

**Válvulas,
Semicondutores e
Fontes de alimentação.**

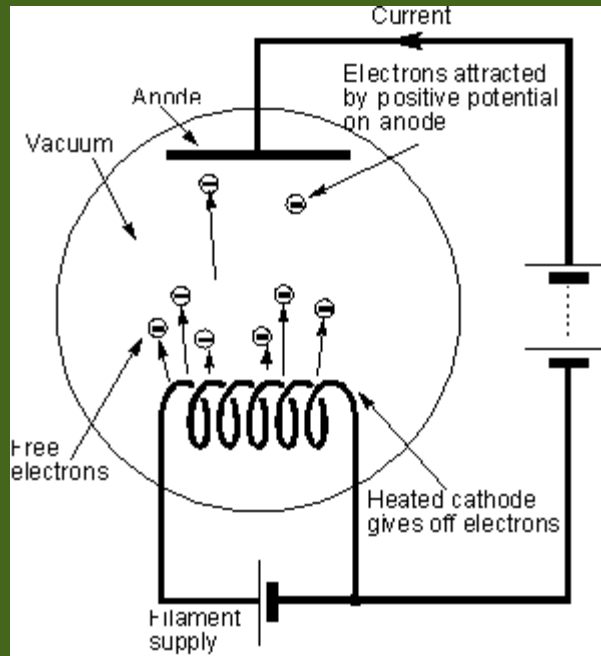
Diodos, junções PN

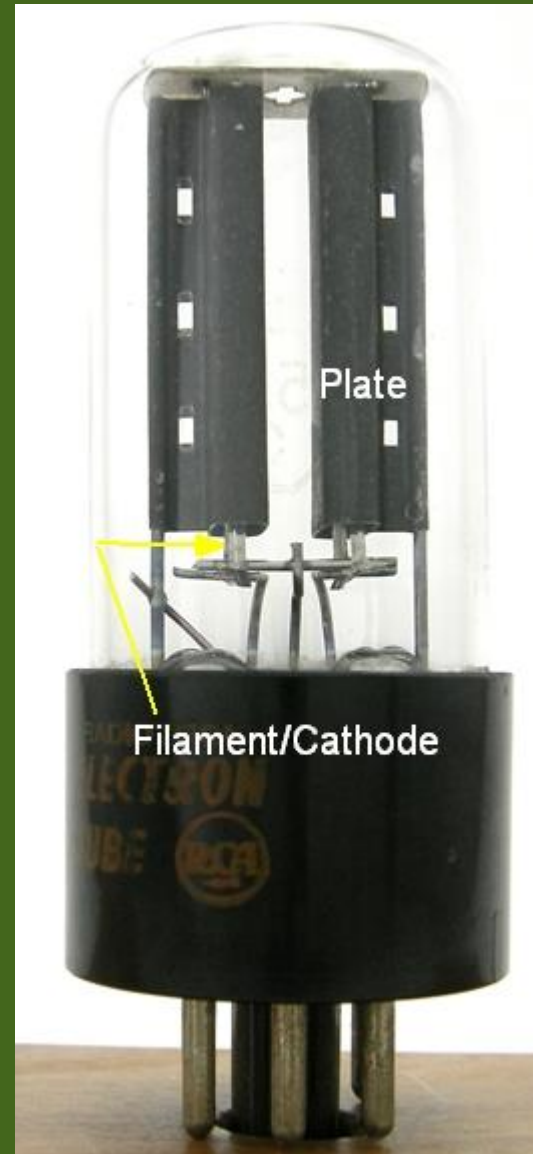
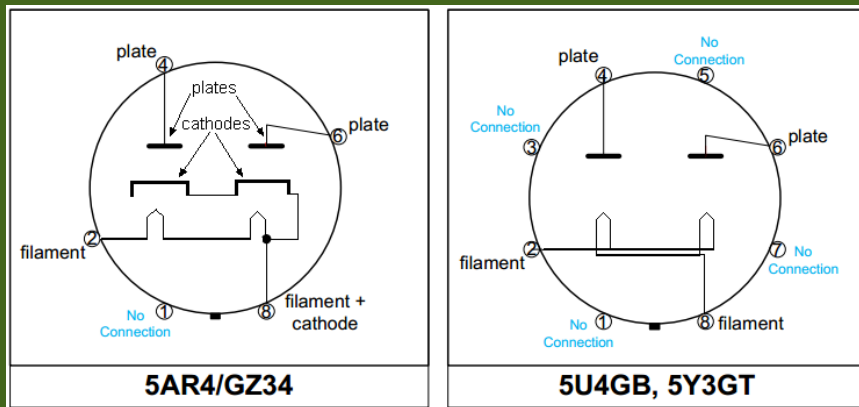
Vacuum tubes (válvulas)



Vacuum Tubes (Valvulas)

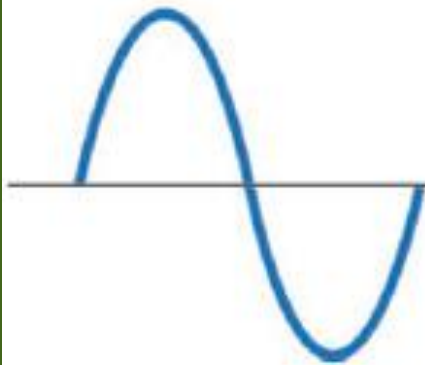
Diodo





5Y3GT Rectifier

AC voltage coming from the transformer is a sine wave.



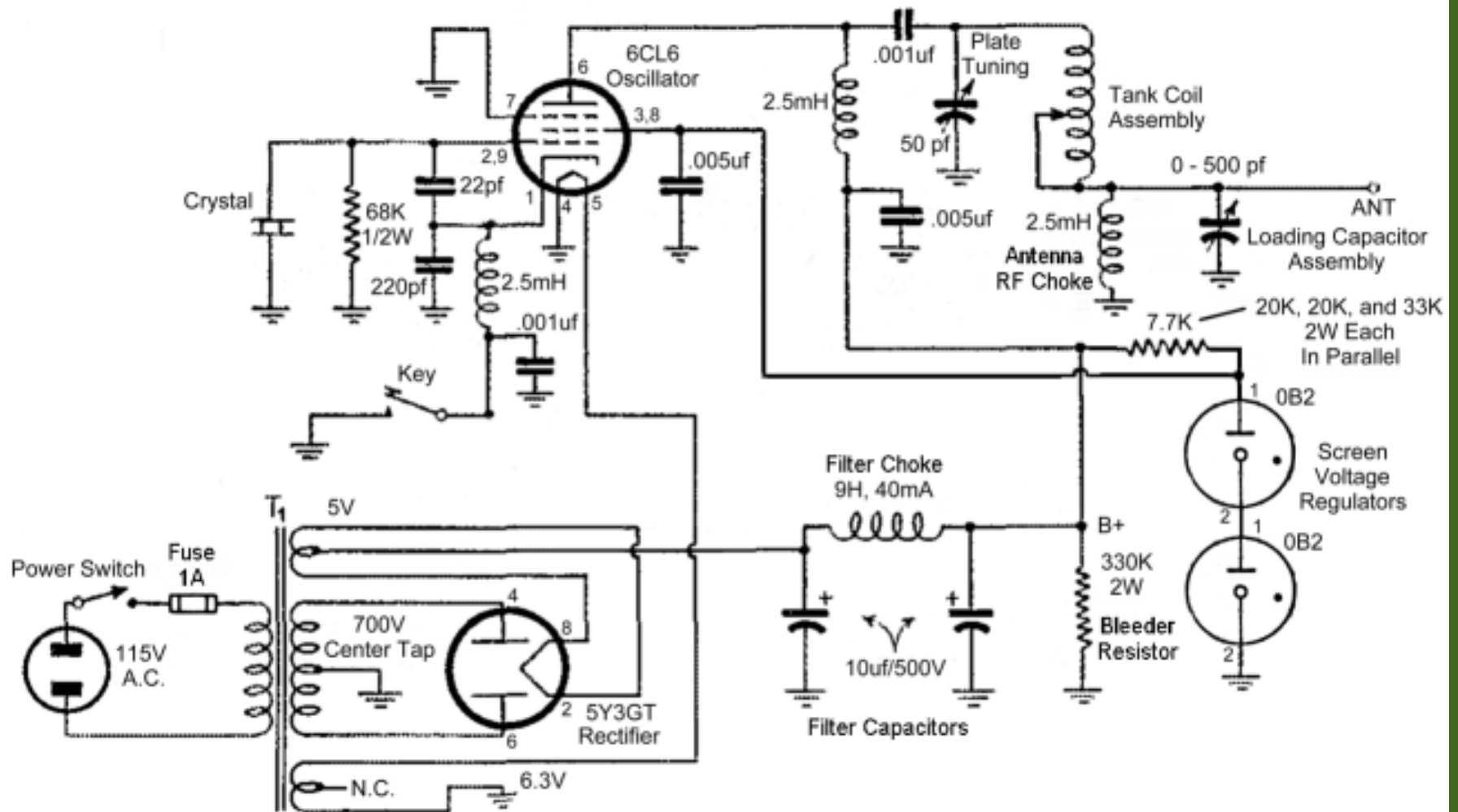
The rectifier tube flips half of the wave to create a DC ripple.



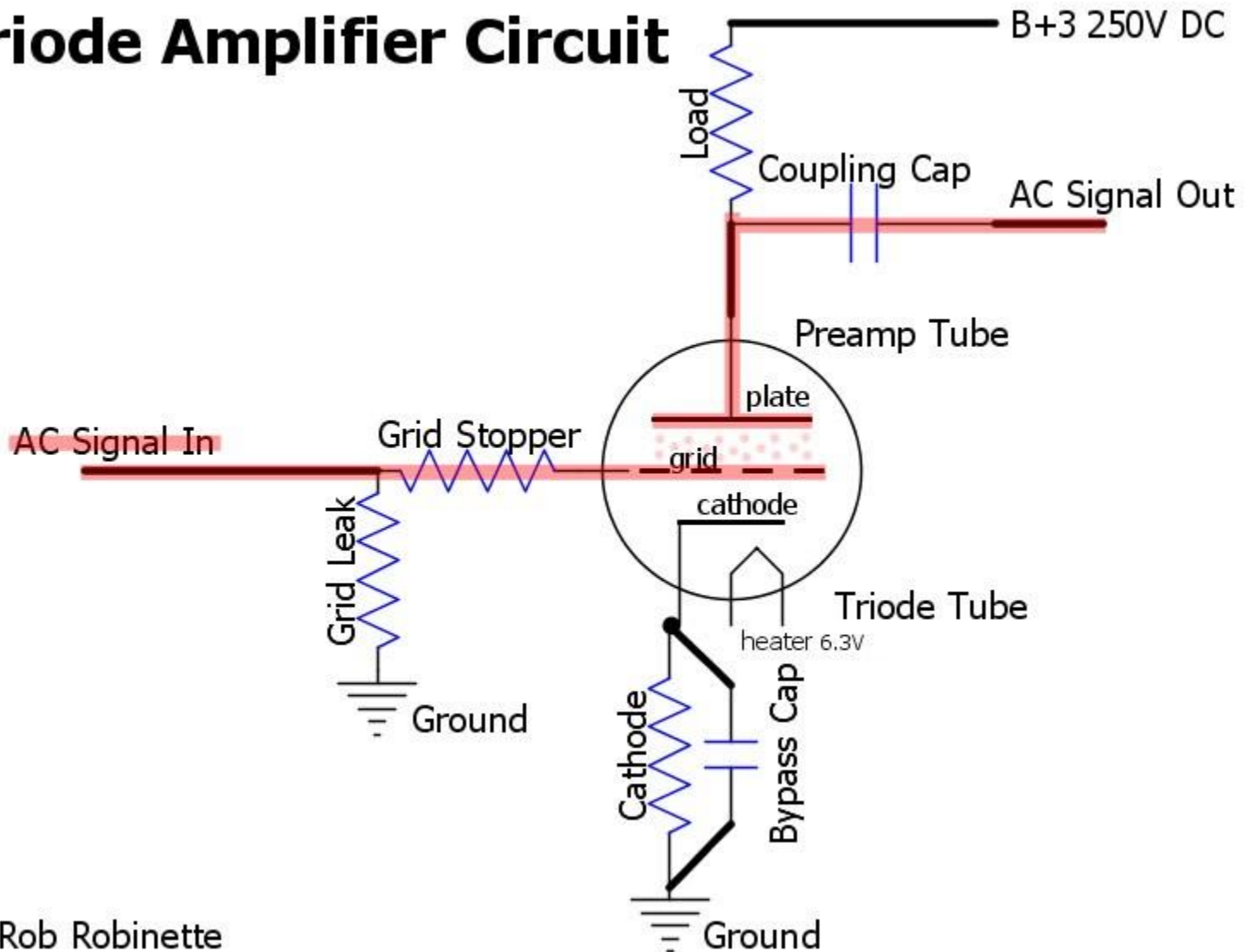
The filter capacitors help smoothe out the ripple.



