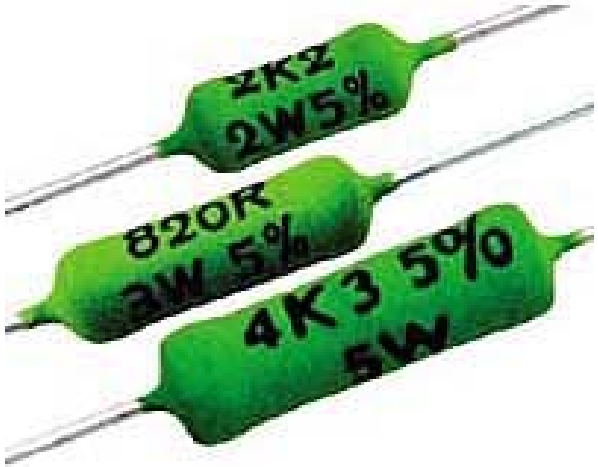
(c) Metal-film precision resistors
App: Where high stability, low temperature coefficient, and low noise level desired

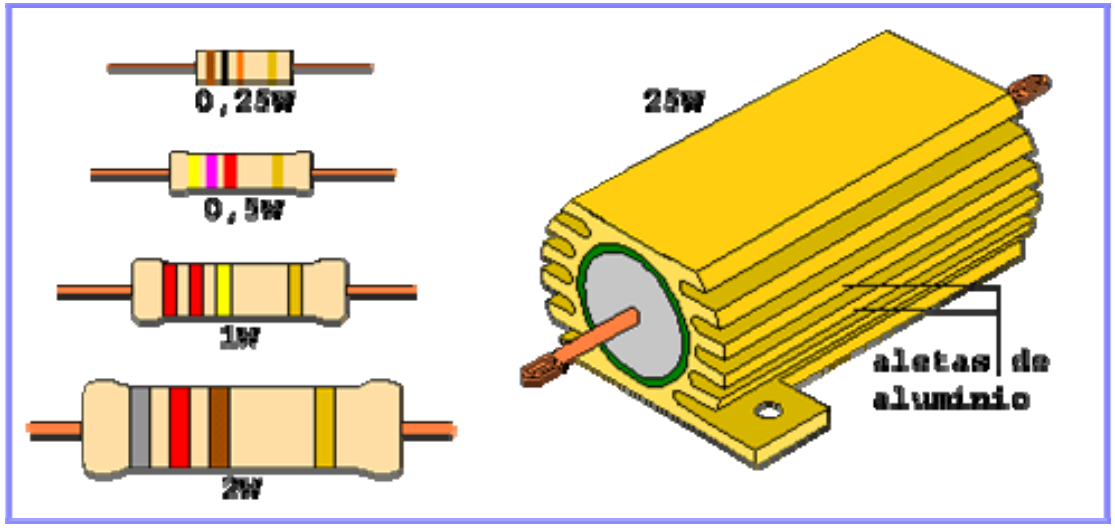
Resistores de precisão de filme metálico.

Resistores

Tipos de resistores:

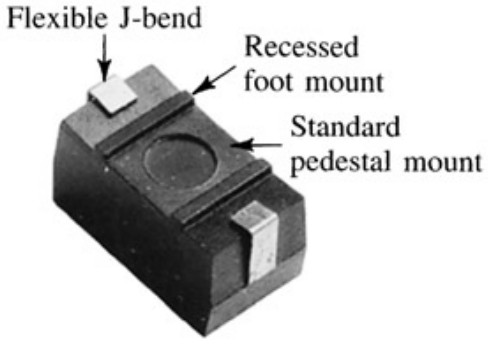
Resistores de potência.





Resistores

Tipos de resistores:

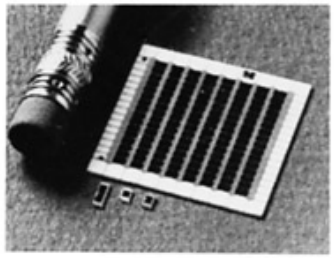


(a) Surface mount power resistor ideal for printed circuit boards. Patented J-bends eliminate need for solder connections. (0.8 W to 3 W in wire-wound, film, or power film construction)

Resistores de potência de fio.

(b) Precision power wire-wound resistors with ratings as high as 2 W and tolerances as low as 0.05%. Temperature coefficients as low as 20 ppm/°C are also available.

Resistores de precisão de fio.

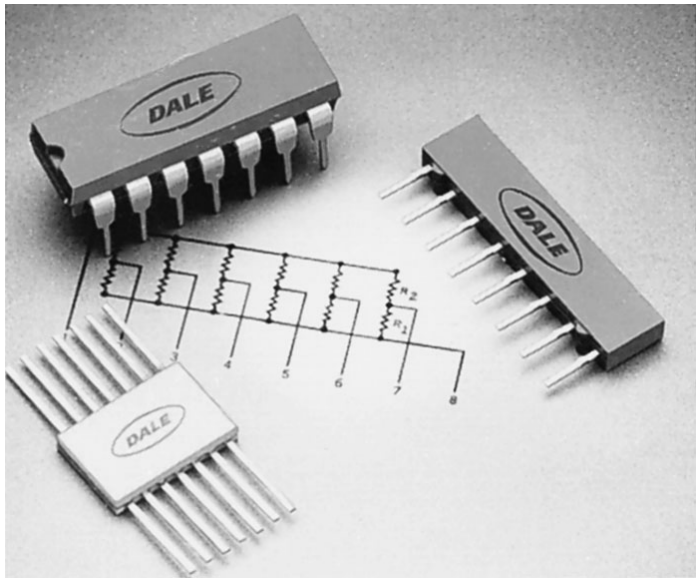


(c) Thick-film chip resistors for design flexibility with hybrid circuitry. Pre-tinned, gold or silver electrodes available. Operating temperature range −55°C to +150°C.

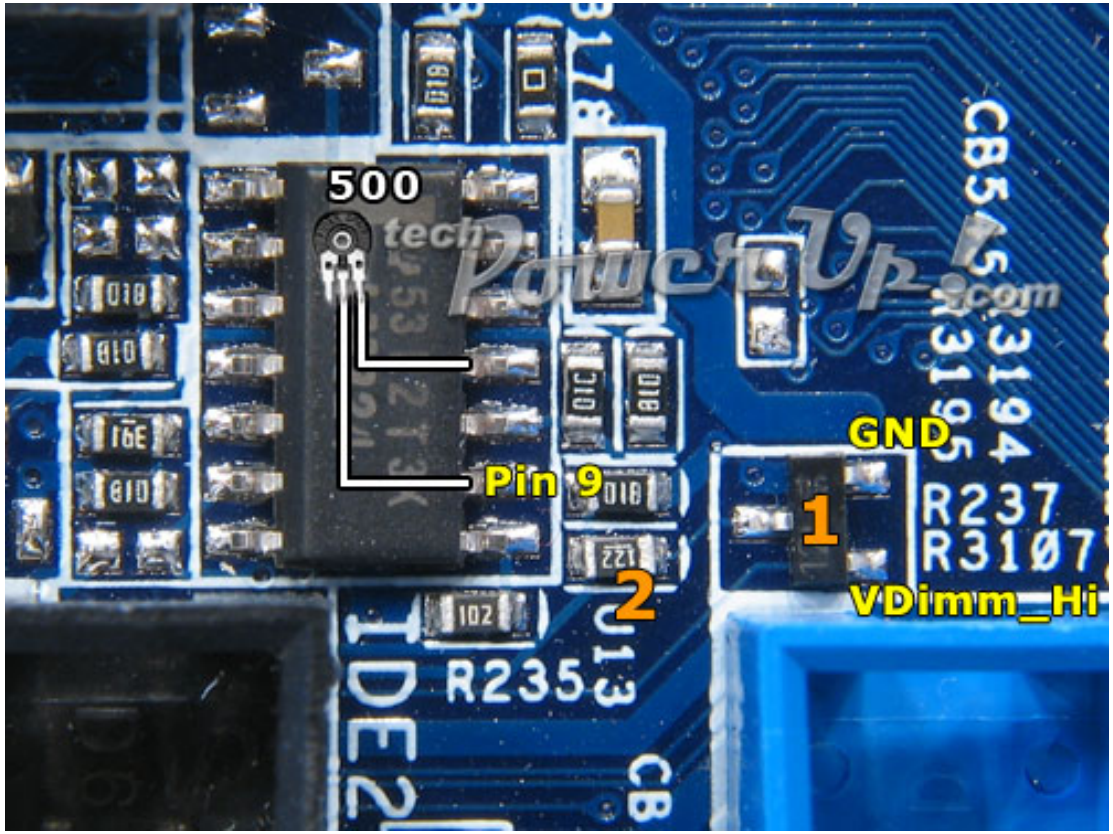
Resistores de filme em chip.

Resistores

Tipos de resistores:

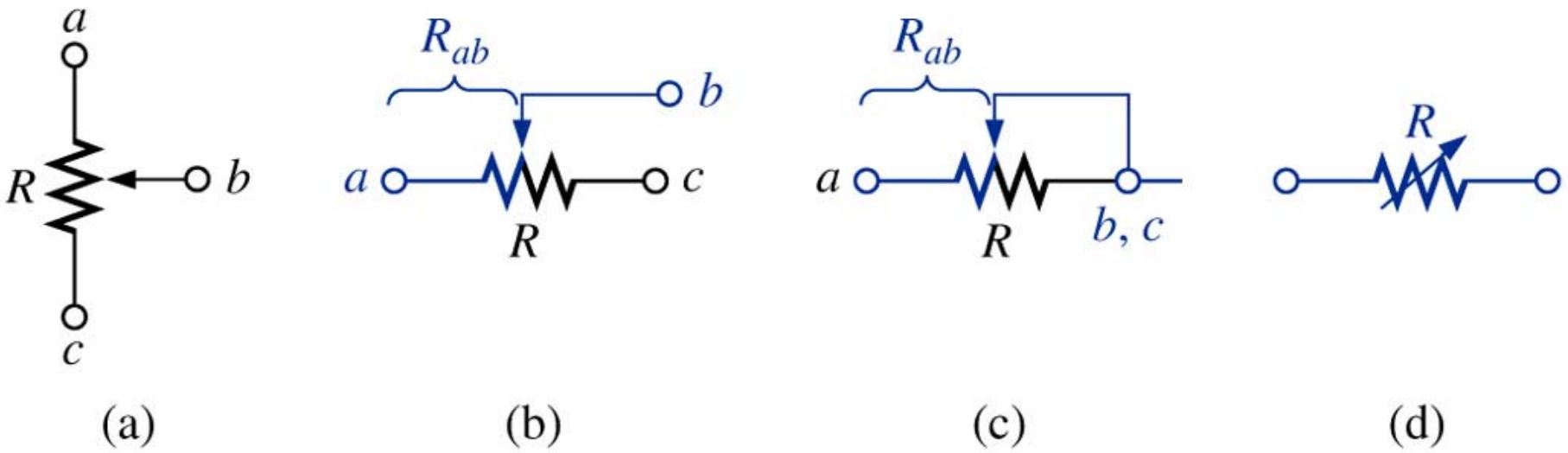


Resistores integrados e smd.

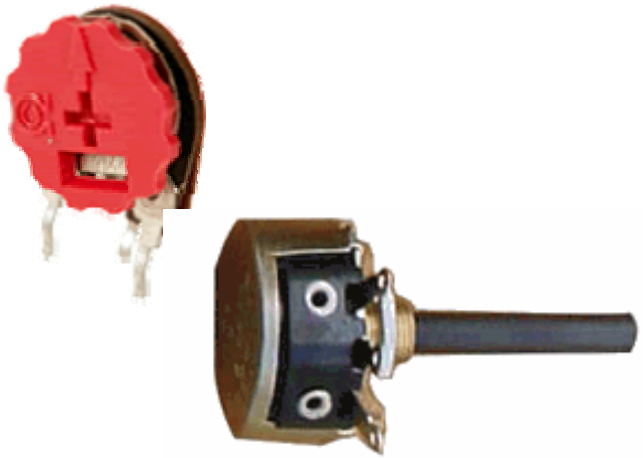


Resistores

Tipos de resistores:



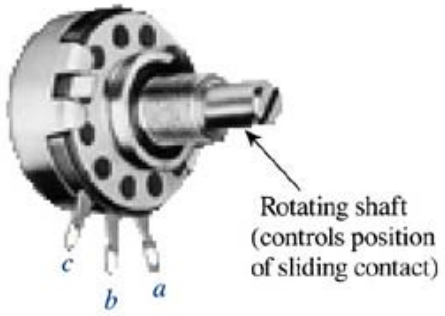
Resistores variáveis e ajustáveis. → Trimpots e potenciômetros.



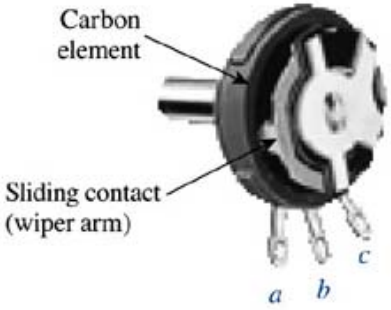
Resistores

Tipos de resistores:

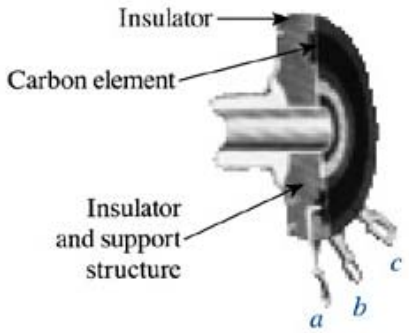
Resistores variáveis e ajustáveis.



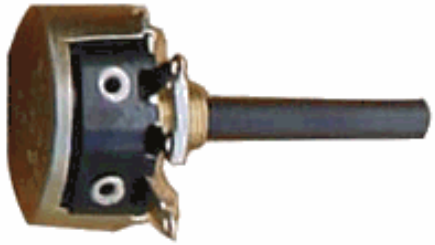
(a) External view

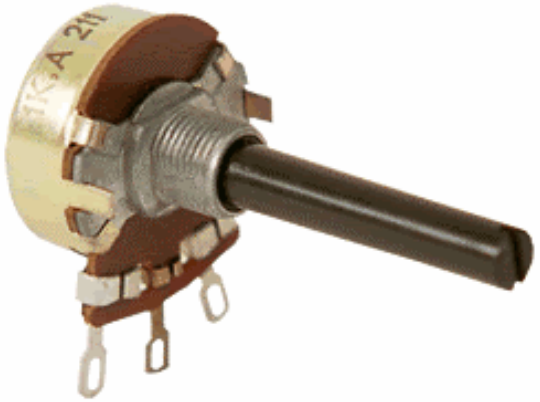


(b) Internal view



(c) Carbon element

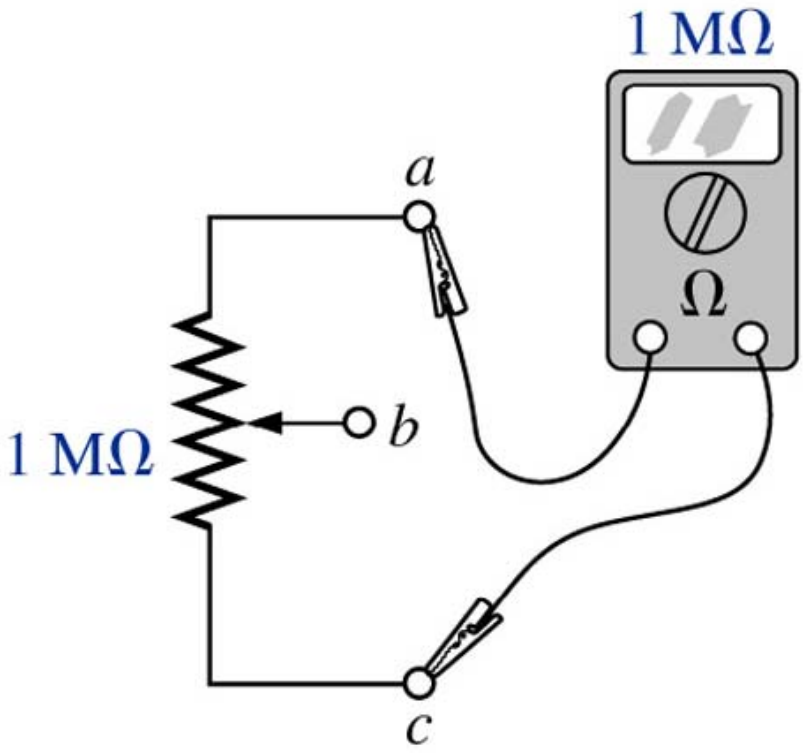




Resistores

Tipos de resistores:

Resistores variáveis e ajustáveis.



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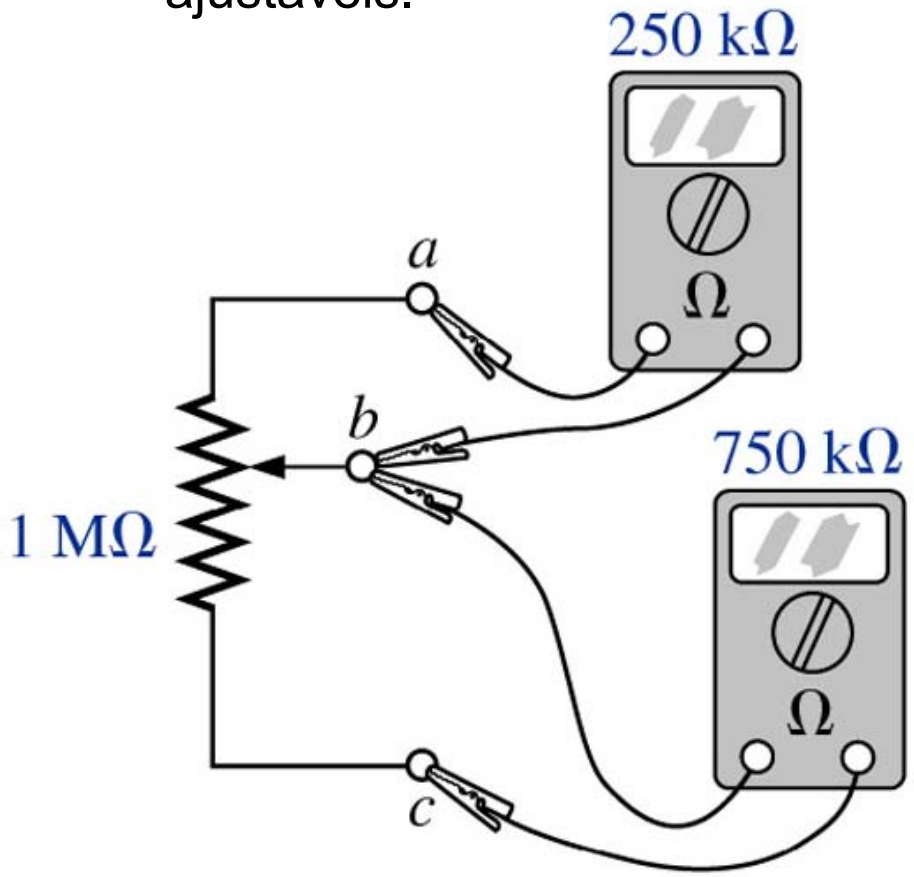
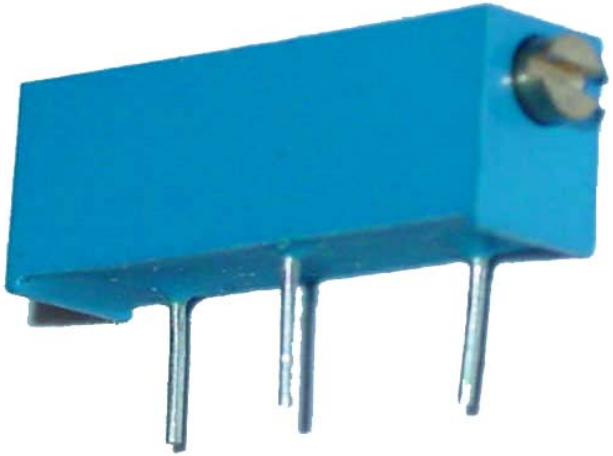
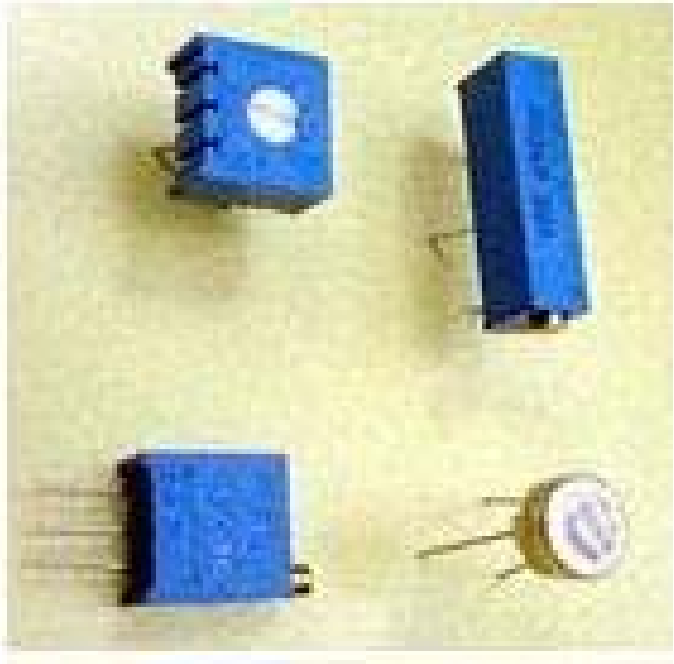


(b)

Resistores

Tipos de resistores:

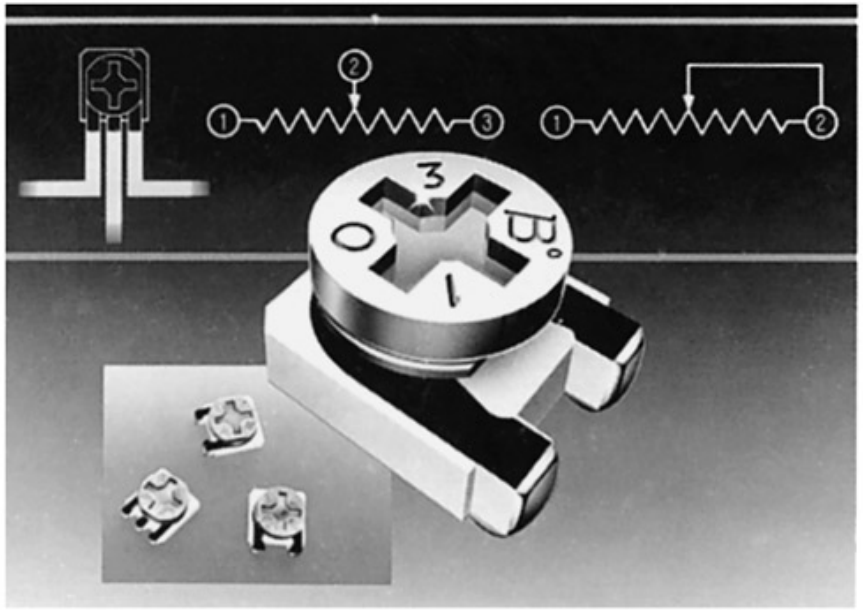




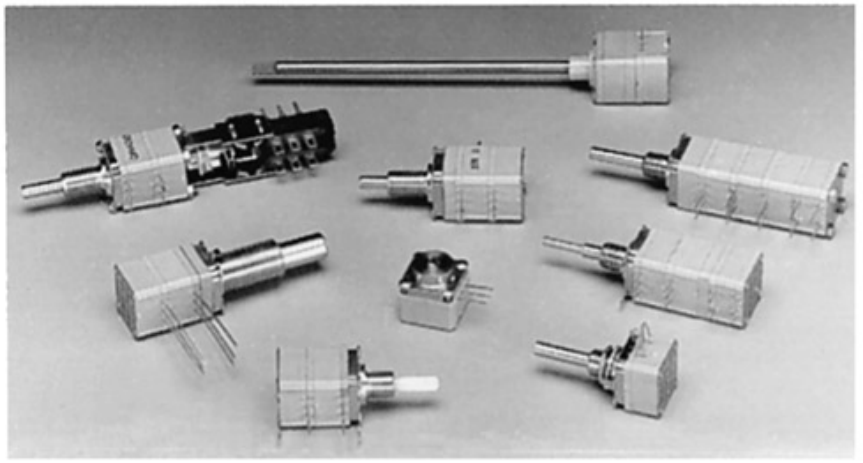
Resistores variáveis e ajustáveis.

Resistores

Tipos de resistores:



(a)



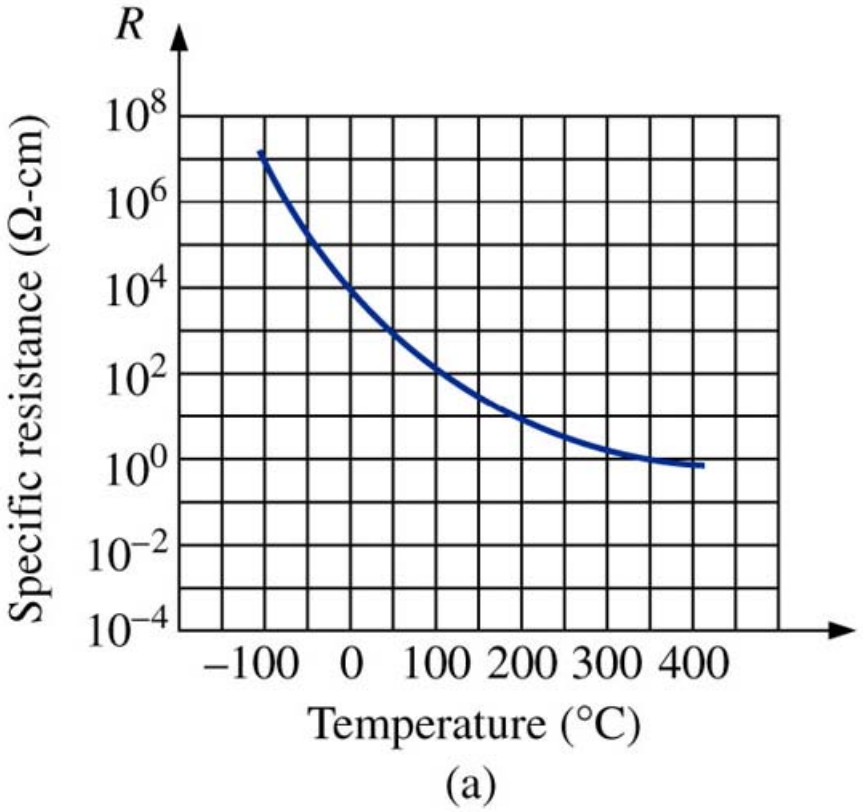
(b)

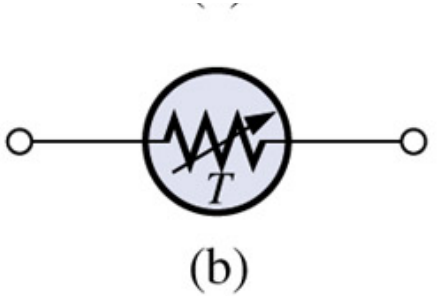
Potenciômetros de precisão ou multivoltas.

Termistores

Termistor:

- Resistor cuja resistência é sensível à variação da temperatura.





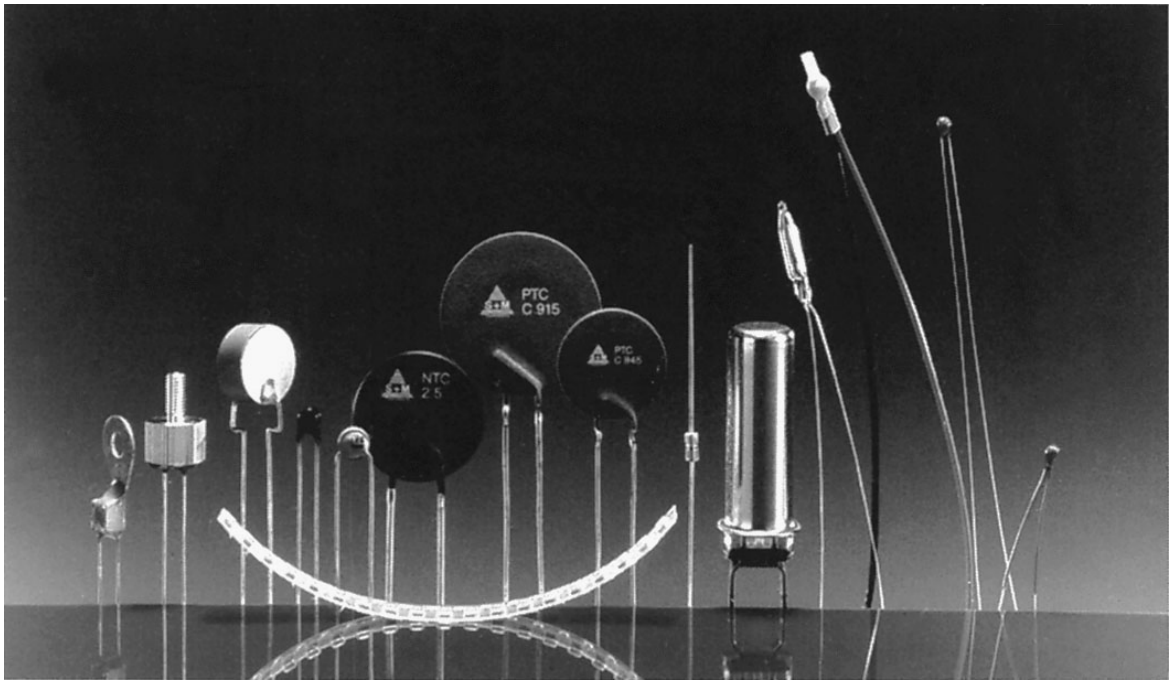
Termistores

Termistor NTC:

- Coeficiente negativo de temperatura;
- Resistência diminui com o aumento da temperatura.