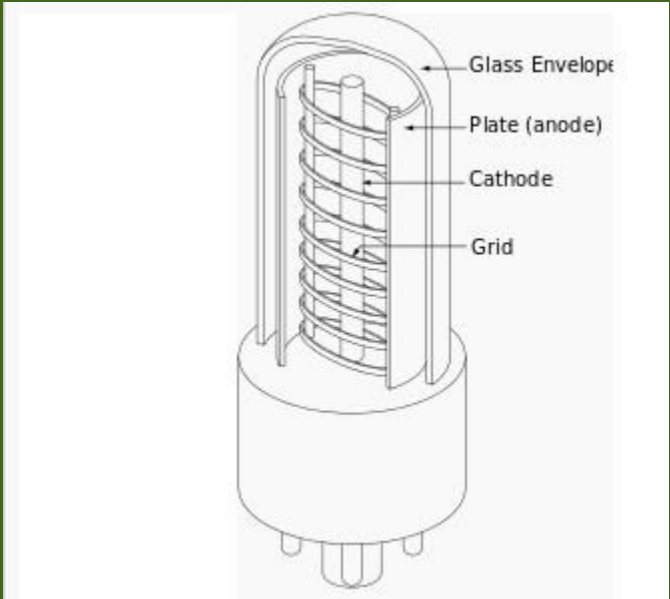
AA8V/W8EXI 6CL6 One-Tube Transmitter

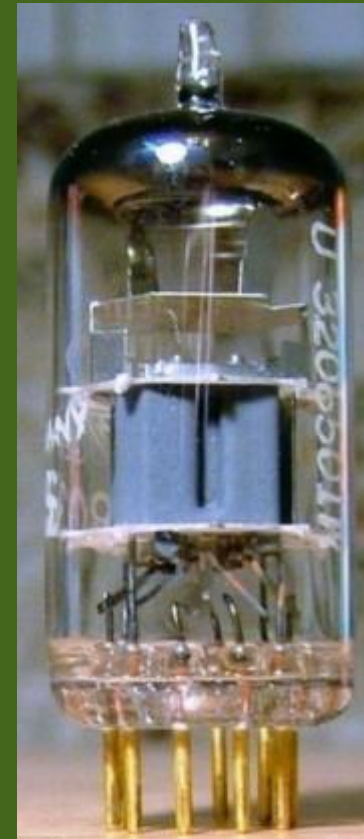
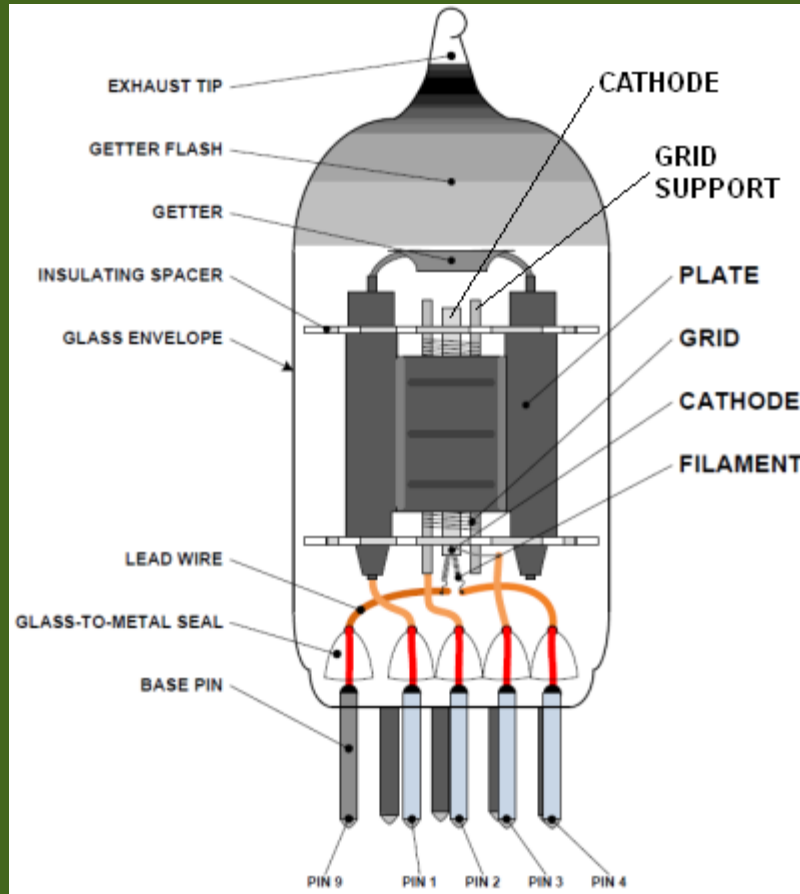


Triode Amplifier Circuit



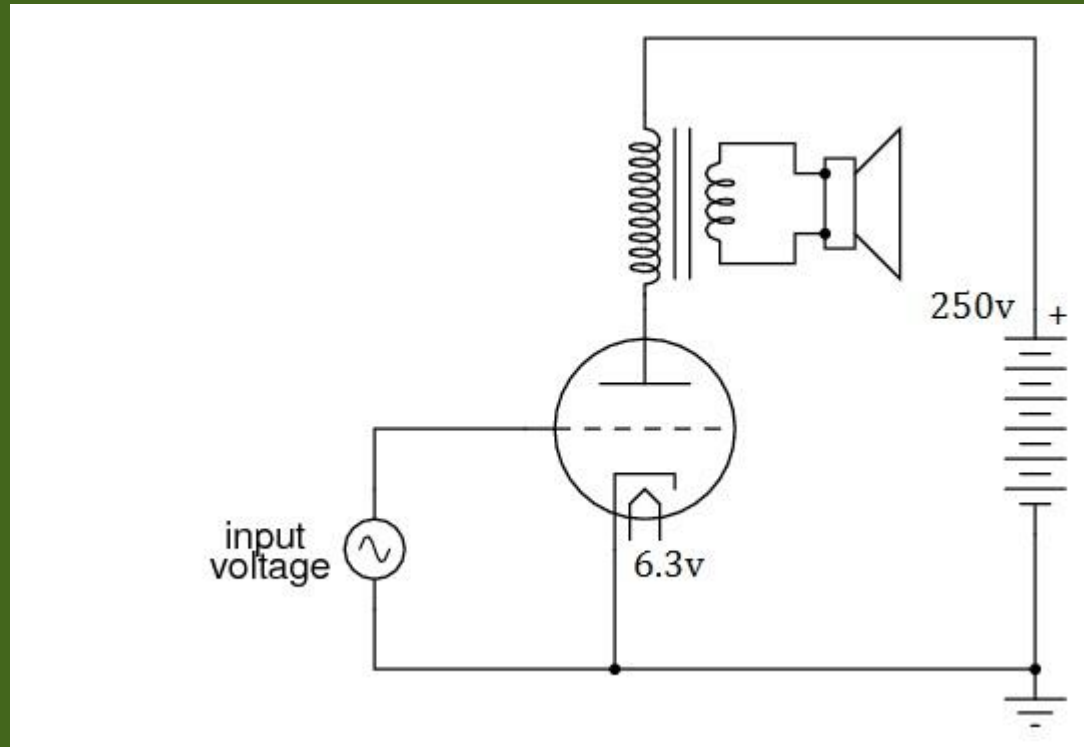
By Rob Robinette





Triode amplifier

Output transformer



In general, vacuum tubes are much less susceptible than corresponding solid-state components to transient overvoltages, such as mains voltage surges or lightning, the [electromagnetic pulse](#) effect of [nuclear explosions](#):

Vacuum tubes are still practical alternatives to solid-state devices in generating high power at [radio frequencies](#) (Klystron)

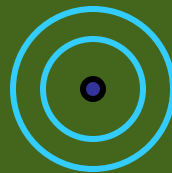
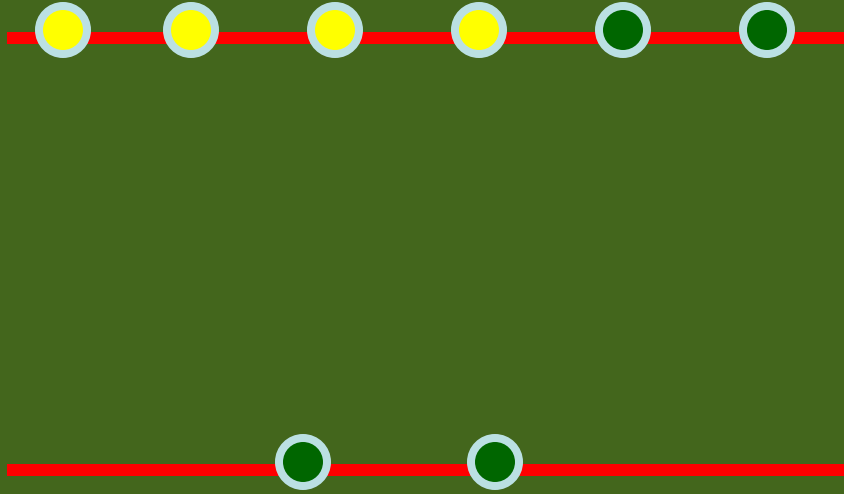
In military applications, a high-power vacuum tube can generate a 10–100 megawatt signal that can burn out an unprotected receiver's frontend. (Film: Matrix)