Termistor PTC:

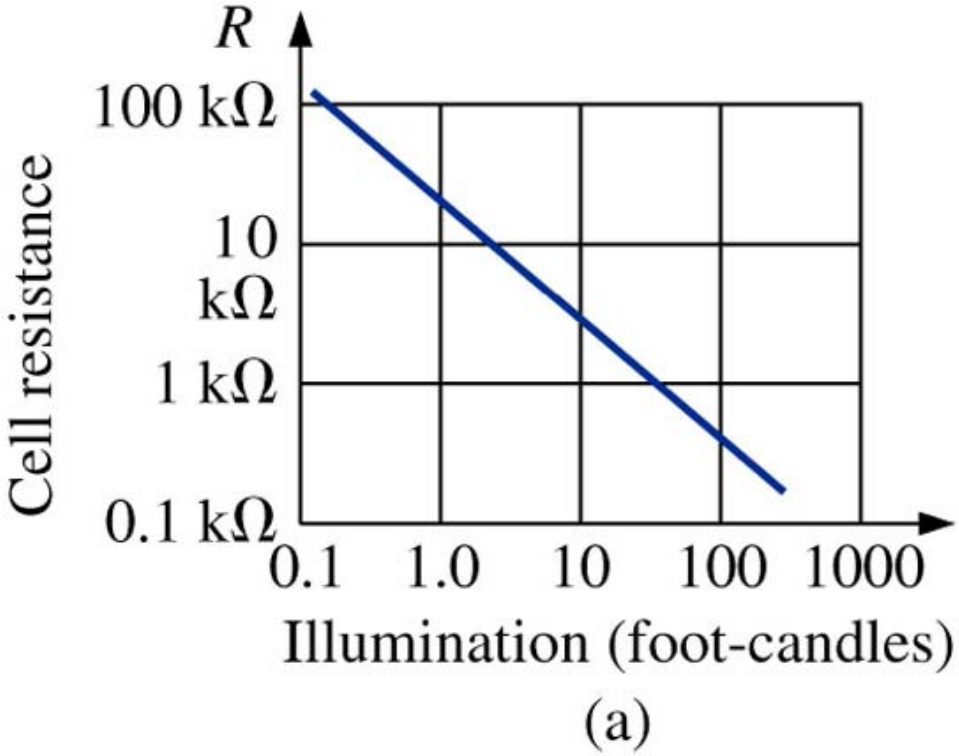
- Coeficiente positivo de temperatura;
- Resistência aumenta com o aumento da temperatura.



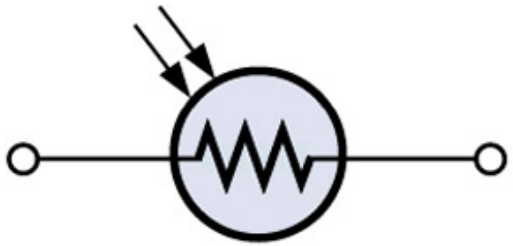
Célula fotocondutora ou LDR

LDR (Light dependent resistor) ou célula fotocondutora:

- A resistência é determinada pela intensidade da luz incidente em sua superfície.

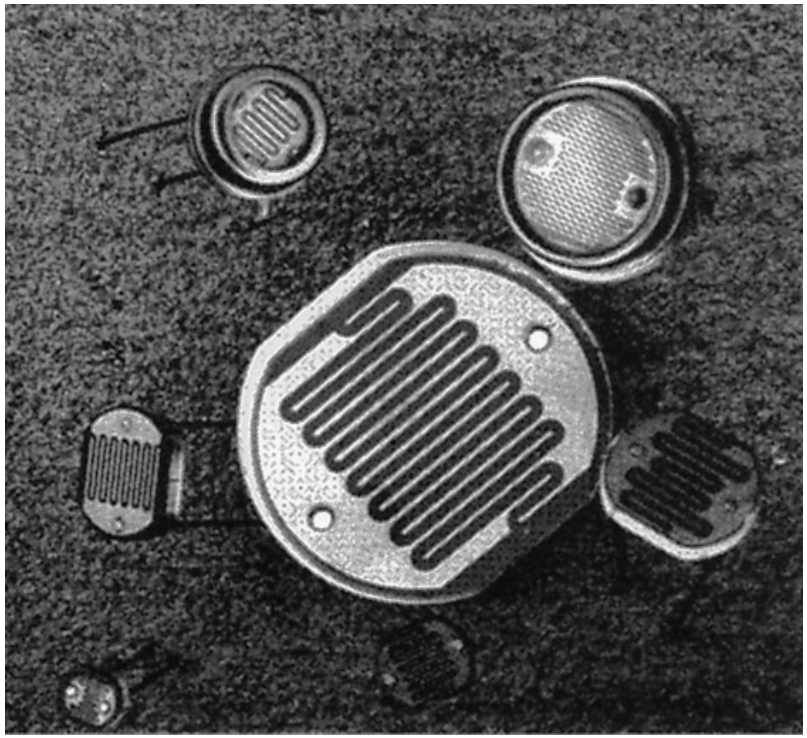


(a)



(b)

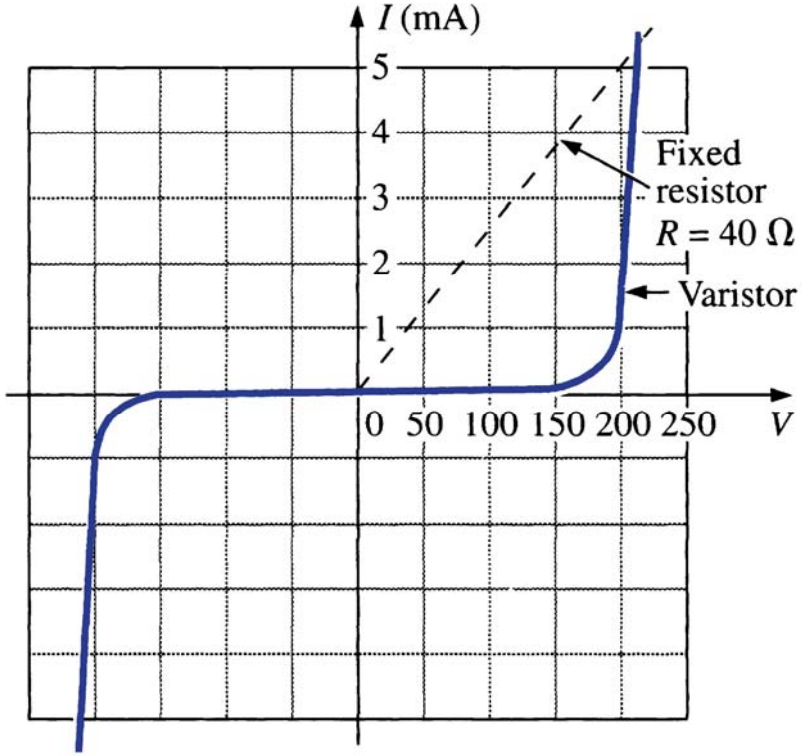
Célula fotocondutora ou LDR



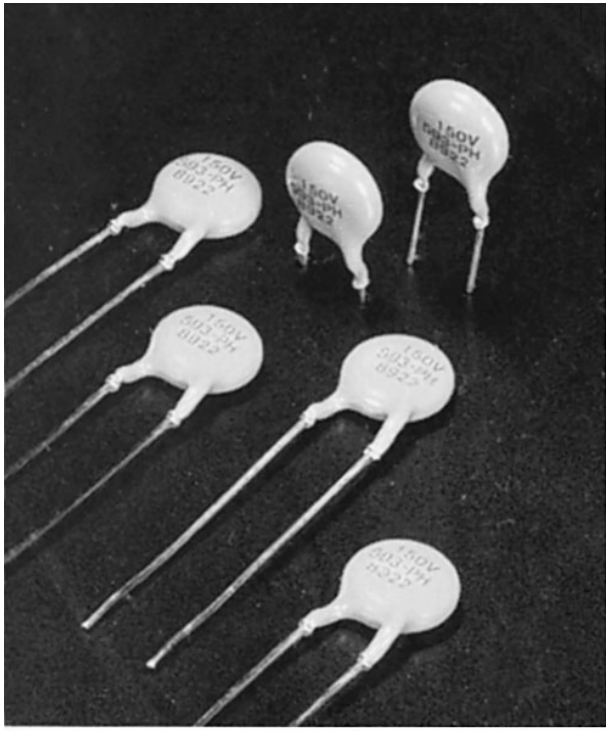
Varistores

Varistores:

- São resistores não-lineares, cuja resistência depende da tensão aplicada, usados para suprimir transientes de alta tensão.



(a)

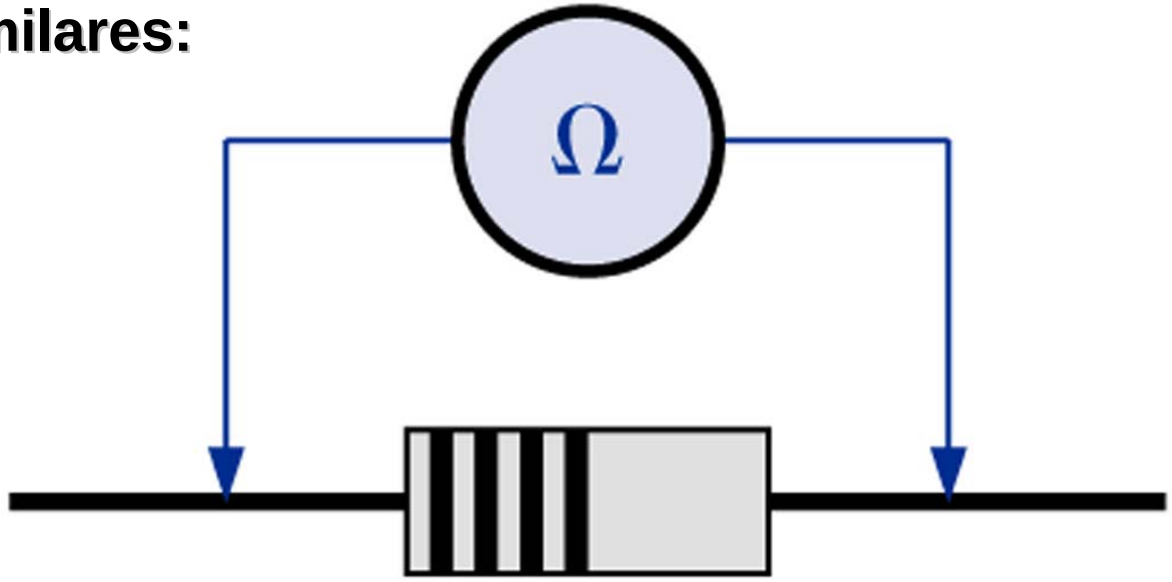


(b)

Resistores e similares

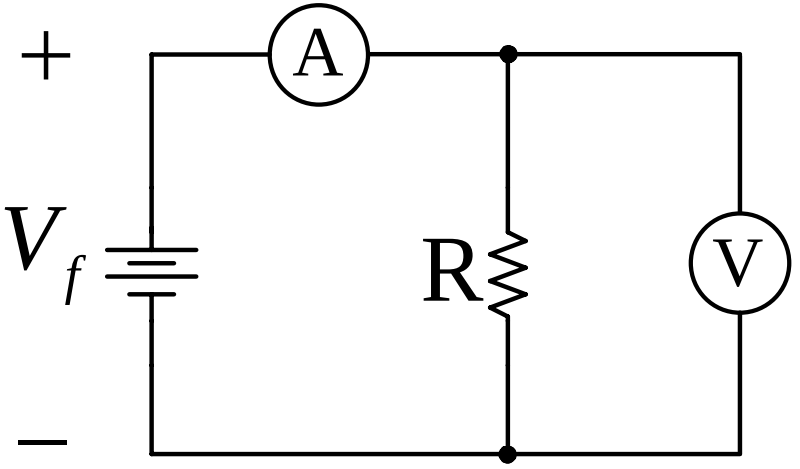
Testando resistores e similares:

Usando multímetro (Ω):



Aplicando a Lei de Ohm:

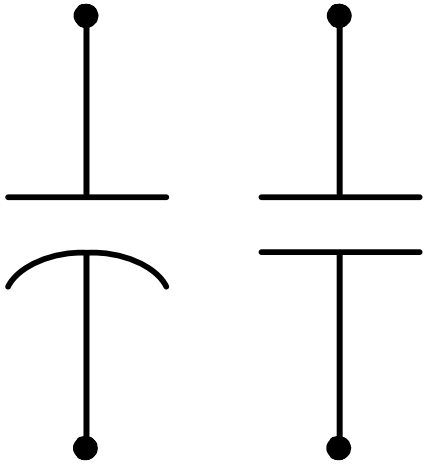
$$R = \frac{V}{I}$$

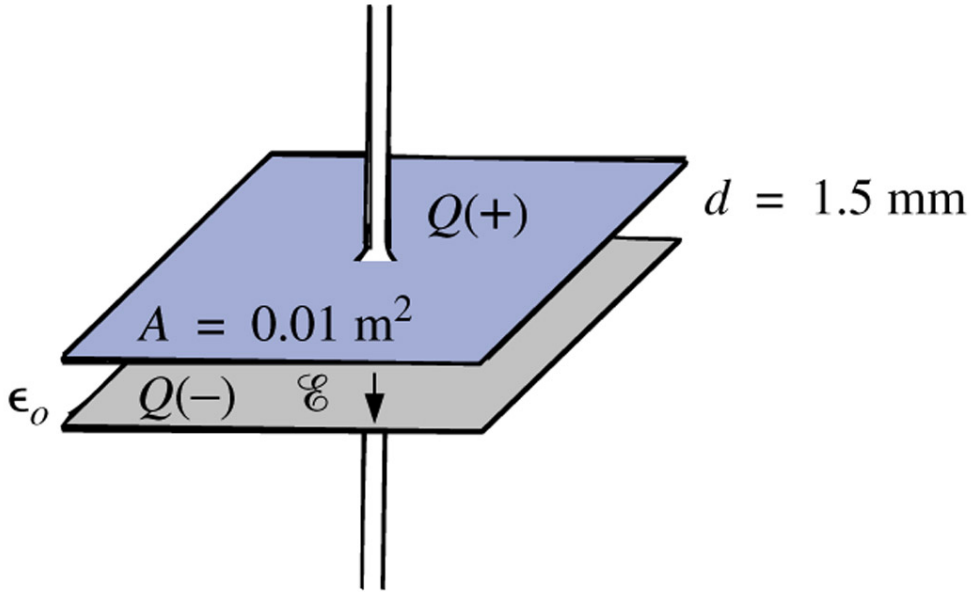


Capacitores

Capacitância depende de:

- Dielétrico (permissividade);
- Área das placas;
- Distância entre as placas.