Semiconductors

energia



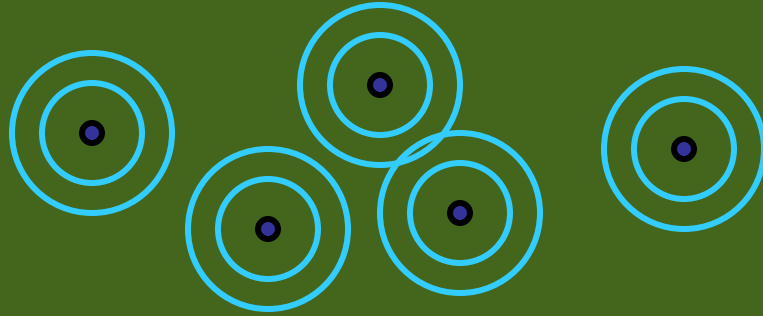
$s^2 p^2$



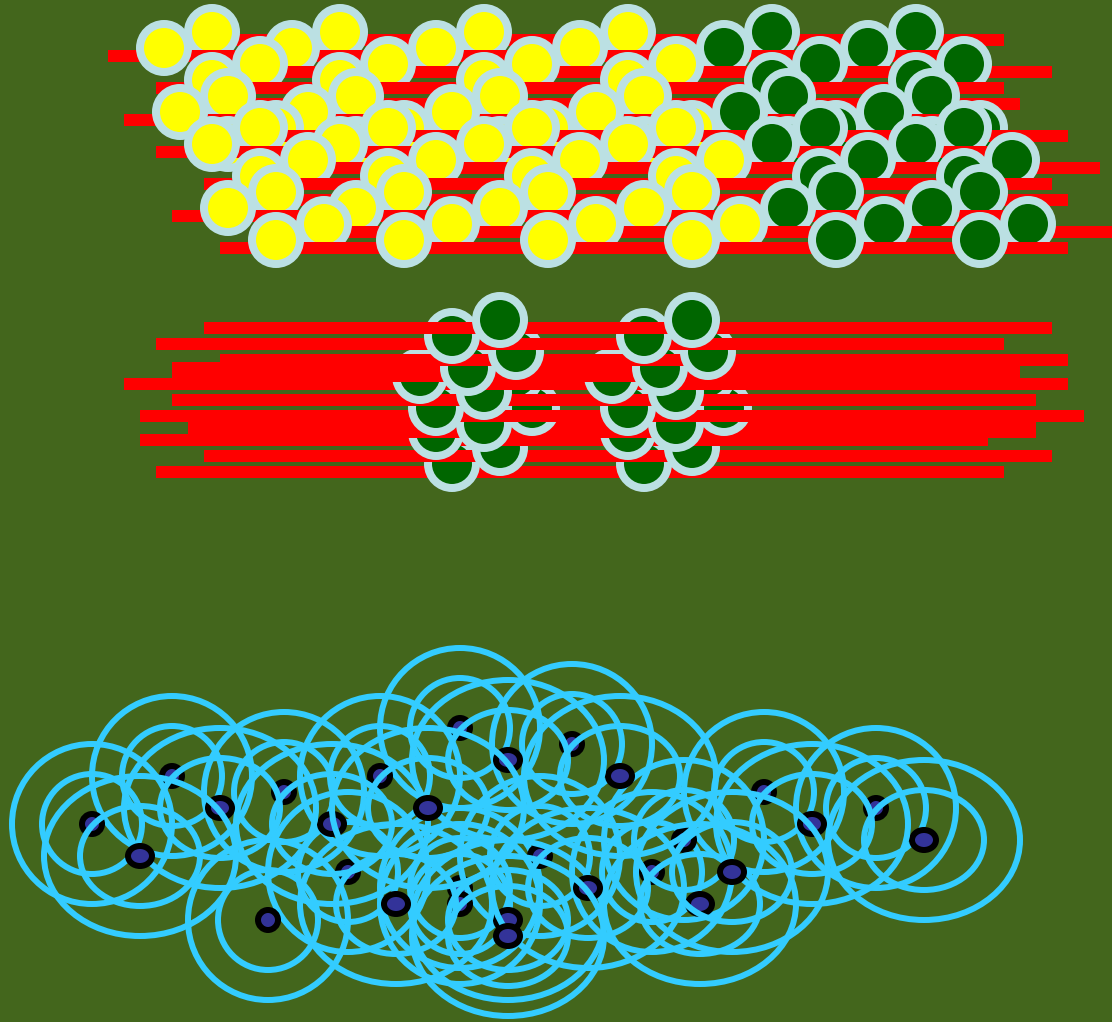
$[\text{Ne}] 3s^2 3p^2$

Silicon

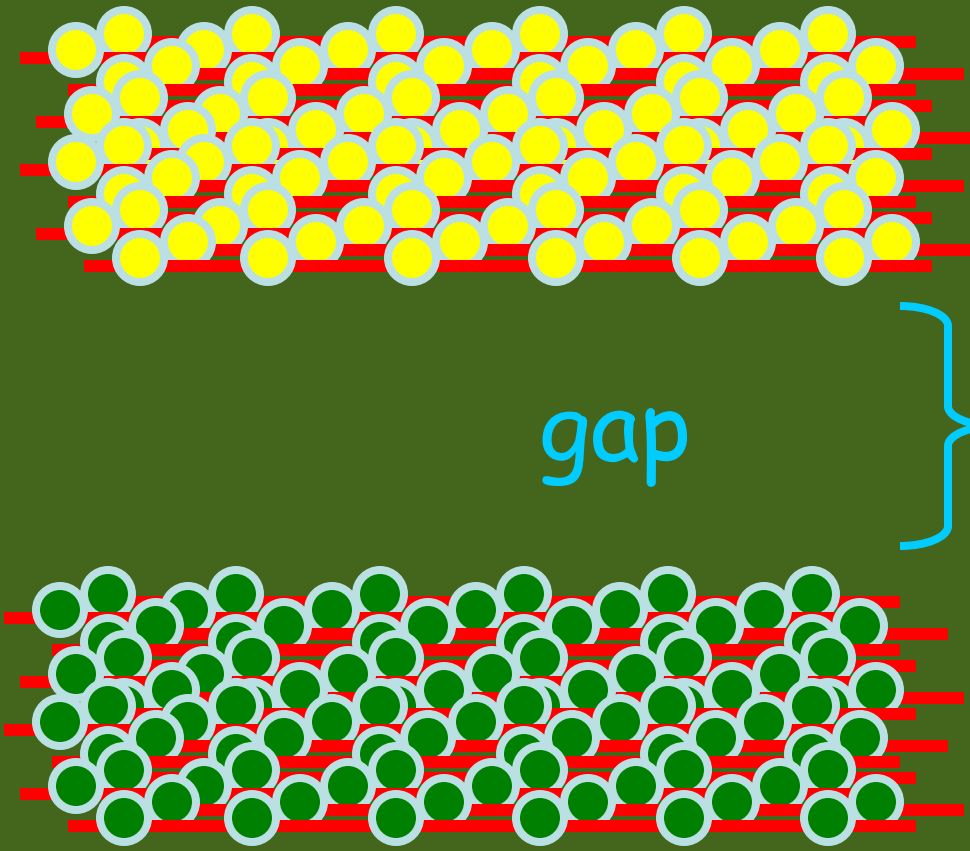
energia



energia



energia



banda de
condução

banda
proibida

banda de
valência

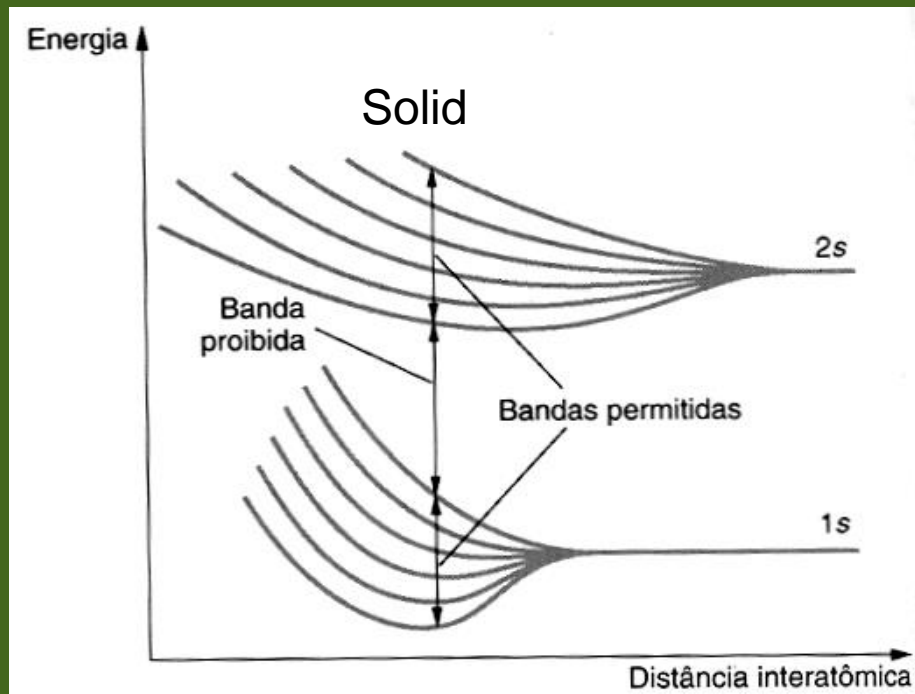
Propriedades elétricas dos materiais

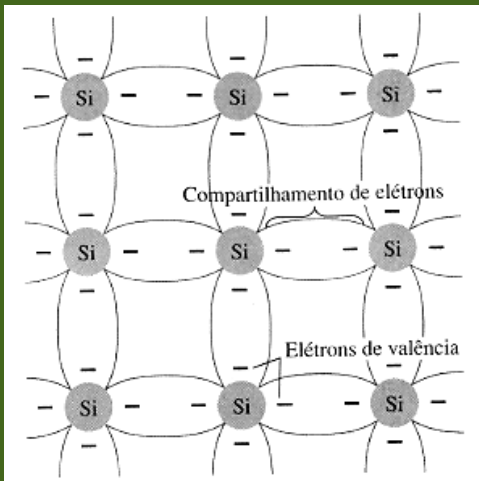
Condutor (ex. Cobre) : Existem elétrons livres que podem circular, e gerar correntes.

Isolante (ex. vidro): elétrons não podem circular Não conduzem eletricidade.

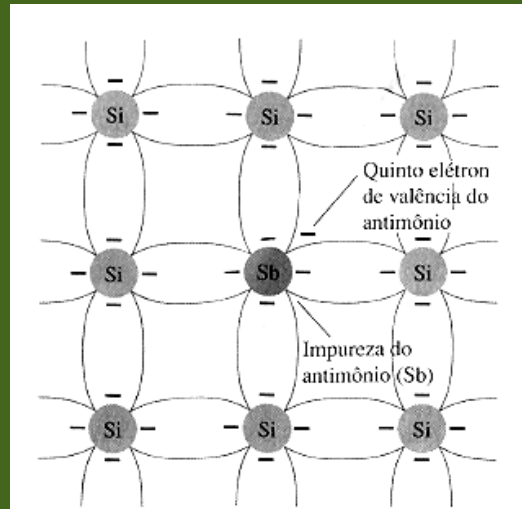
Semicondutor *intrínseco* ou puro (ex. Germânio, Silício):

A temperatura ambiente comporta-se aproximadamente como um isolante
Mas, energia térmica pode produzir elétrons livres e lacunas (buracos, positivos),
portanto ocorre fluxo de corrente (portadores: elétrons (-) e lacunas (+))

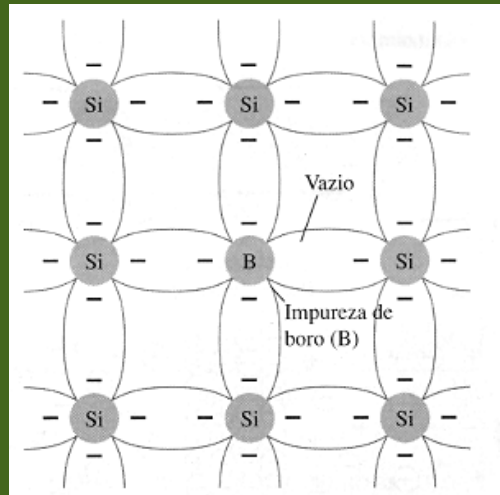




Ligação covalente do átomo de silício.