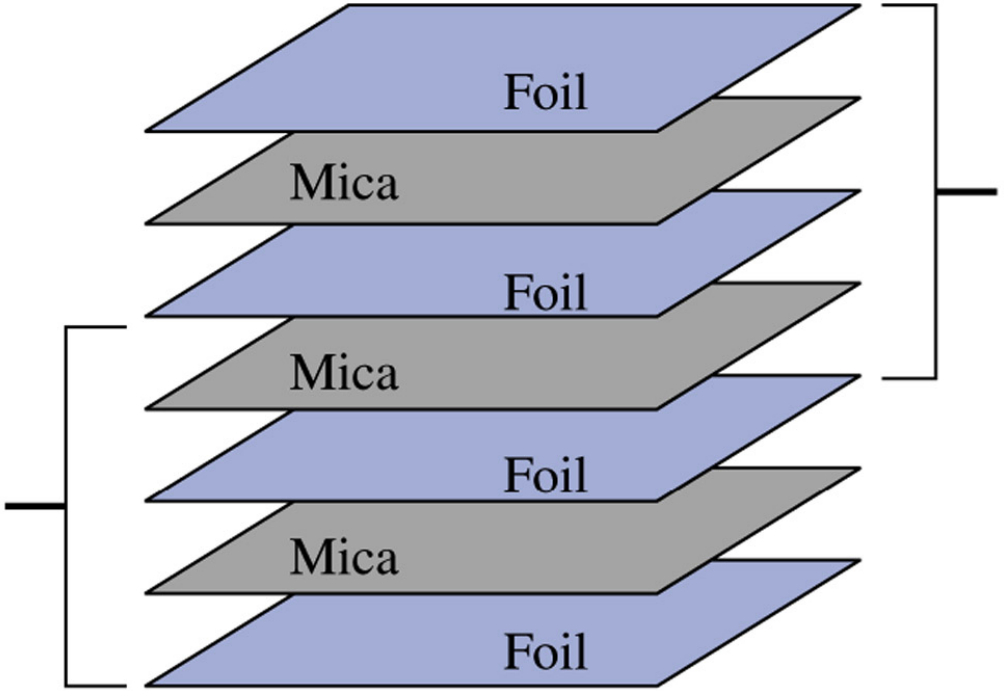


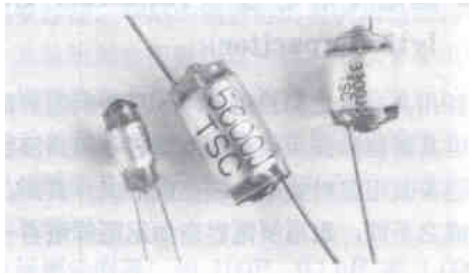


Capacitores

Tipos de capacitores:

Capacitores fixos de mica.

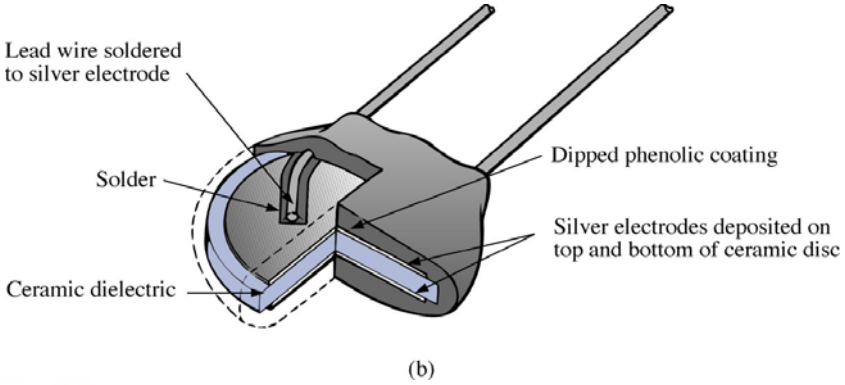


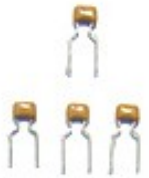


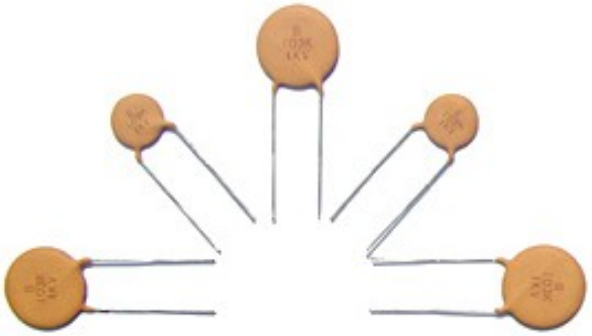
Capacitores

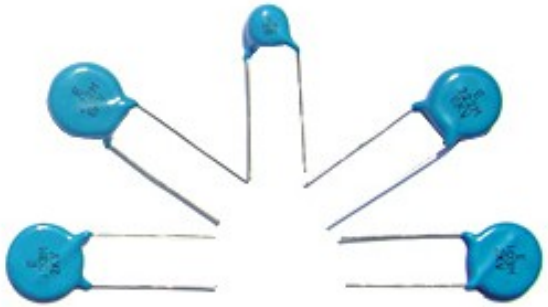
Tipos de capacitores:

Capacitores de disco de cerâmica.







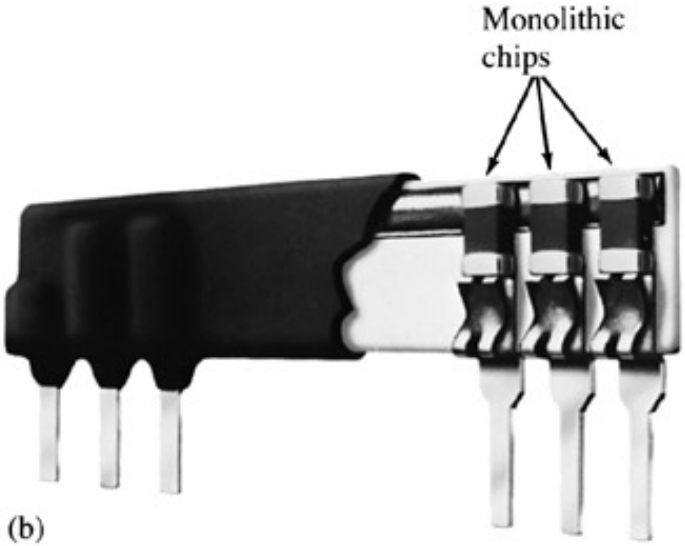


Capacitores

Tipos de capacitores:

Capacitores integrados.

(a)

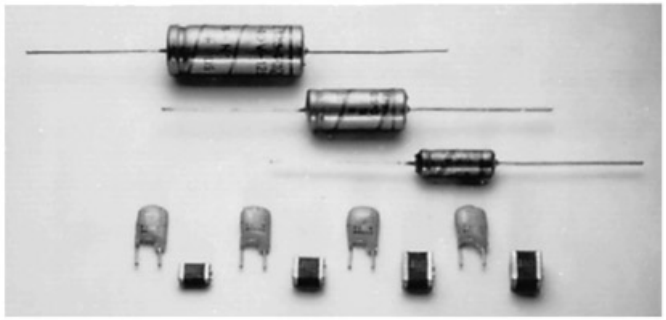


(b)

Capacitores

Tipos de capacitores:

Capacitores eletrolíticos.



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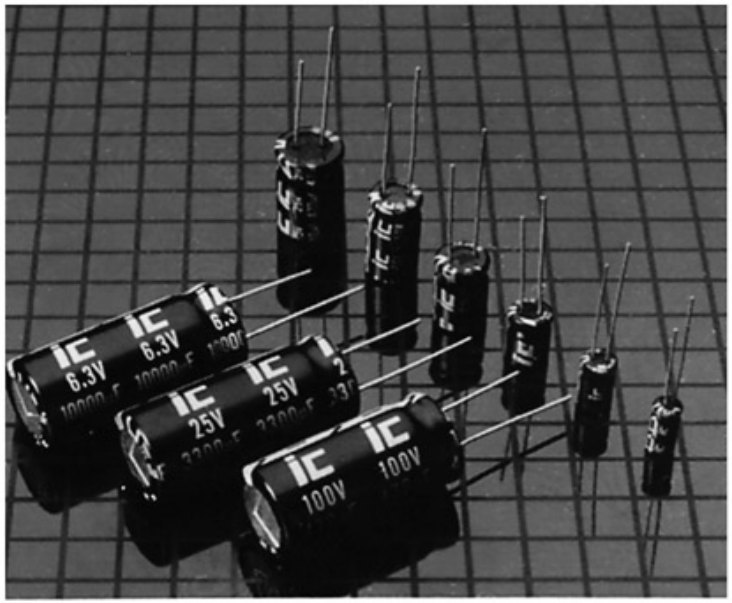
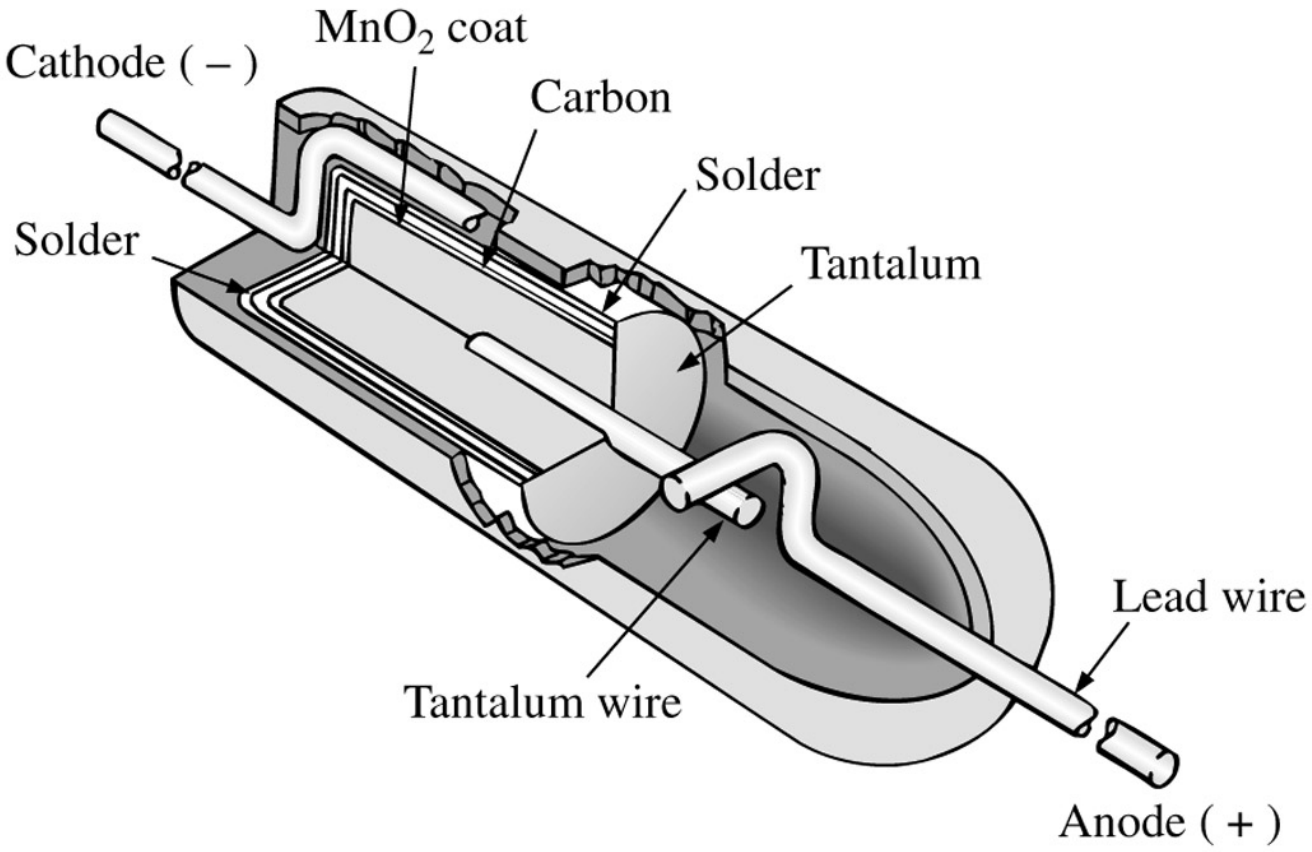


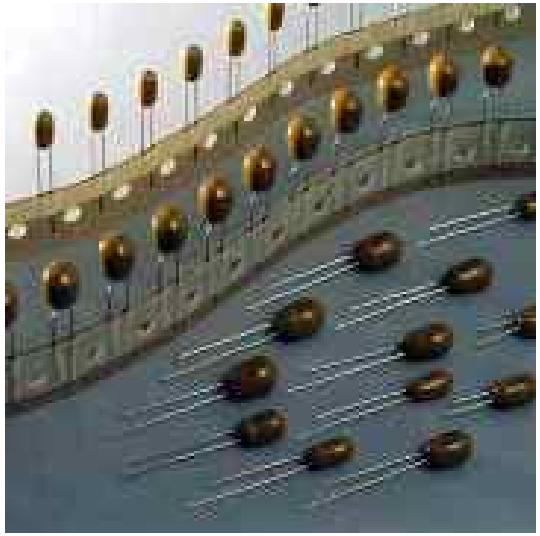
(a)

Capacitores

Tipos de capacitores:

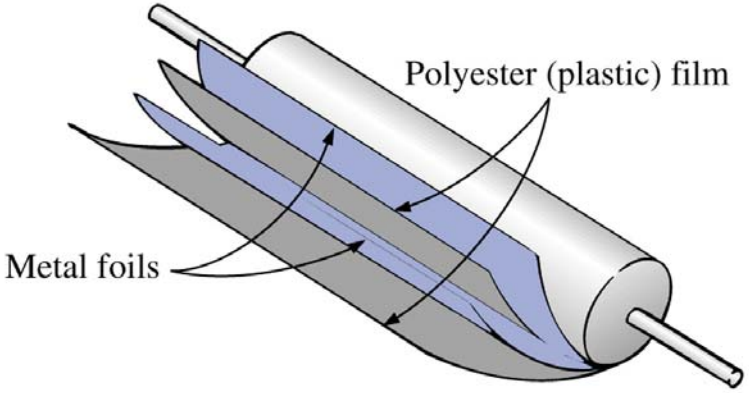
Capacitores de tântalo.



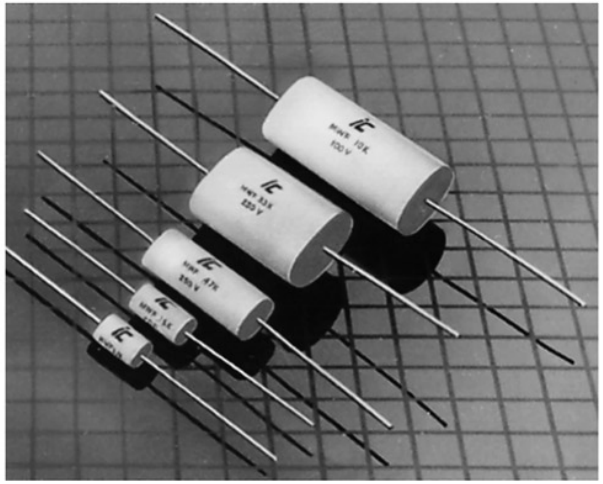


Capacitores

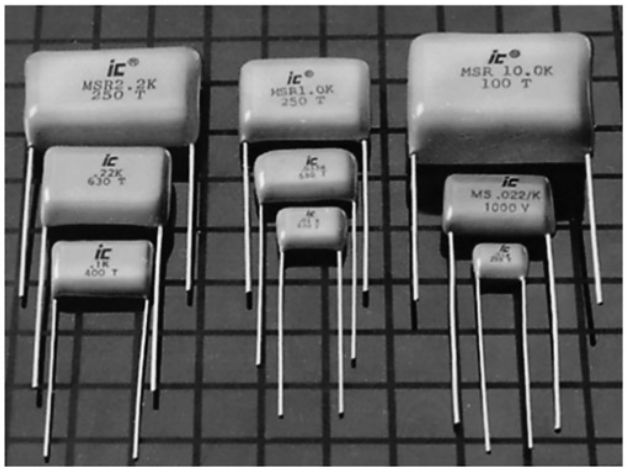
Tipos de capacitores:



Capacitores de
filme de poliéster.