Impureza de antimônio no material do tipo *n*



Impureza de boro no material do tipo *p*.

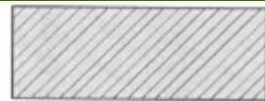
impurezas
cinco elétrons de valência
doador

impurezas
com três elétrons de
átomos aceitadores.

Banda de condução
vazia



Banda de valência
completa



(b) Banda de condução
vazia



—●—●— Níveis
—●—●— doadores



Banda de valência
completa

Banda de condução
vazia



Níveis
aceitadores —●—●—



Banda de valência
completa

Propriedades elétricas dos materiais

Semicondutor *intrínseco* ou puro (ex. Germânio, Silício):

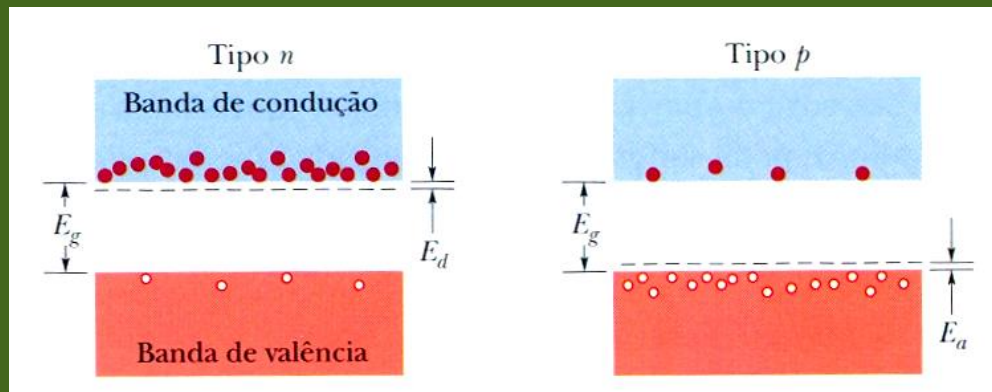
A temperatura ambiente comporta-se aproximadamente como um isolante
Mas, energia térmica pode produzir elétrons livres e lacunas (buracos, positivos),
portanto ocorre fluxo de corrente (portadores: eletrons (-) e lacunas (+))

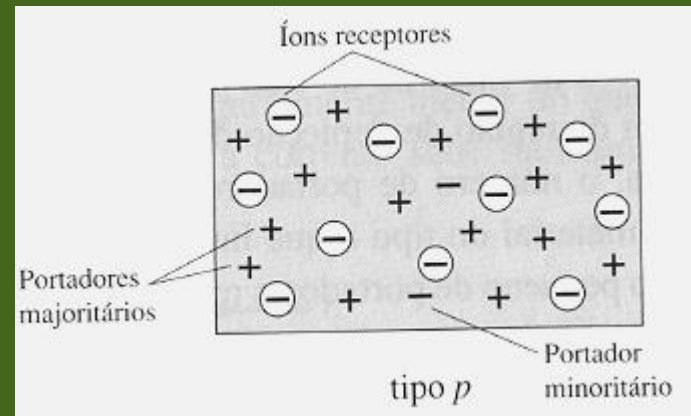
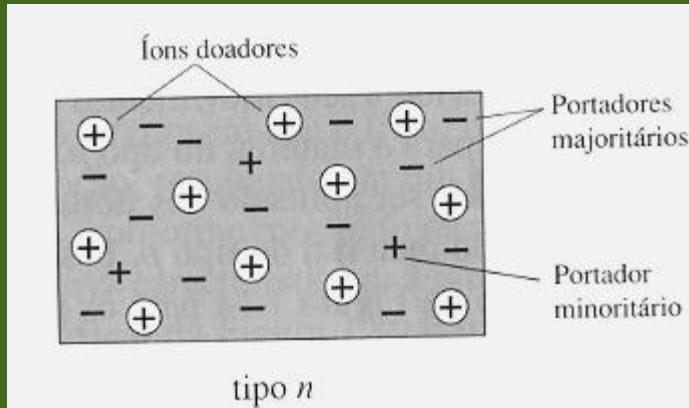
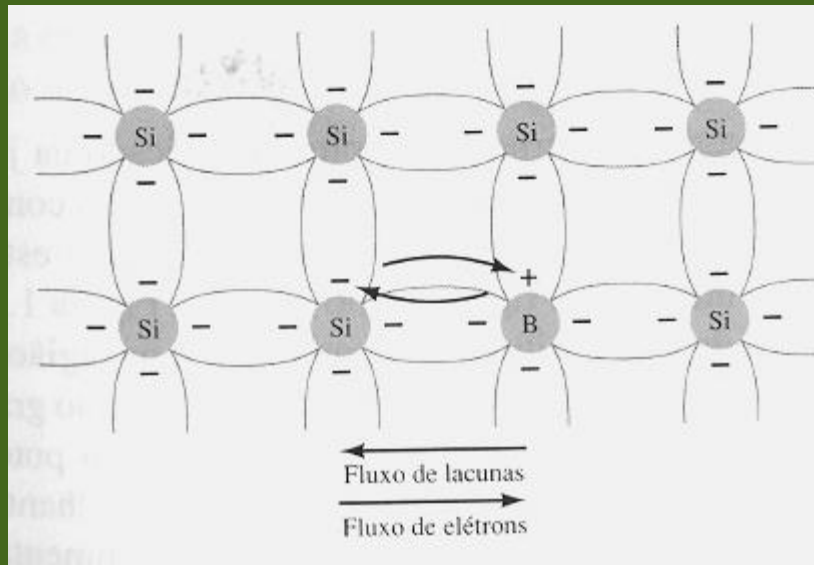
Dopagem de um semicondutor:

Pode-se aumentar a condutibilidade adicionando impurezas (semicondutor *extrínseco*)

Átomos com mais eletrons (P, Sb):
fica um elétron extra,
impureza doadora, dopagem *n*

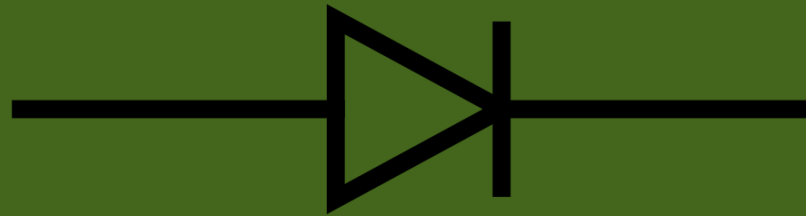
Átomos com menos eletrons (B,Al,Ga):
fica uma lacuna extra,
impureza receptora, dopagem *p*





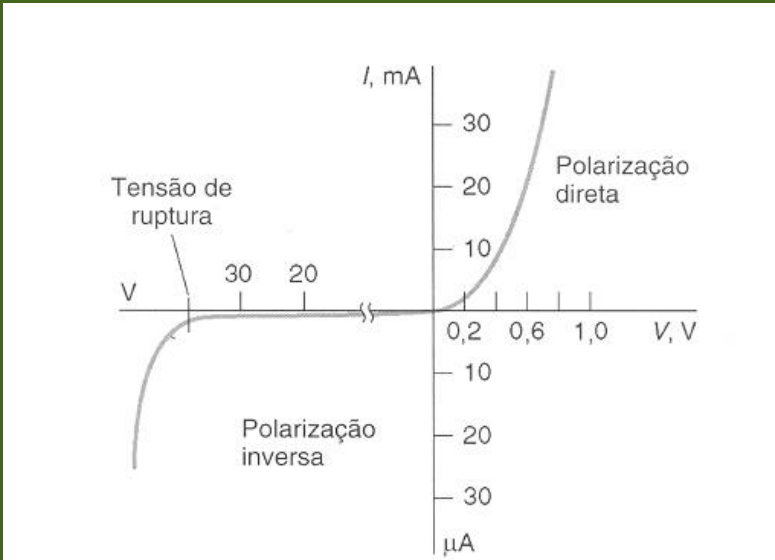
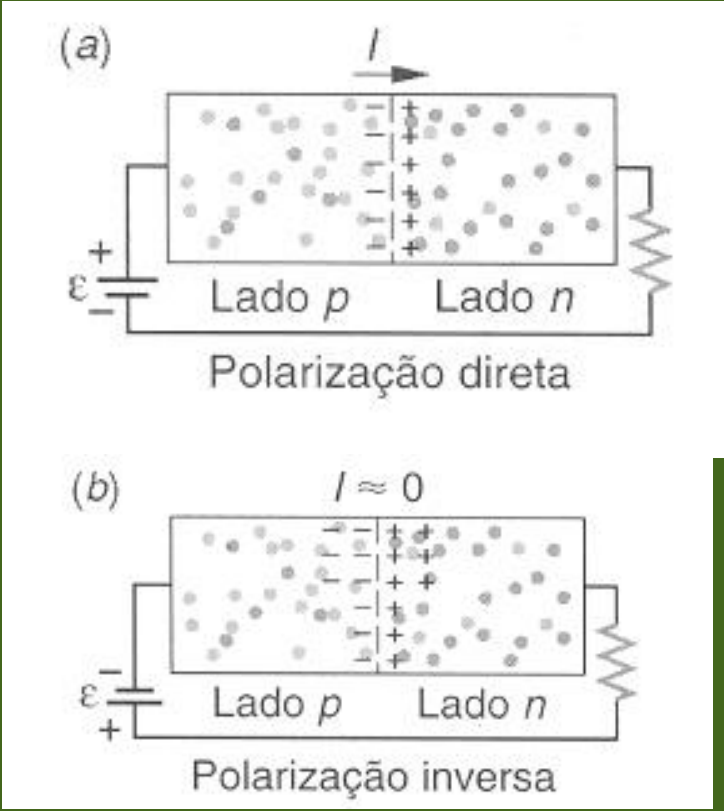
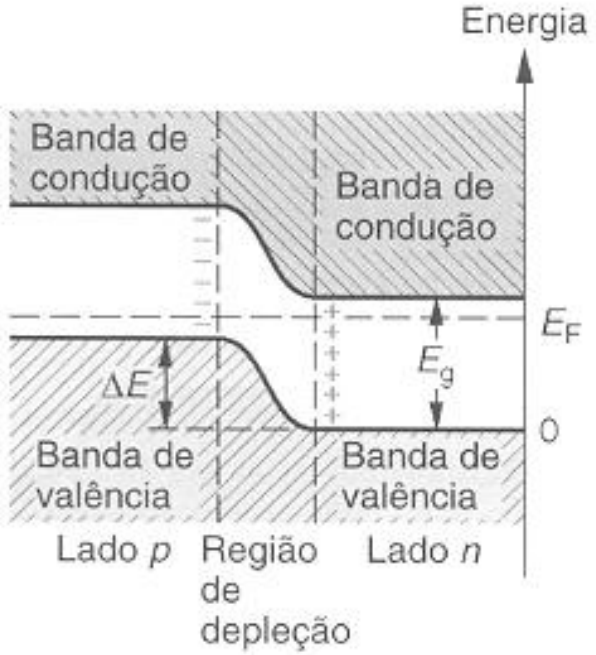
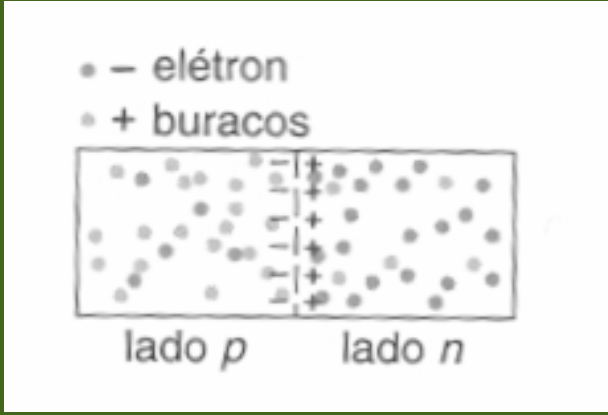
Diode