(a)

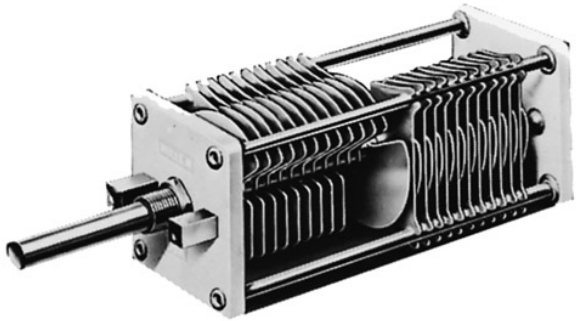


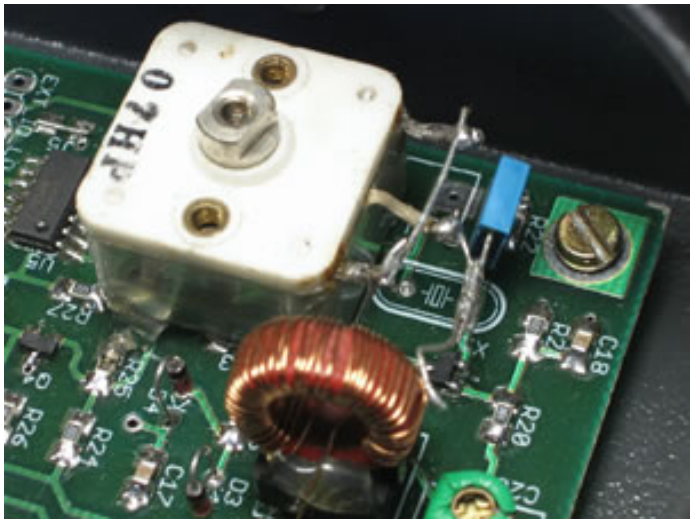
(b)

Capacitores

Tipos de capacitores:

Capacitores variáveis
e ajustáveis.





Capacitores

Tipos de capacitores:

Small capacitance	3F, 2.3V – 300F, 2.3V	back-up power, on-board UPS, etc.
Medium capacitance	300F, 2.3V – 5000F, 2.7V	peak power, UPS, etc.
Large capacitance	5000F, 2.7V – 80.000F, 1.8 V	peak power, low maintenance energy storage, etc.
Supercapacitor modules	5V- 700V, capacitance on request.	Higher voltage applications

Super capacitores

Capacitores

Tipos de capacitores, resumo:

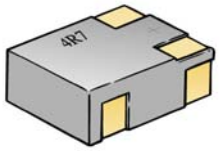
Type: Miniature Axial Electrolytic
Typical Values: 0.1 ∝F to 15,000 ∝F
Typical Voltage Range: 5 V to 450 V
Capacitor tolerance: ±20%
Applications: Polarized, used in DC power supplies, bypass filters, DC blocking.

Type: Miniature Radial Electrolyte
Typical Values: 0.1 ∝F to 15,000 ∝F
Typical Voltage Range: 5 V to 450 V
Capacitor tolerance: ±20%
Applications: Polarized, used in DC power supplies, bypass filters, DC blocking.

Type: Ceramic Disc
Typical Values: 10 pF to 0.047 ∝F
Typical Voltage Range: 100 V to 6 kV
Capacitor tolerance: ±5%, ±10%
Applications: Non-polarized, NPO type, stable for a wide range of temperatures. Used in oscillators, noise filters, circuit coupling, tank circuits.

Type: Dipped Tantalum (solid and wet)
Typical Values: 0.047 ∝F to 470 ∝F
Typical Voltage Range: 6.3 V to 50 V
Capacitor tolerance: ±10%, ±20%
Applications: Polarized, low leakage current, used in power supplies, high frequency noise filters, bypass filter.

Type: Surface Mount Type (SMT)
Typical Values: 10 pF to 10 ∝F
Typical Voltage Range: 6.3 V to 16 V
Capacitor tolerance: ±10%
Applications: Polarized and non-polarized, used in all types of circuits, requires a minimum amount of PC board real estate.



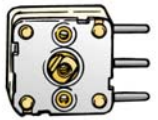
Type: Silver Mica
Typical Value: 10 pF to 0.001 ∝F
Typical Voltage Range: 50 V to 500 V
Capacitor tolerance: ±5%
Applications: Non-polarized, used in oscillators, in circuits that require a stable component over a range of temperatures and voltages.

Type: Mylar Paper
Typical Value: 0.001 ∝F to 0.68 ∝F
Typical Voltage Range: 50 V to 600 V
Capacitor tolerance: ±22%
Applications: Non-polarized, used in all types of circuits, moisture resistant.

Type: AC/DC Motor Run
Typical Value: 0.25 ∝F to 1200 ∝F
Typical Voltage Range: 240 V to 660 V
Capacitor tolerance: ±10%
Applications: Non-polarized, used in motor run-start, high-intensity lighting supplies, AC noise filtering.

Type: Trimmer Variable
Typical Value: 1.5 pF to 600 pF
Typical Voltage Range: 5 V to 100 V
Capacitor tolerance: ±10%
Applications: Non-polarized, used in oscillators, tuning circuits, AC filters.

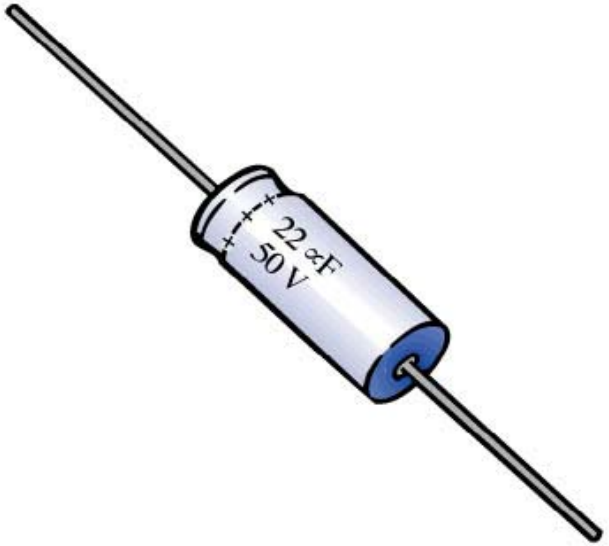
Type: Tuning variable
Typical Value: 10 pF to 600 pF
Typical Voltage Range: 5 V to 100 V
Capacitor tolerance: ±10%
Applications: Non-polarized, used in oscillators, radio tuning circuit.



Capacitores

Tipos de capacitores:

Type: Miniature Axial Electrolytic
Typical Values: 0.1 ∝F to 15,000 ∝F
Typical Voltage Range: 5 V to 450 V
Capacitor tolerance: ±20%
Applications: Polarized, used in DC power supplies, bypass filters, DC blocking.



Capacitores

Tipos de capacitores:

Type: Miniature Radial Electrolyte
Typical Values: 0.1 ∝F to 15,000 ∝F
Typical Voltage Range: 5 V to 450 V
Capacitor tolerance: ±20%
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Capacitores

Tipos de capacitores:

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Typical Values: 10 pF to 0.047 ∝F
Typical Voltage Range: 100 V to 6 kV
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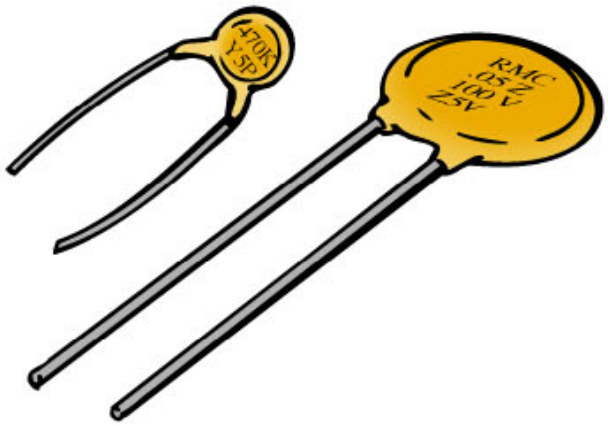
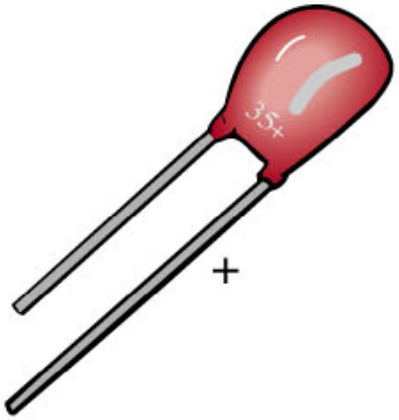
Applications: Non-polarized, NPO type, stable for a wide range of temperatures. Used in oscillators, noise filters, circuit coupling, tank circuits.



Capacitores

Tipos de capacitores:

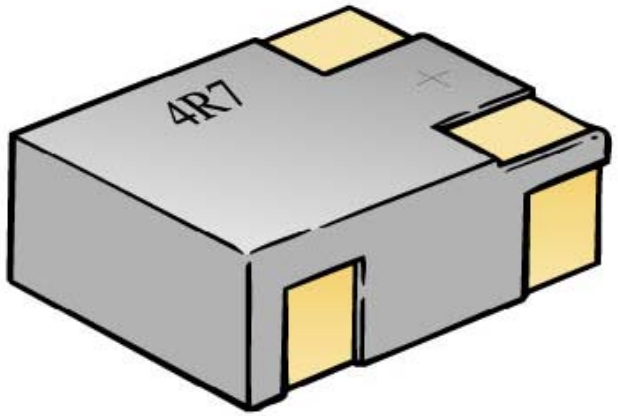
Type: Dipped Tantalum (solid and wet)
Typical Values: 0.047 ∝F to 470 ∝F
Typical Voltage Range: 6.3 V to 50 V
Capacitor tolerance: ±10%, ±20%
Applications: Polarized, low leakage current, used in power supplies, high frequency noise filters, bypass filter.



Capacitores

Tipos de capacitores:

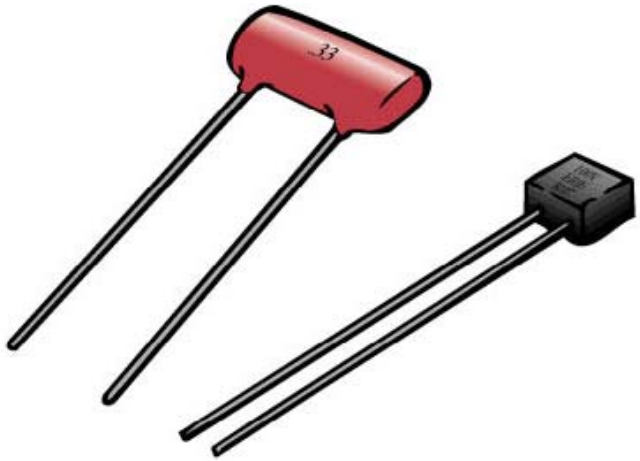
Type: Surface Mount Type (SMT)
Typical Values: 10 pF to 10 ∝F
Typical Voltage Range: 6.3 V to 16 V
Capacitor tolerance: ±10%
Applications: Polarized and non-polarized, used in all types of circuits, requires a minimum amount of PC board real estate.



Capacitores

Tipos de capacitores:

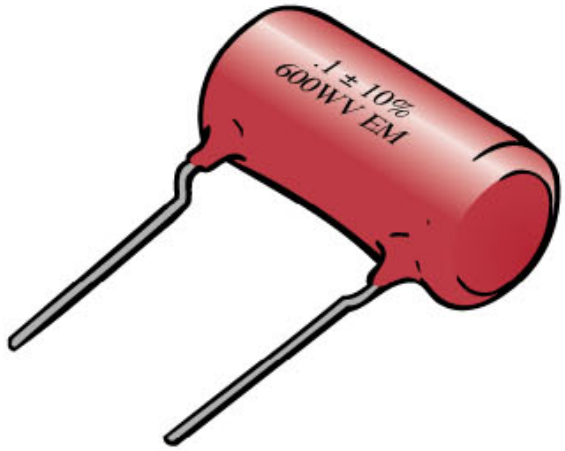
Type: Silver Mica
Typical Value: 10 pF to 0.001 ∝F
Typical Voltage Range: 50 V to 500 V
Capacitor tolerance: ±5%
Applications: Non-polarized, used in oscillators, in circuits that require a stable component over a range of temperatures and voltages.



Capacitores

Tipos de capacitores:

Type: Mylar Paper
Typical Value: 0.001 ∝F to 0.68 ∝F
Typical Voltage Range: 50 V to 600 V
Capacitor tolerance: ±22%
Applications: Non-polarized, used in all types of circuits, moisture resistant.



Capacitores

Tipos de capacitores:

Type: AC/DC Motor Run
Typical Value: 0.25 ∝F to 1200 ∝F
Typical Voltage Range: 240 V to 660 V
Capacitor tolerance: ±10%
Applications: Non-polarized, used in motor run-start, high-intensity lighting supplies, AC noise filtering.

Capacitores

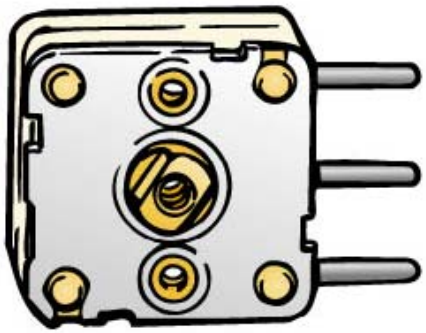
Tipos de capacitores:

Type: Trimmer Variable
Typical Value: 1.5 pF to 600 pF
Typical Voltage Range: 5 V to 100 V
Capacitor tolerance: ±10%
Applications: Non-polarized, used in oscillators, tuning circuits, AC filters.