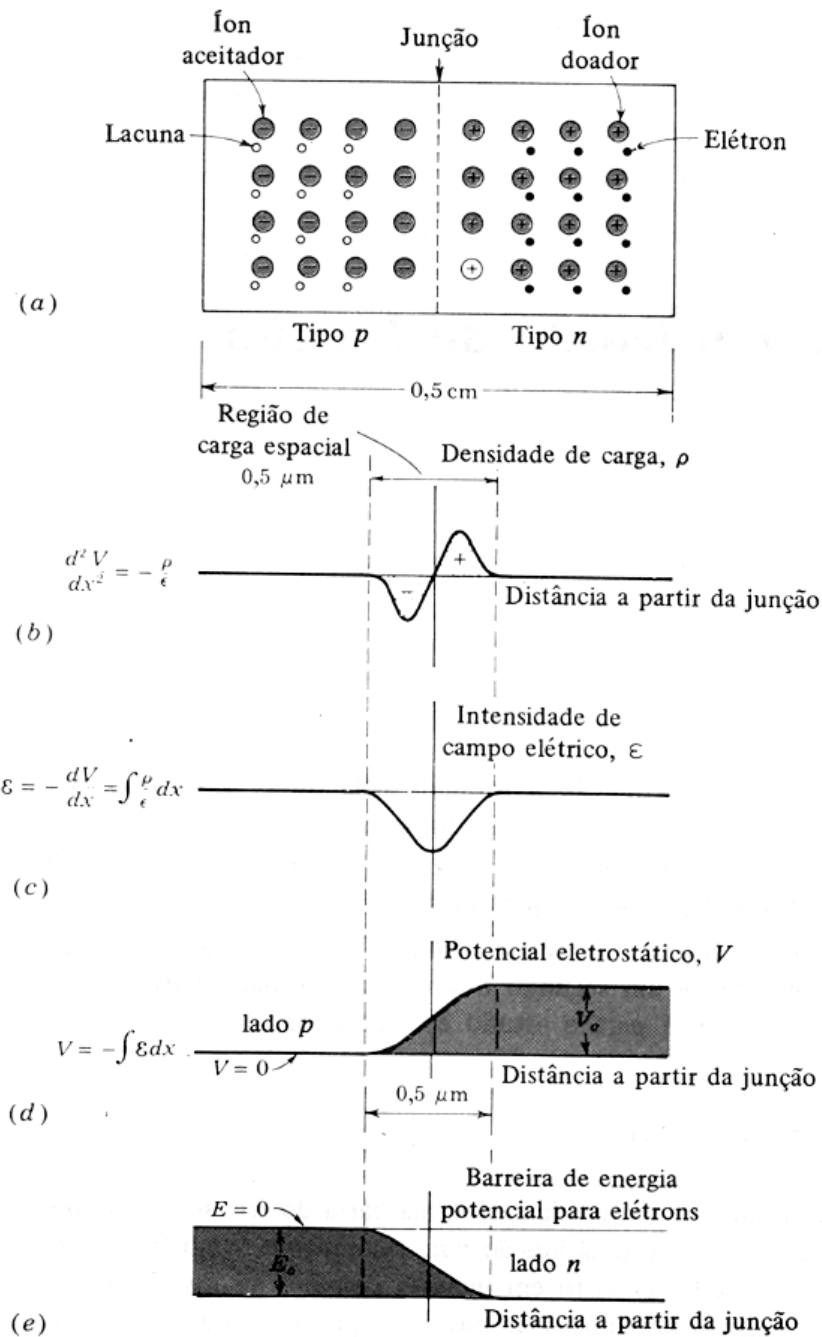
Ânodo
(+)



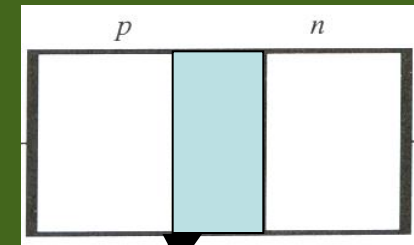
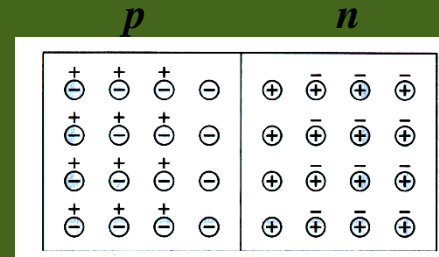
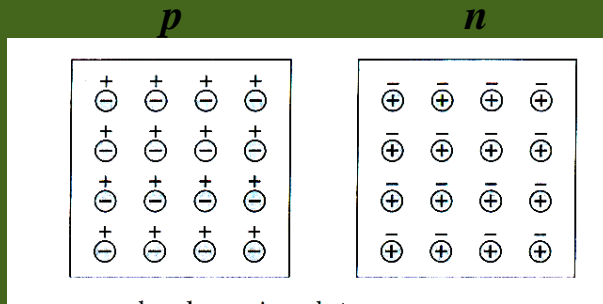
Cátodo
(-)



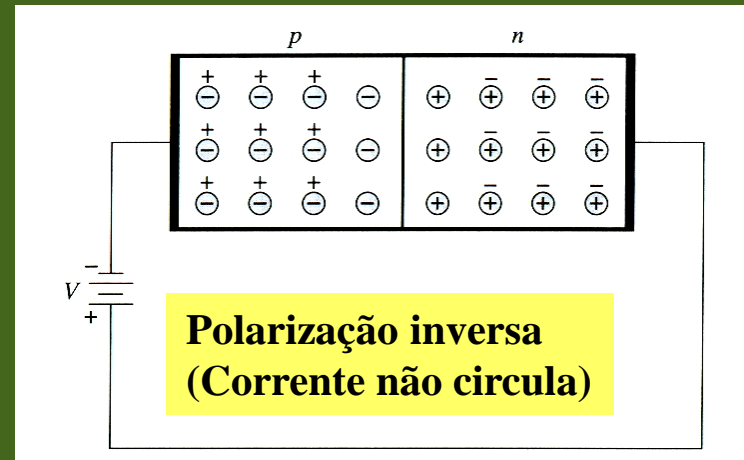
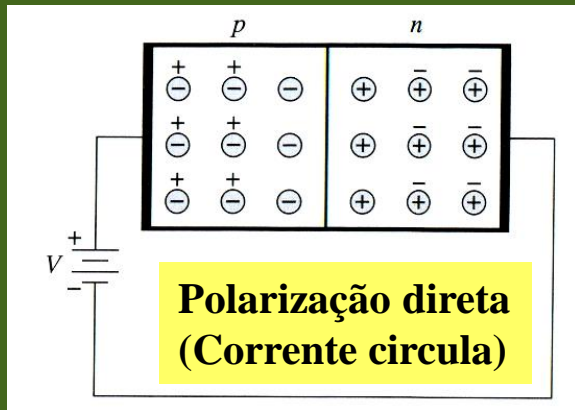




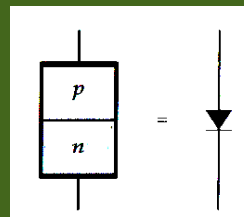
Junção $p-n$

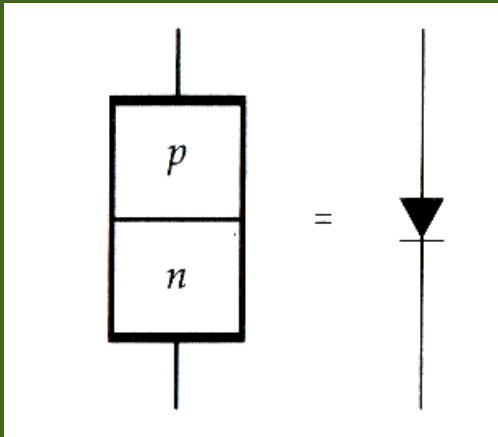


Camada de depleção
(barrera de potencial 0.3 eV Ge, 0.7 eV Si)

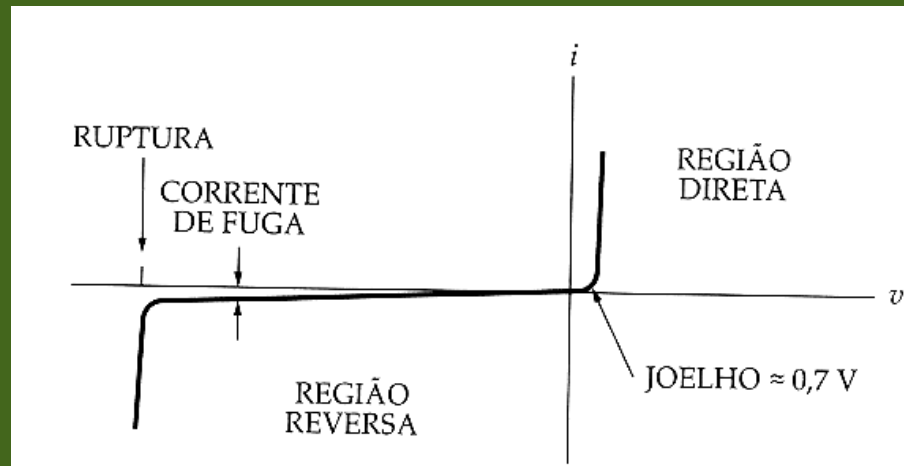
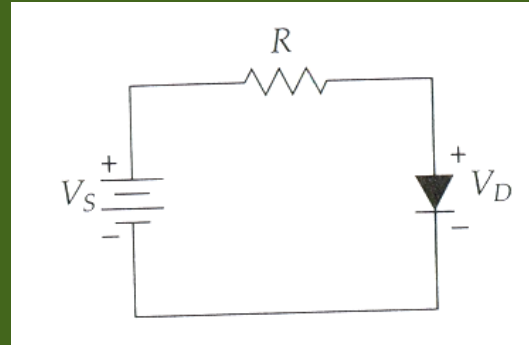


Diodo
(contração “dois –eletrodos”)





polarização direta.

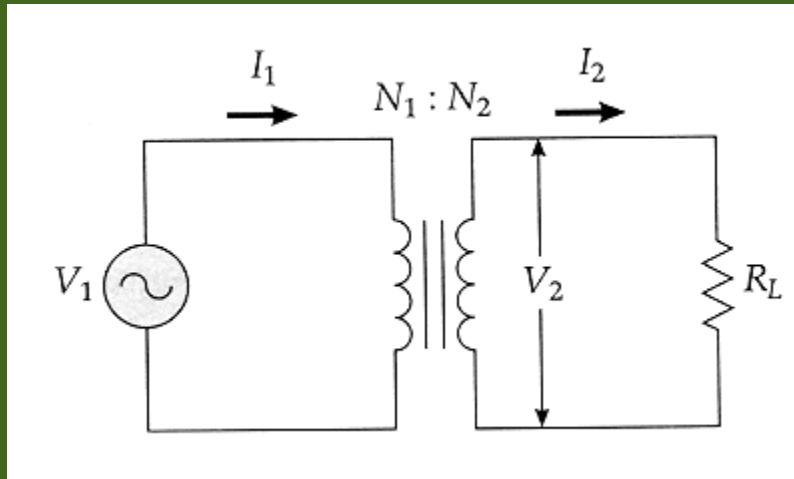


A curva do diodo.