Capacitores

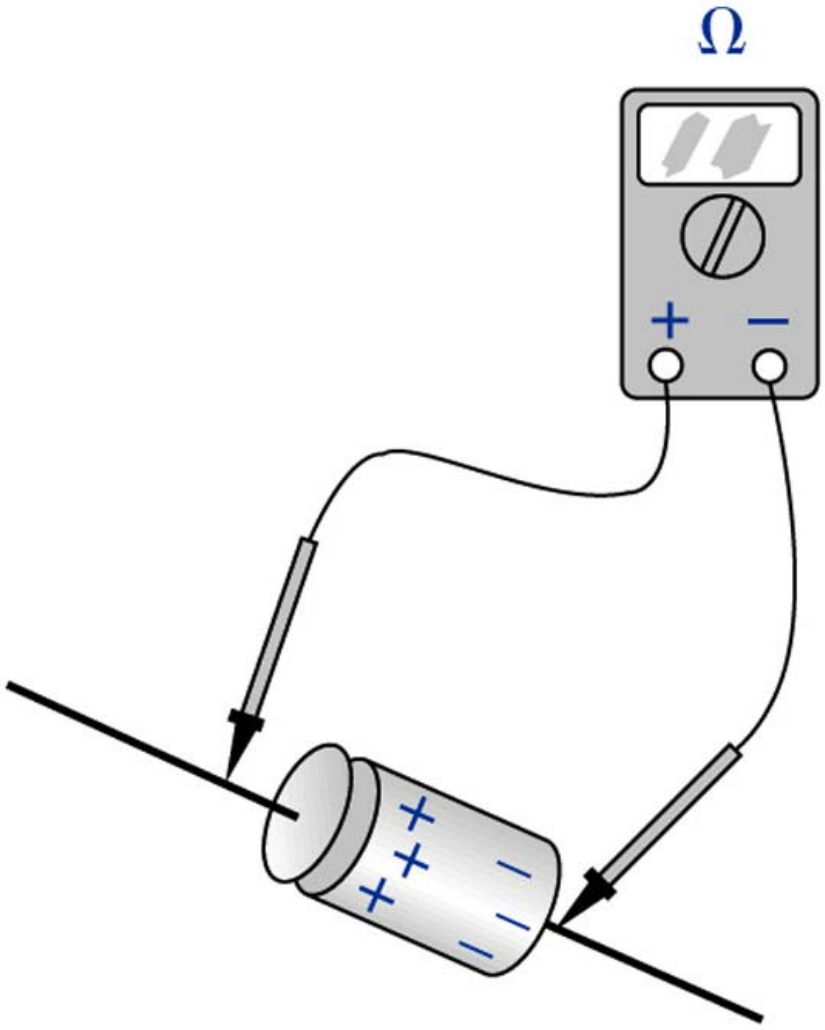
Tipos de capacitores:

Type: Tuning variable
Typical Value: 10 pF to 600 pF
Typical Voltage Range: 5 V to 100 V
Capacitor tolerance: ±10%
Applications: Non-polarized, used in oscillators, radio tuning circuit.



Capacitores

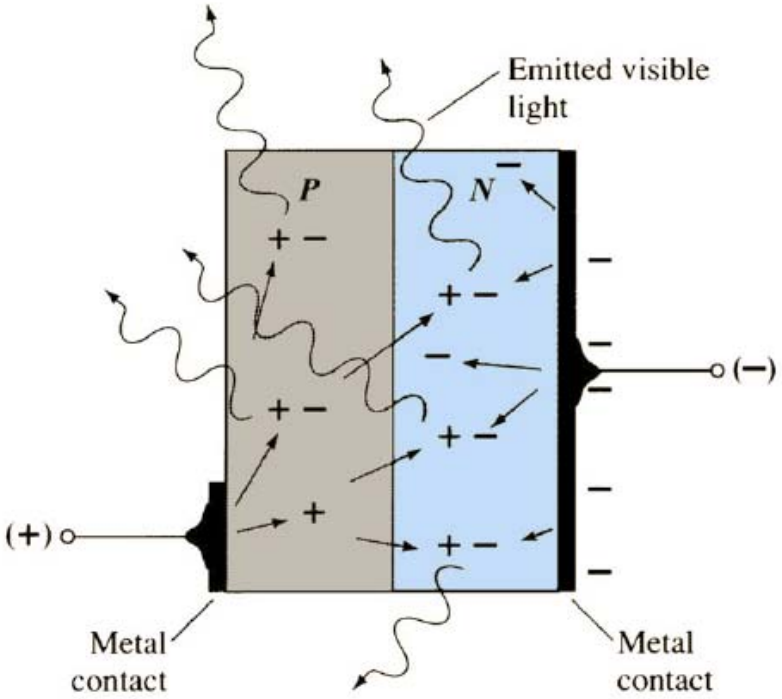
Testando capacitores:



LED

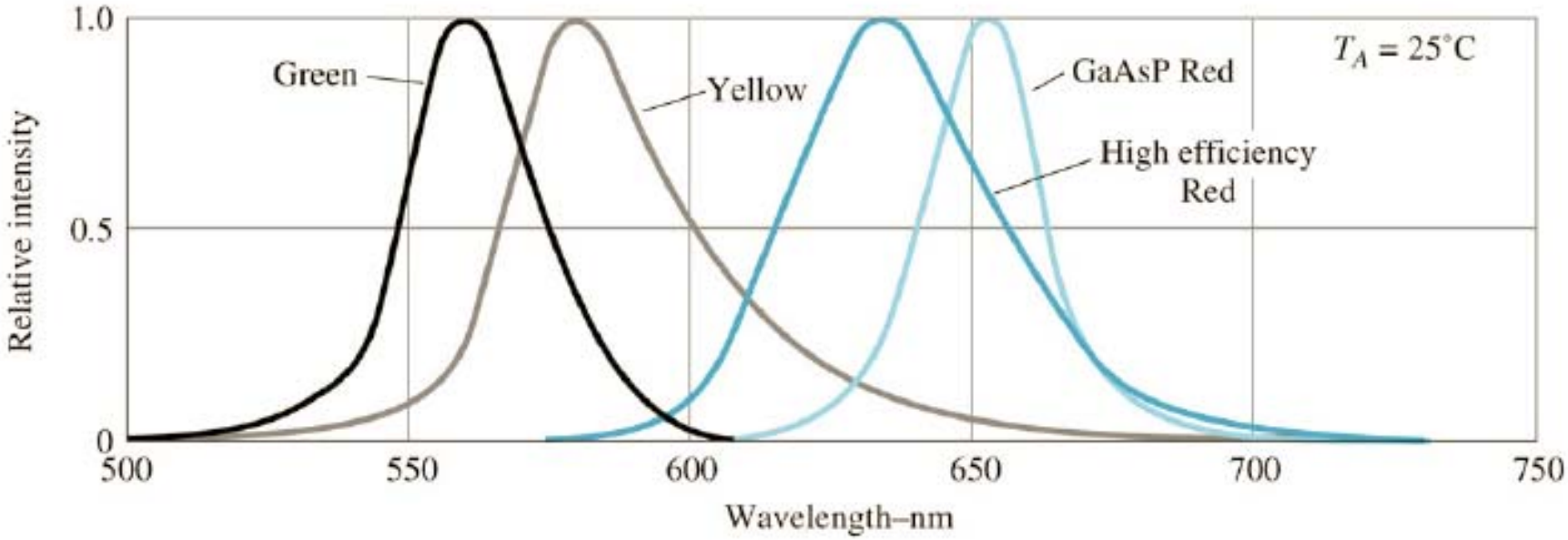
Diodos emissores de luz (LEDs):

- Eletroluminescência – processo de emissão de luz pela aplicação de uma fonte elétrica de energia.



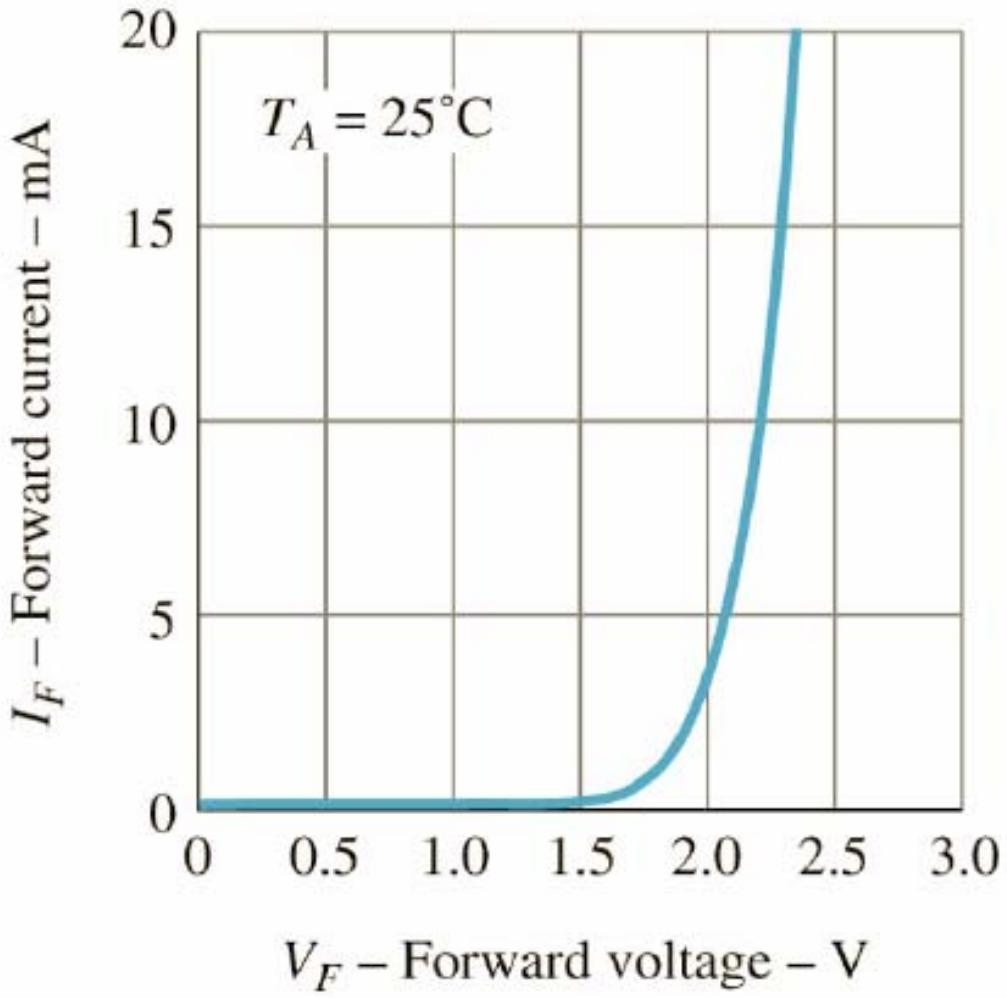
LED

Comprimentos de onda dos leds:



LED

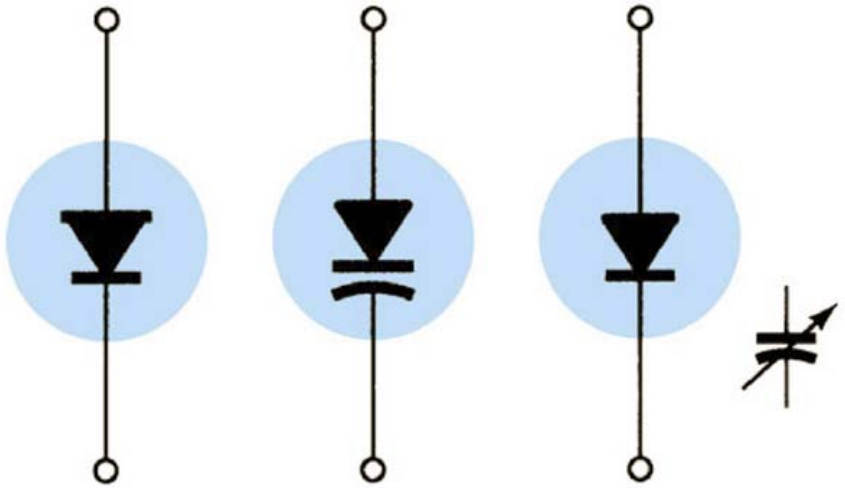
Corrente direta versus tensão direta para leds miniatura:

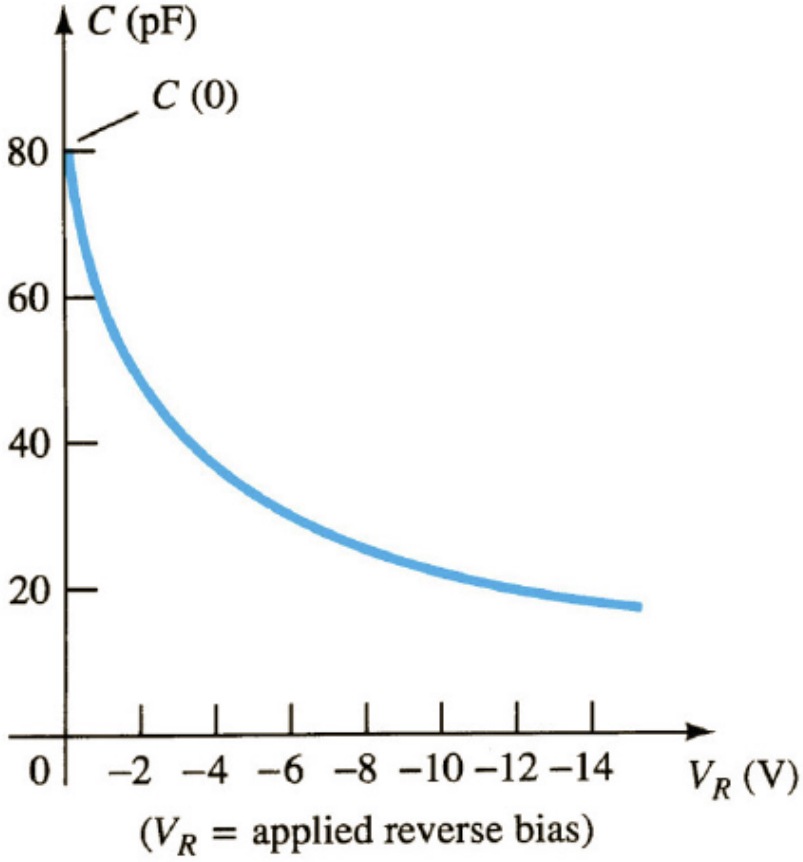


Diodos Varactor (Varicap)

Varicap:

- São diodos que variam sua capacitância com a tensão aplicada nos seus terminais.