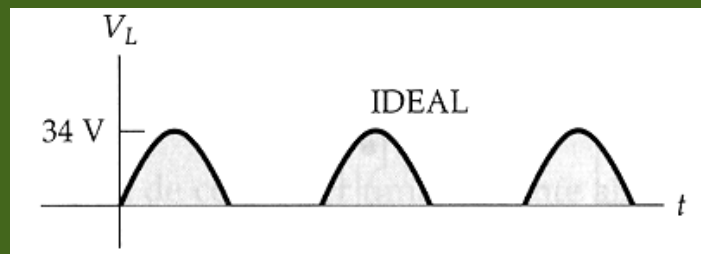
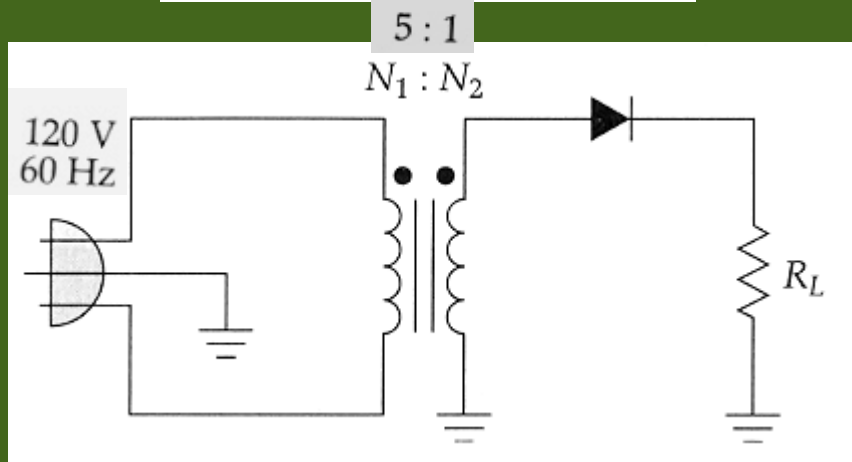
Fontes e retificação

O transformador com carga.

$$V_2 = \frac{N_2}{N_1} V_1$$

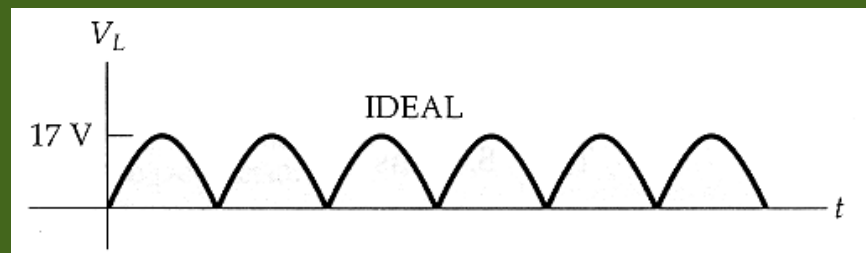
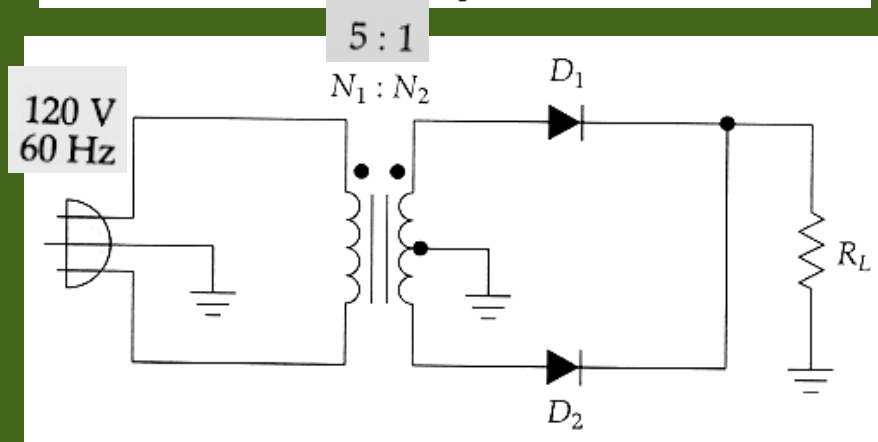


O retificador de meia onda.



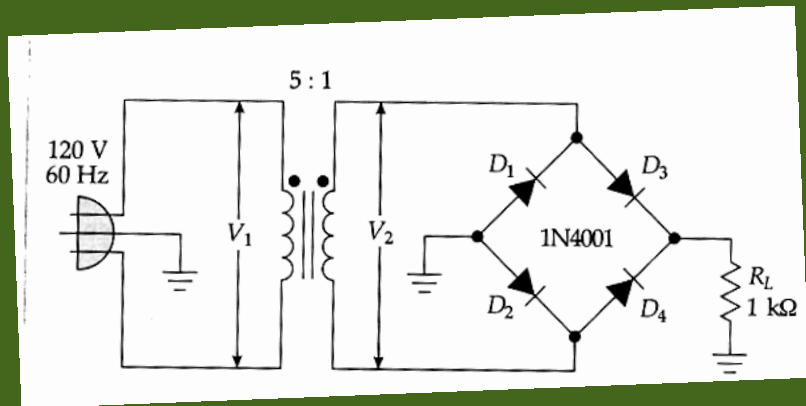
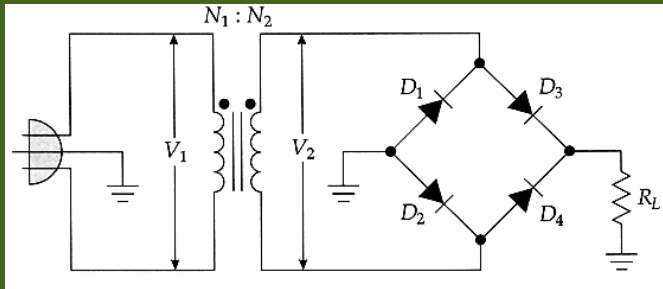
O sinal de meia onda.

O retificador de onda completa com tomada central.

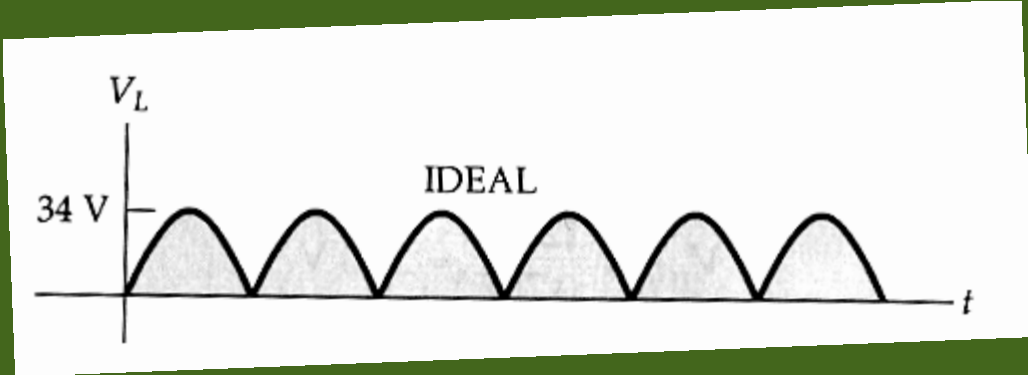


O sinal de onda completa.

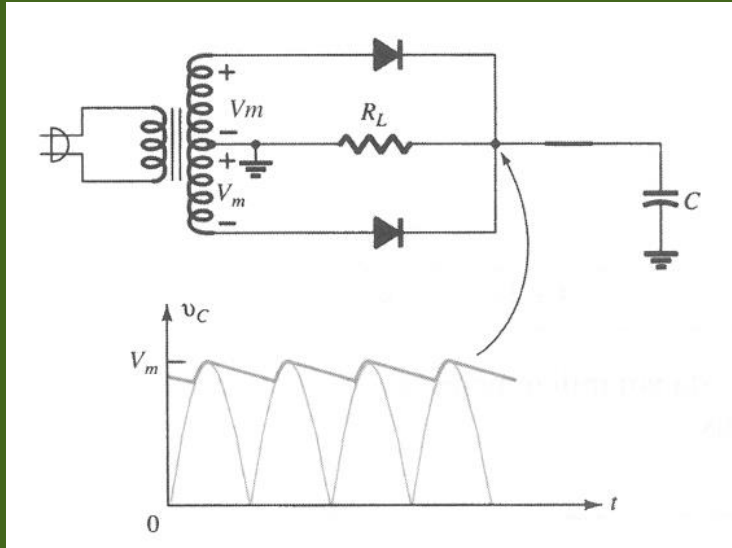
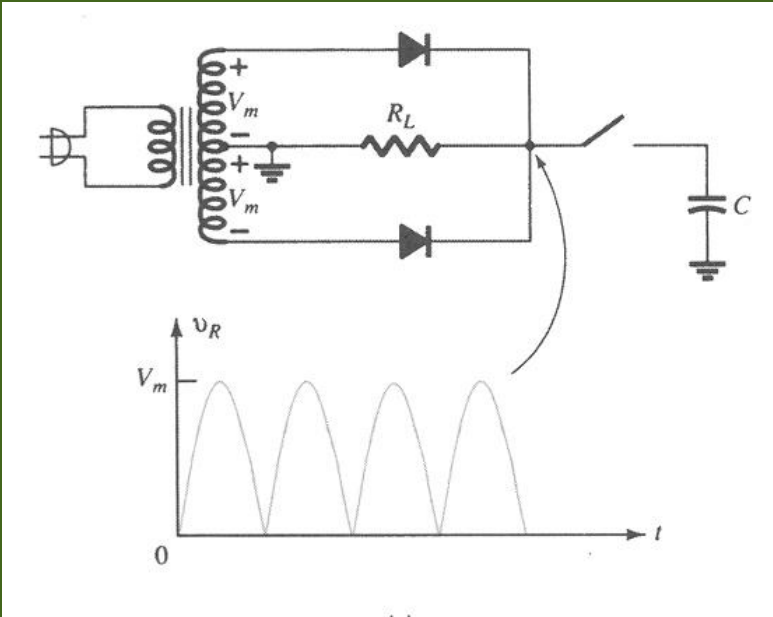
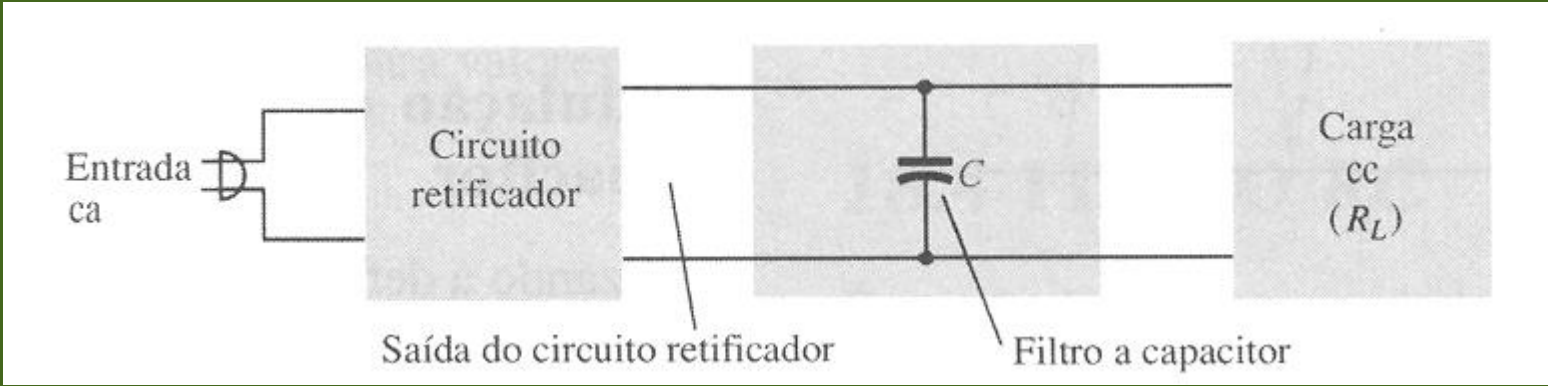
O retificador de onda completa em ponte.

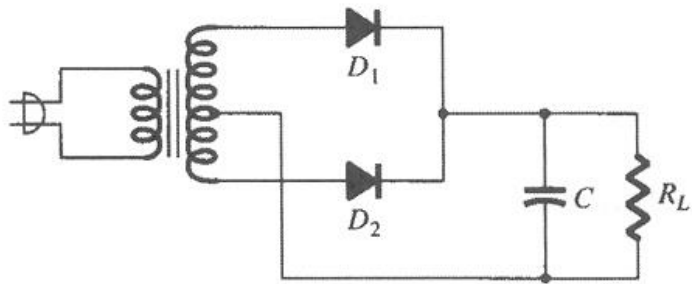


$$V_p = 34 \text{ V} - 2(0,7 \text{ V}) = 32,6 \text{ V}$$

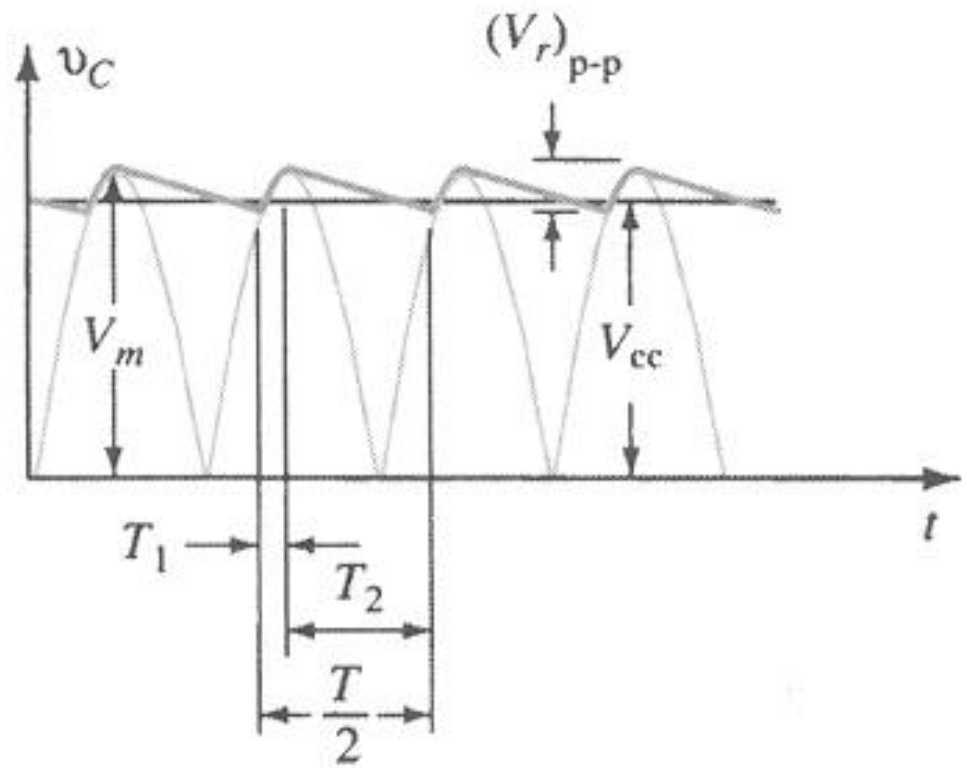


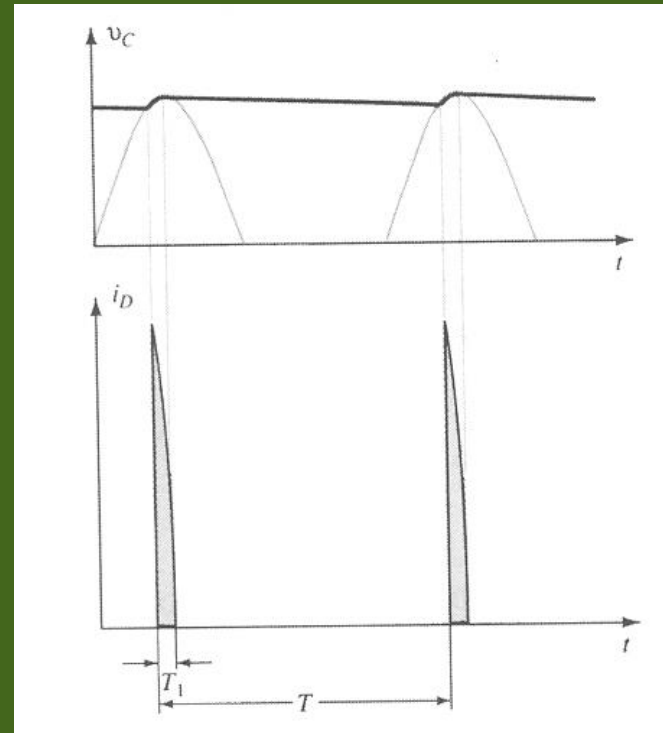
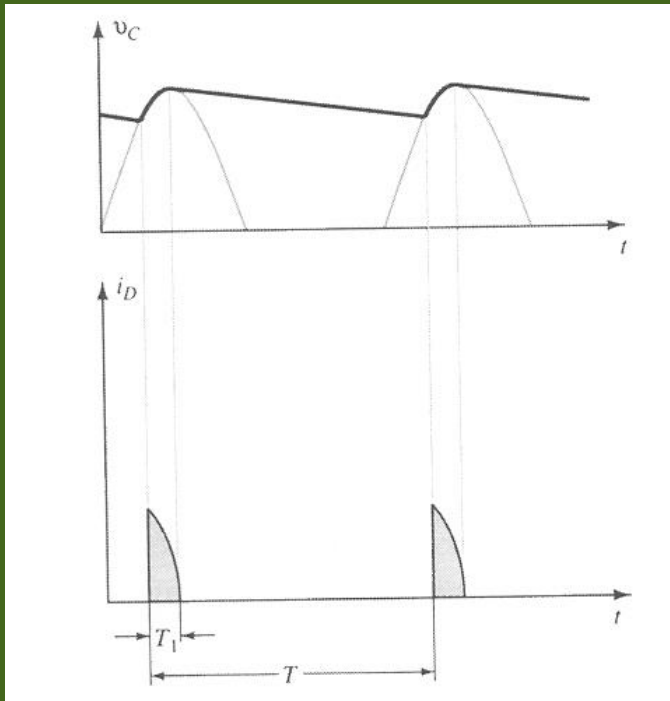
O sinal de onda completa.





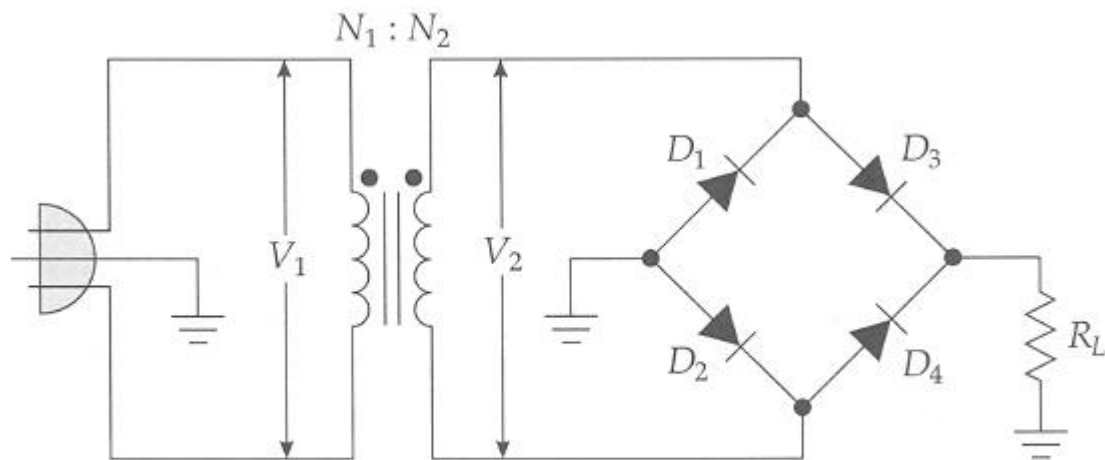
(a)