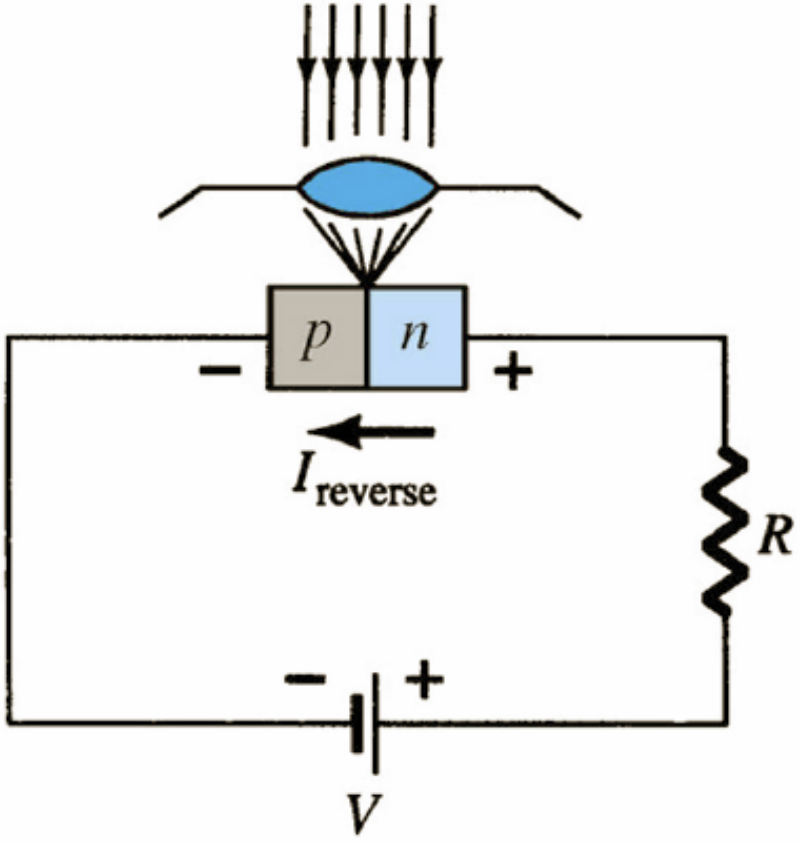


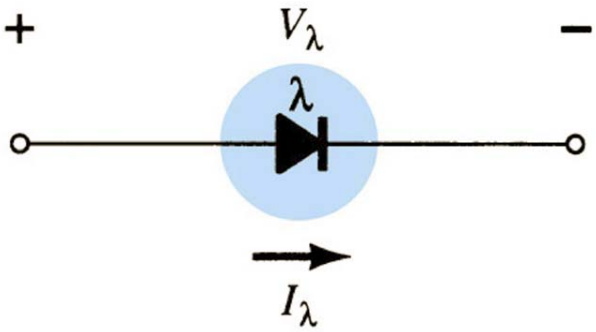


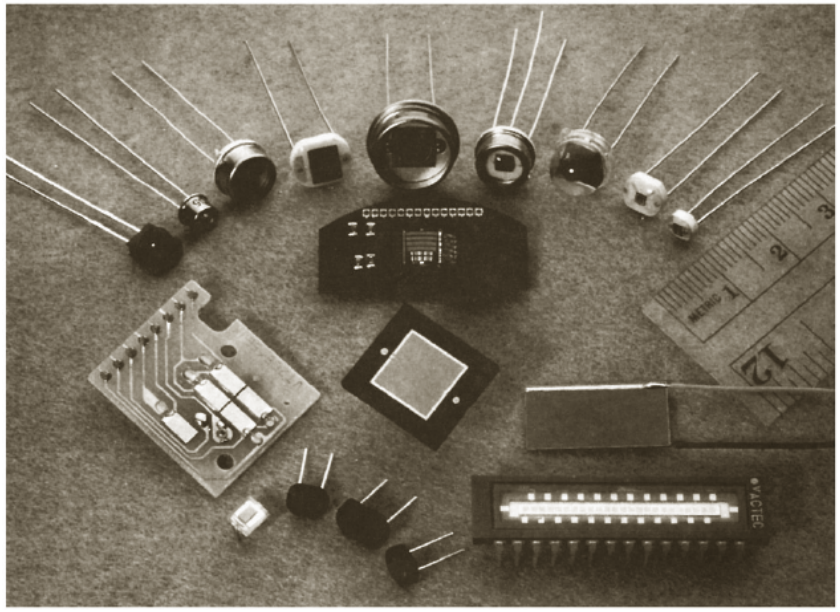
Fotodiodos

Fotodiodos:

- São diodos que operam na região reversa e são sensíveis à luz.
- Optoeletrônica – campo de estudo dos dispositivos sensíveis à luz.

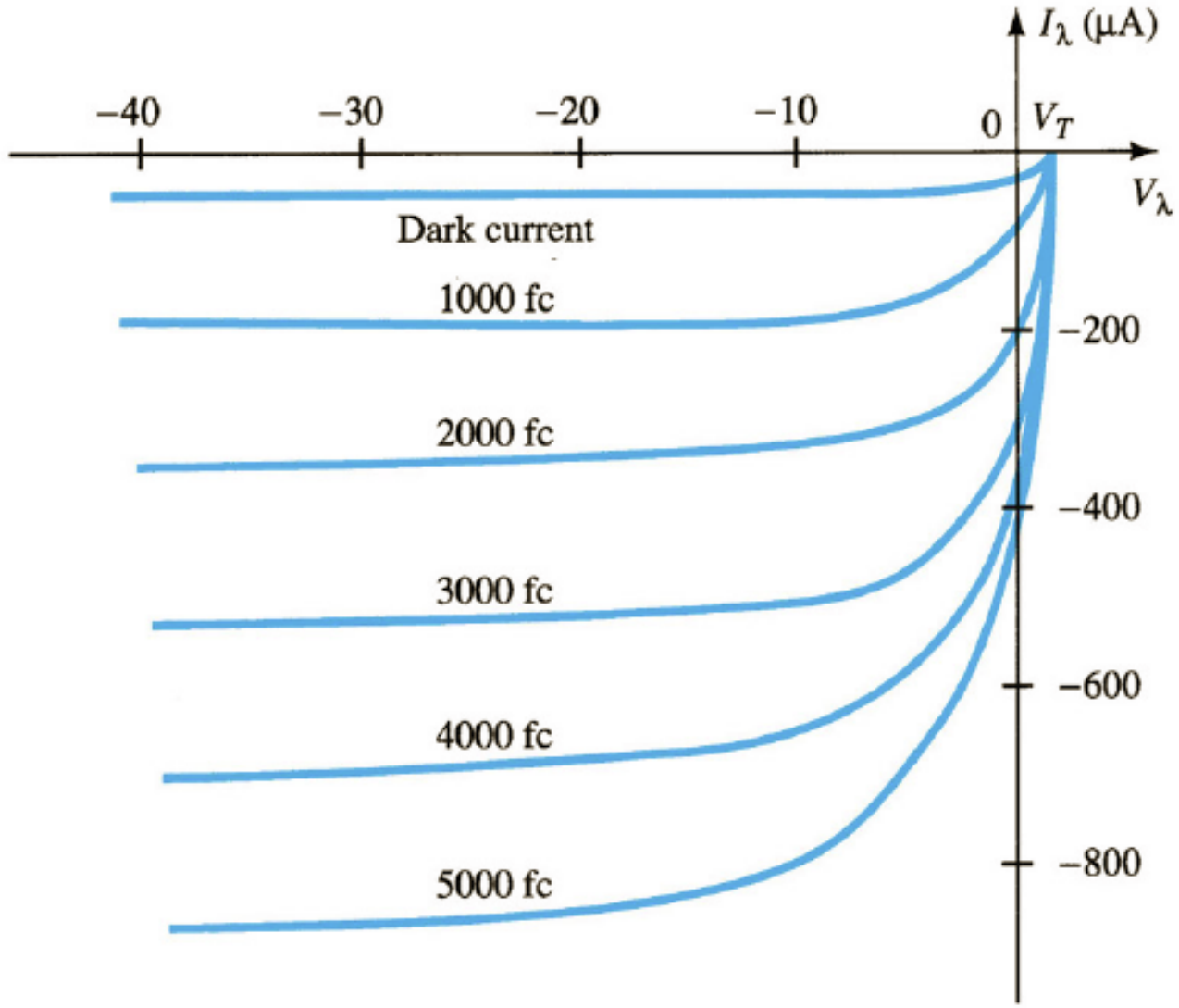






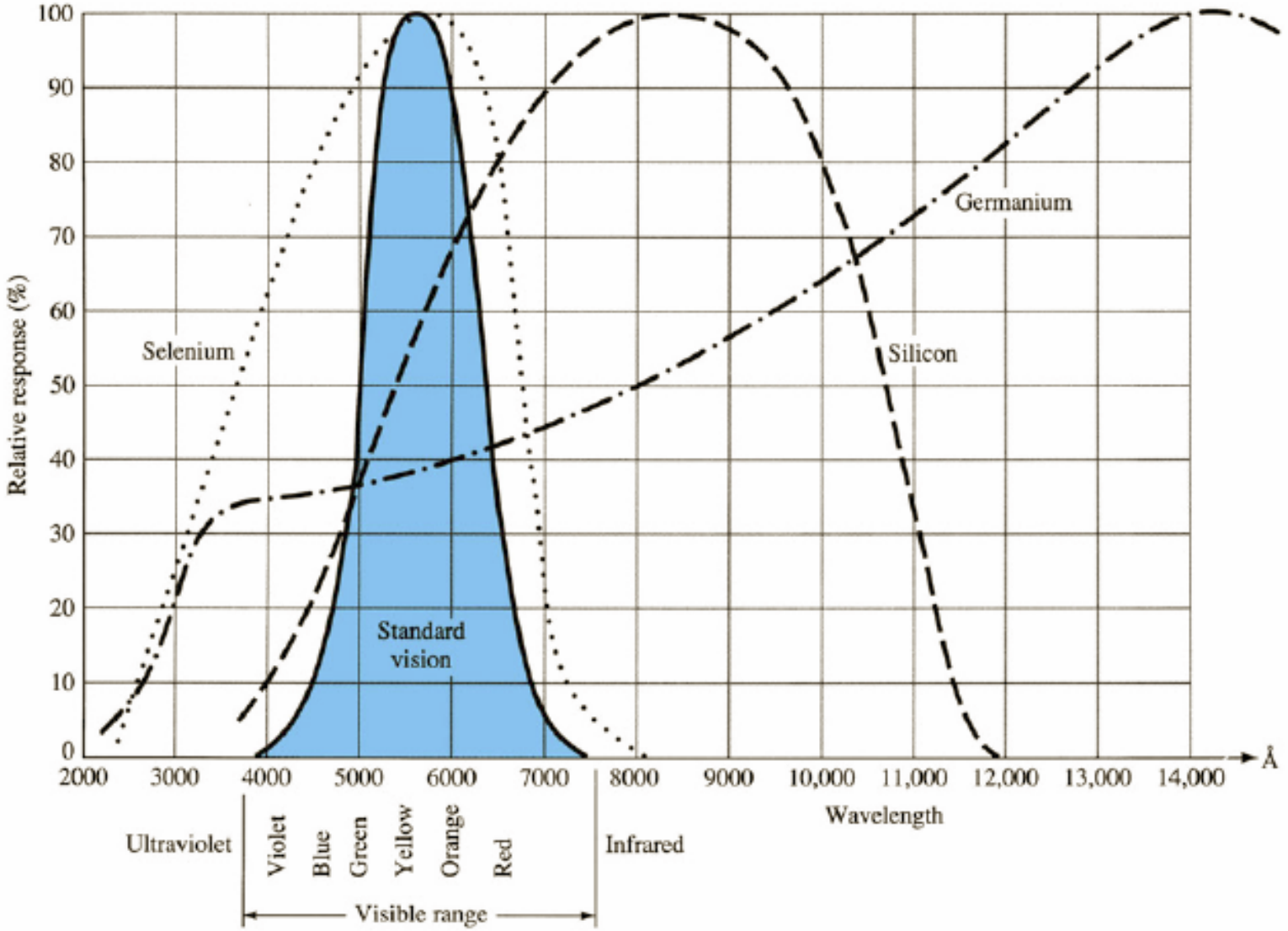
Fotodiodos

Curvas características dos fotodiodos:



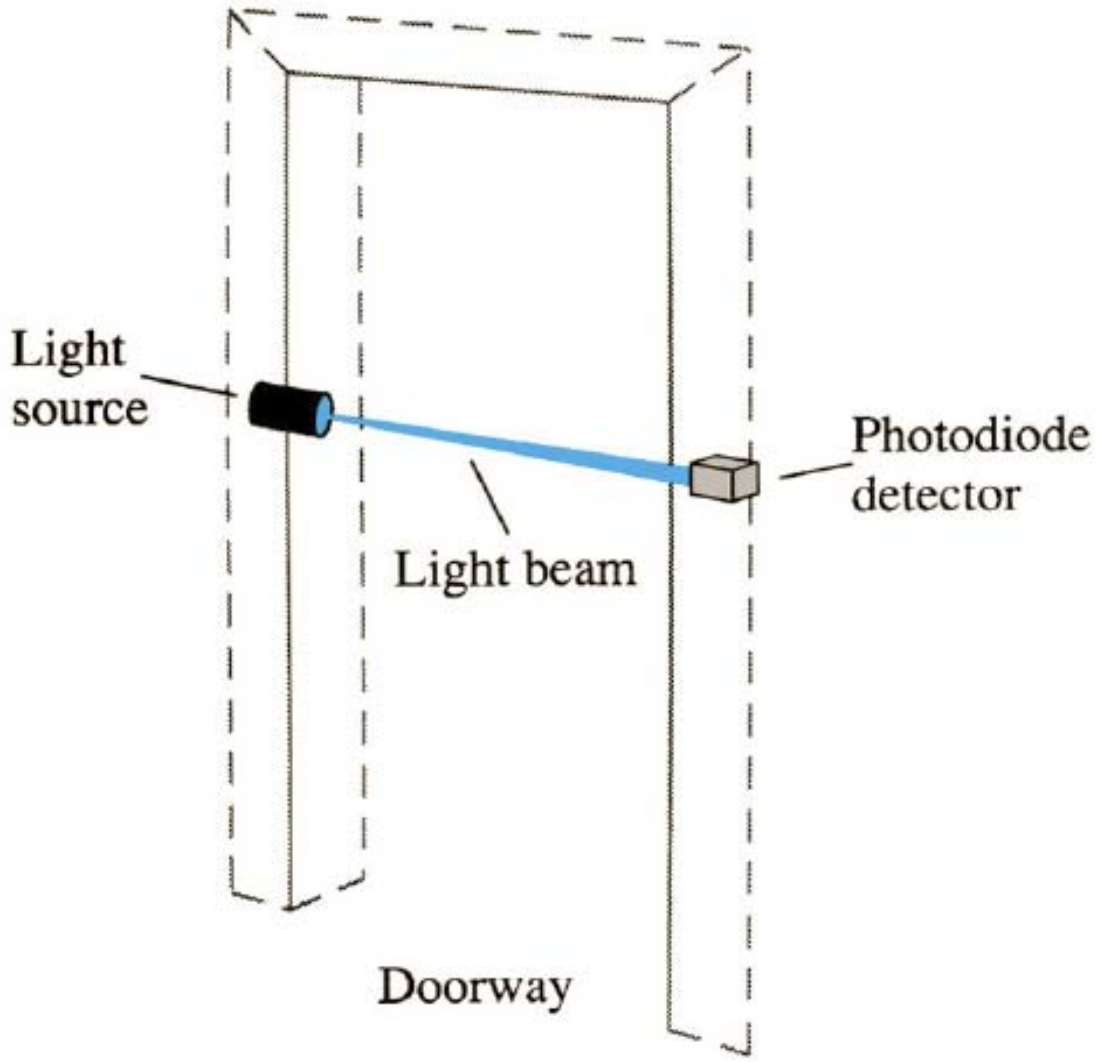
Fotodiodos

Resposta espectral de fotodiodos:



Fotodiodos

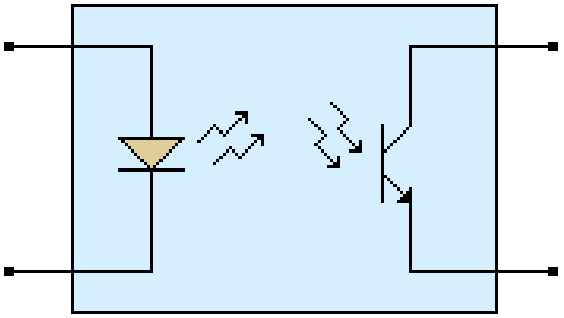
Exemplo de aplicação:



Fototransistor

Fototransistor:

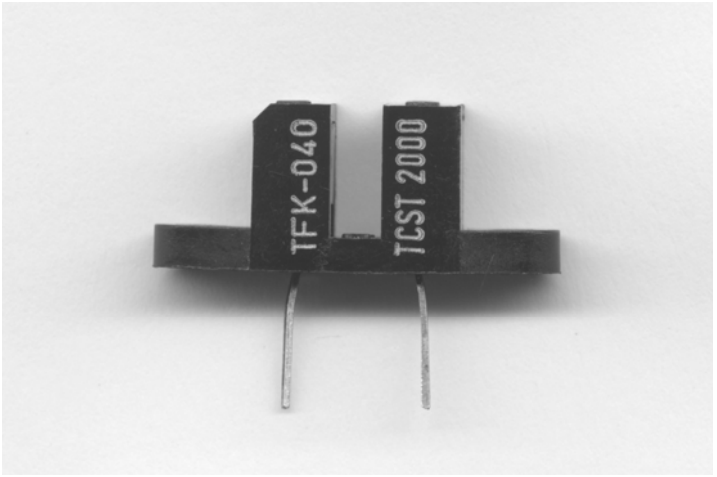
- São transistores sensíveis à luz.



Optoacopladores

Optoacoplador:

- São dispositivos que possuem no mesmo encapsulamento um fotodiodo e um fototransistor (ou tiristor), montados de maneira a permitirem o acoplamento óptico entre os dois.
- Usados para isolação entre circuitos, pois não ocorre ligação elétrica entre os circuitos, por exemplo para transmissão de dados.



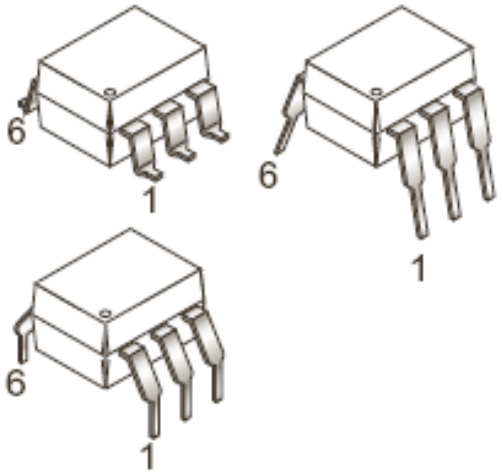
Optoacopladores

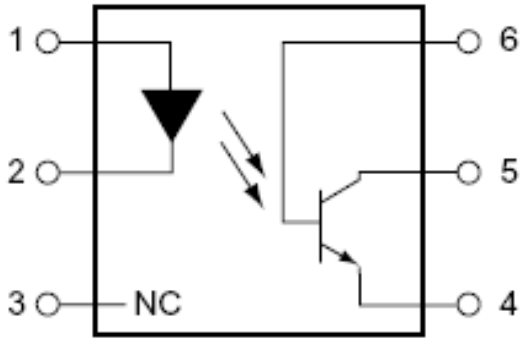
FAIRCHILD SEMICONDUCTOR®

March 2007

4N25M, 4N26M, 4N27M, 4N28M, 4N35M, 4N36M, 4N37M, H11A1M, H11A2M, H11A3M, H11A4M, H11A5M

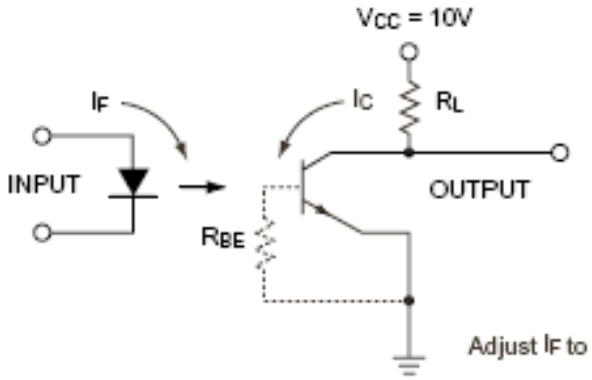
General Purpose 6-Pin Phototransistor Optocouplers





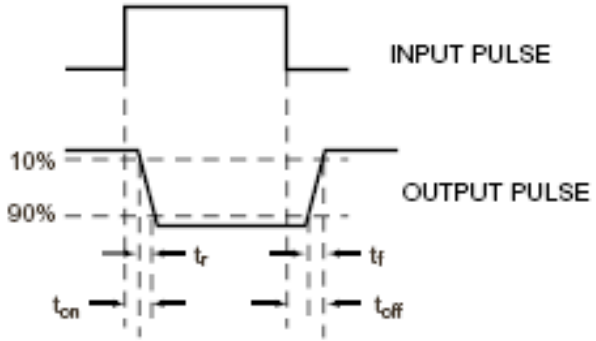
PIN 1. ANODE
2. CATHODE
3. NO CONNECTION
4. EMITTER
5. COLLECTOR
6. BASE

TEST CIRCUIT



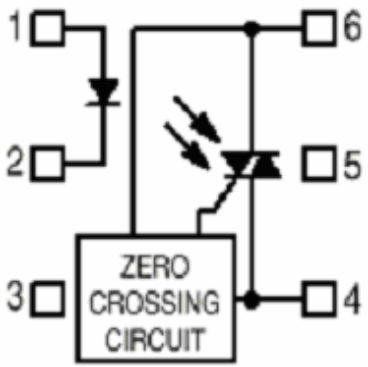
Adjust I_F to produce I_C = 2 mA

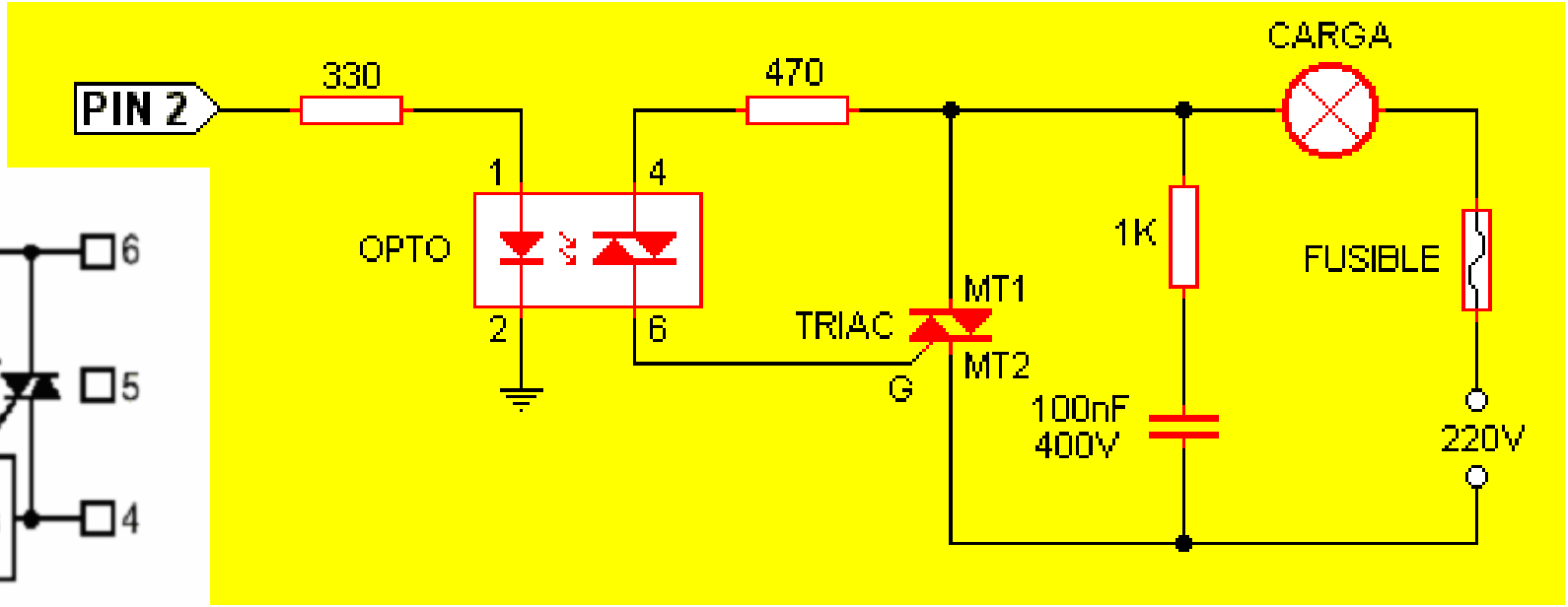
WAVE FORMS



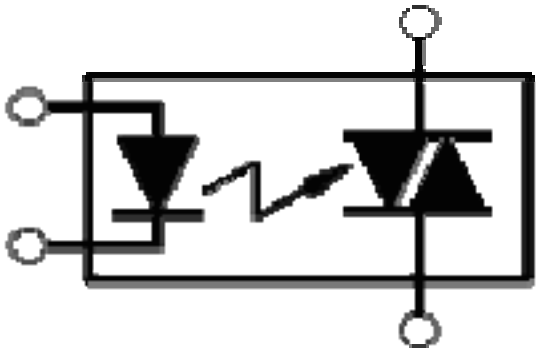
Optoacopladores

Optoacoplador com saída tiristorizada:





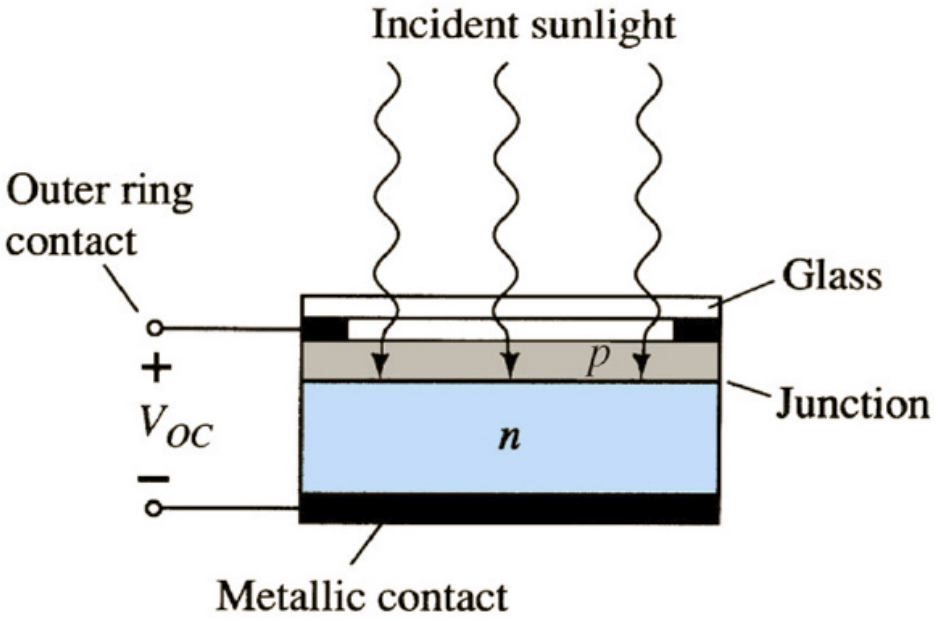
1. ANODE
2. CATHODE
3. NC
4. MAIN TERMINAL
5. SUBSTRATE
   DO NOT CONNECT
6. MAIN TERMINAL

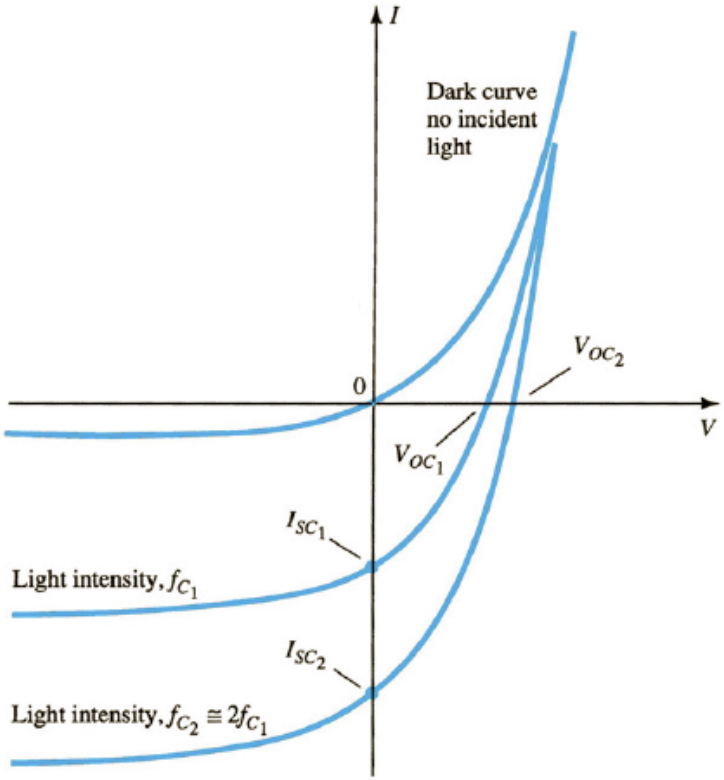


Células solares

Células solares:

- São dispositivos construídos a partir de materiais semicondutores e que são sensíveis à luz.
- Geram potências da ordem de mW quando iluminados.





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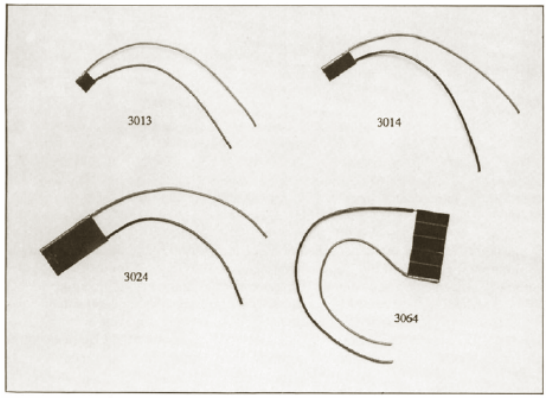

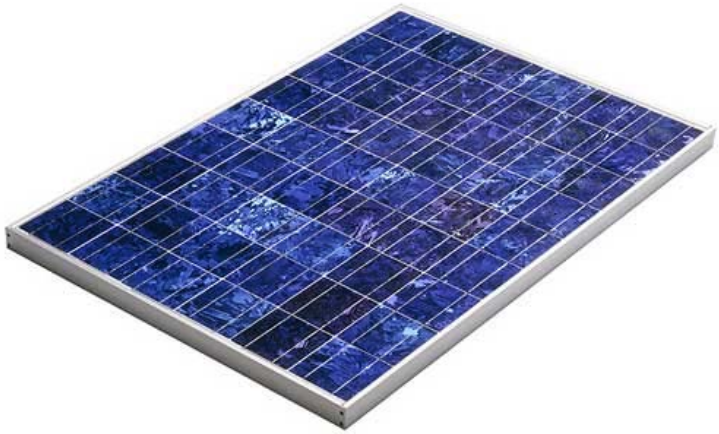

Na próxima aula

Seqüência de conteúdos:

1. Simulação de circuitos;
2. Transistores.