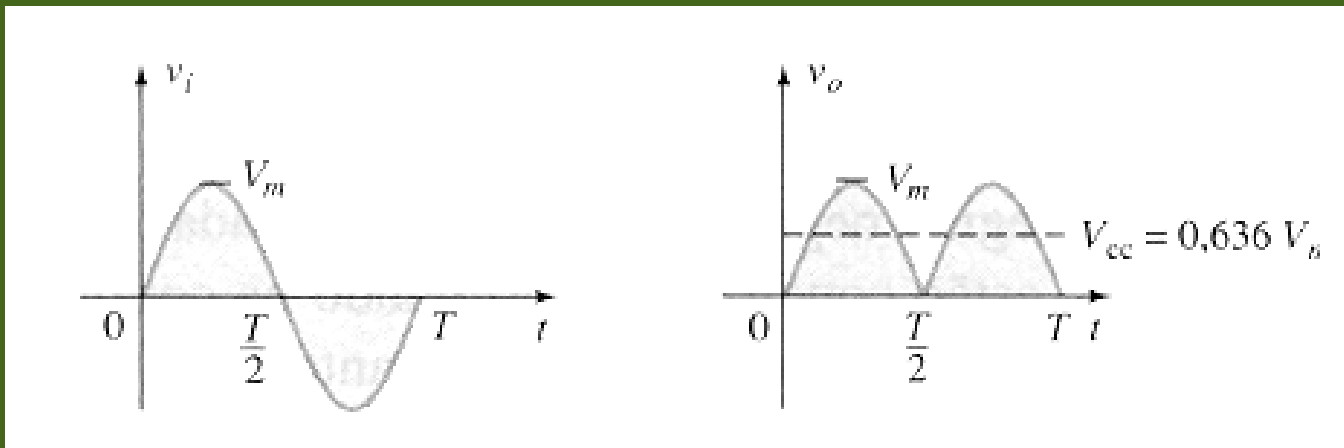
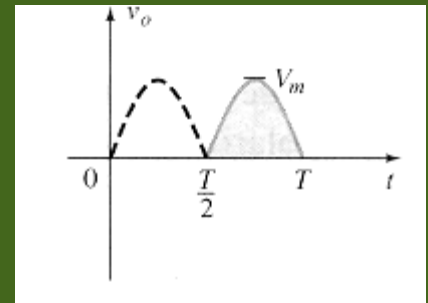
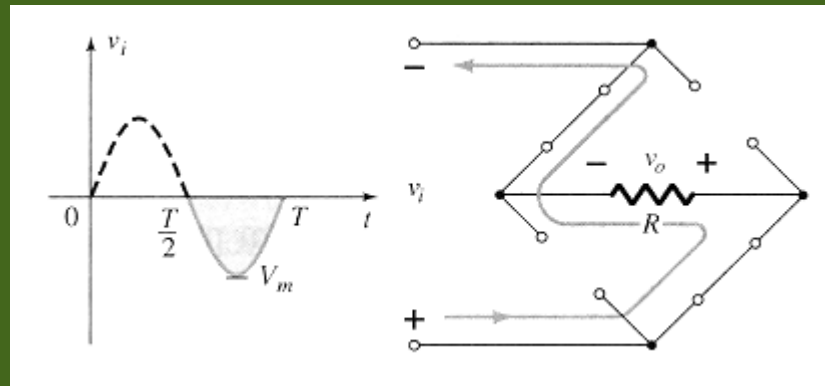
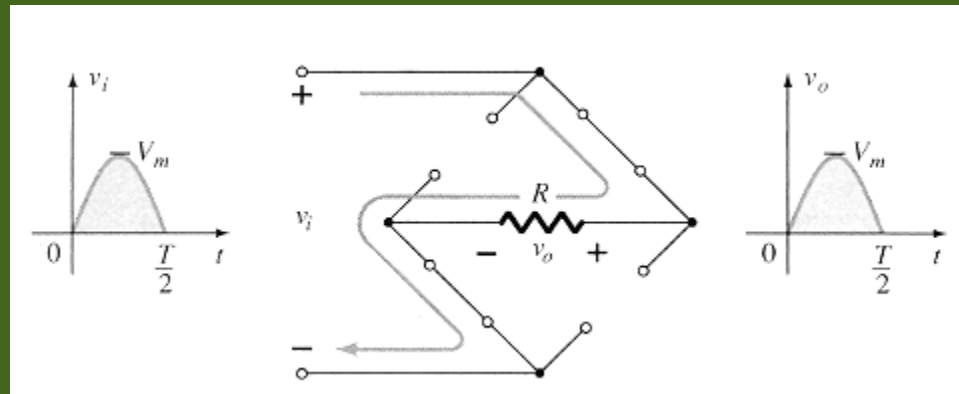
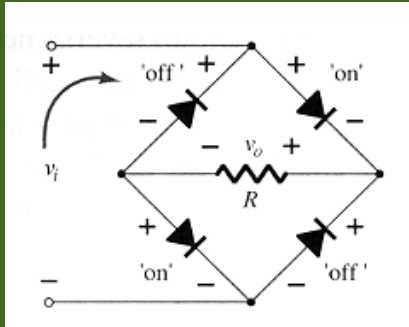


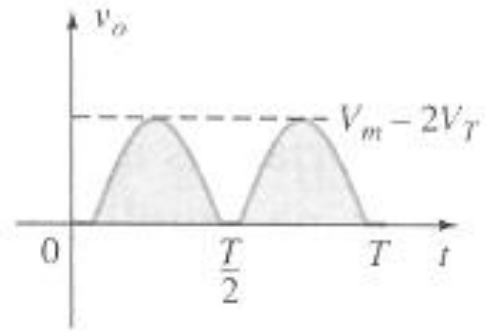
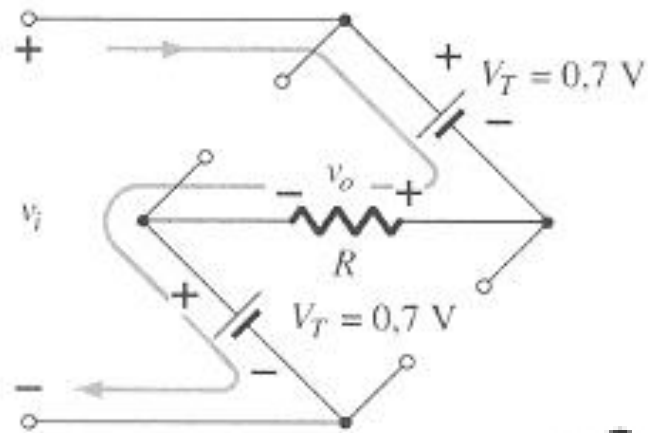
Tensão de saída e formas de onda da corrente no diodo

(a) C pequeno; (b) C alto.

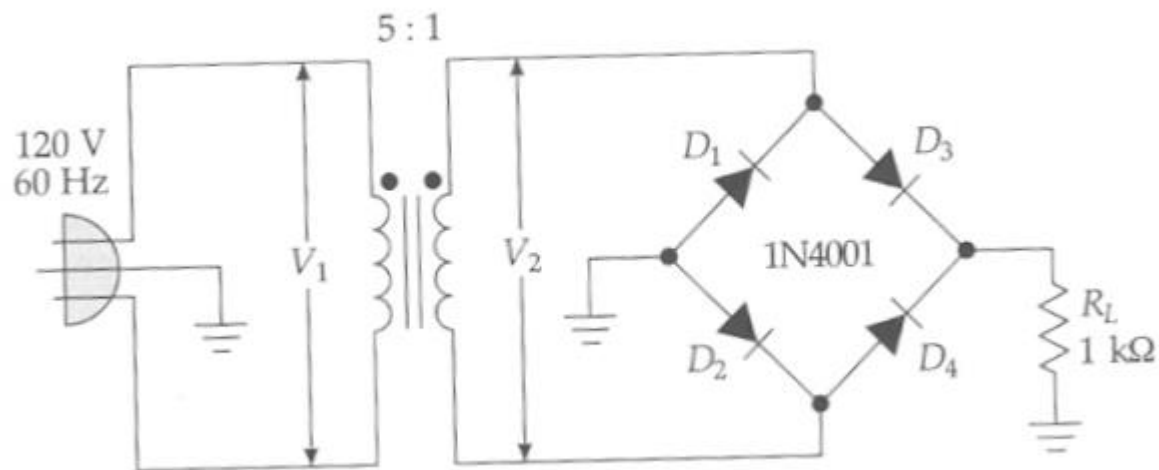


O retificador de onda completa em ponte.

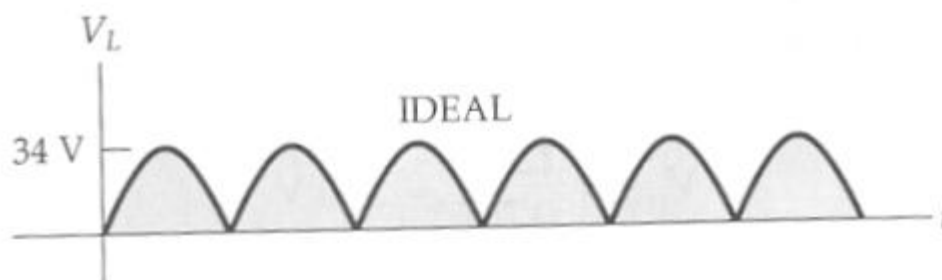




$$2 V_T$$

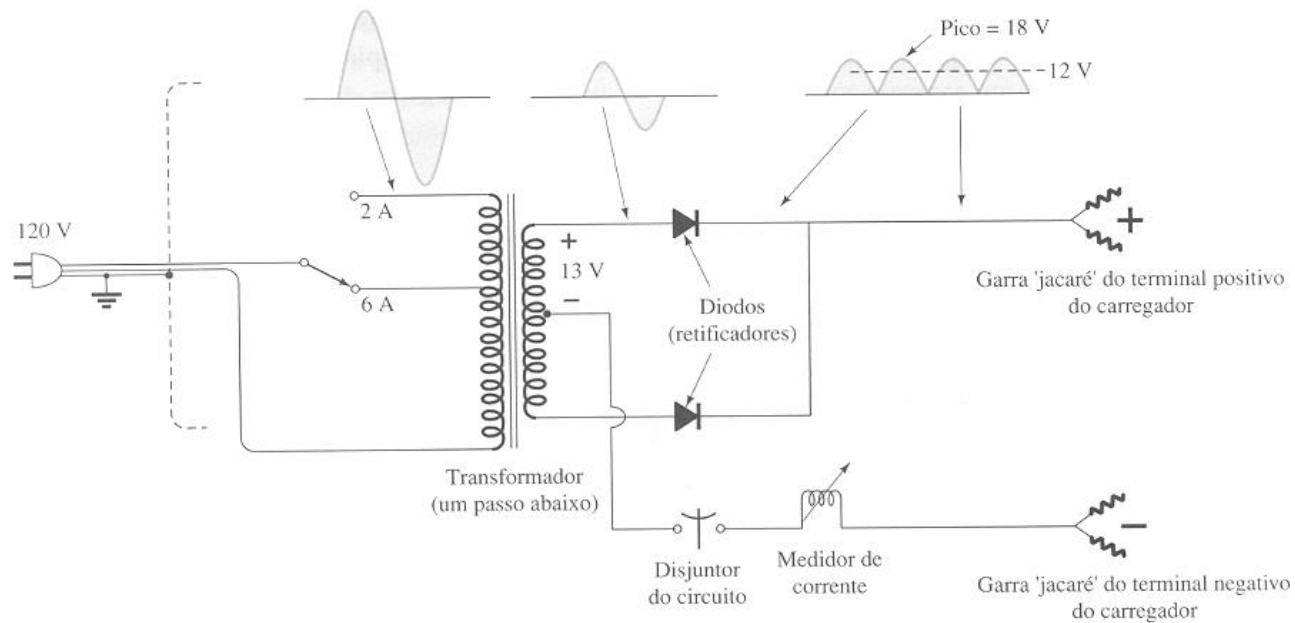
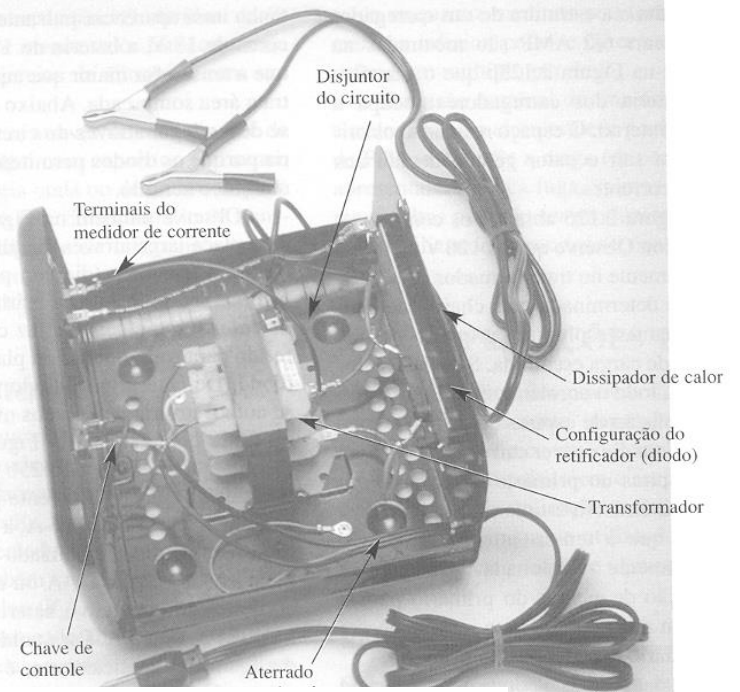


$$V_p = 34 \text{ V} - 2(0,7 \text{ V}) = 32,6 \text{ V}$$



O sinal de onda completa.

Carregador de bateria



End!!!