Centro Federal de Educação Tecnológica de Santa Catarina
Departamento Acadêmico de Eletrônica
Retificadores

Características dos diodos

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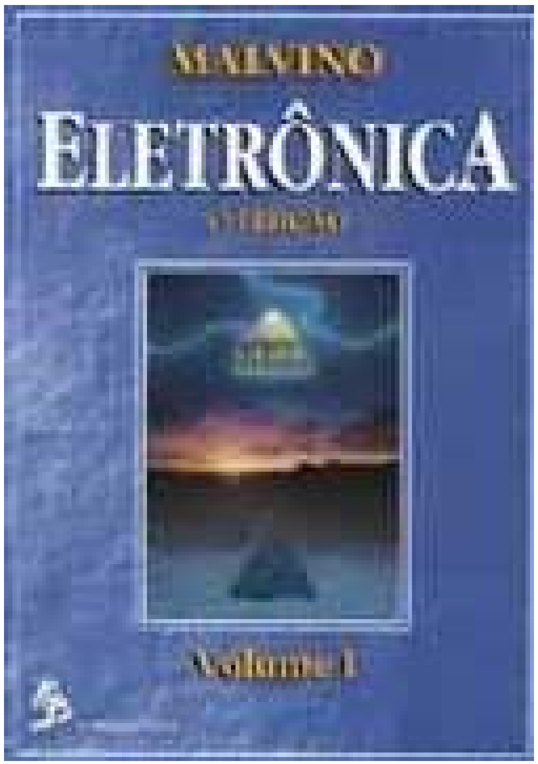
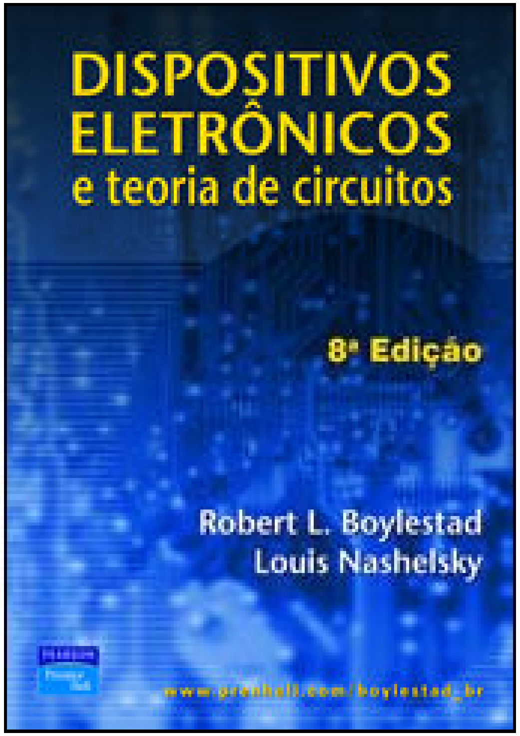
Florianópolis, abril de 2008.

Bibliografia para esta aula

Capítulo 1: Diodos semicondutores

1. Características dos diodos.





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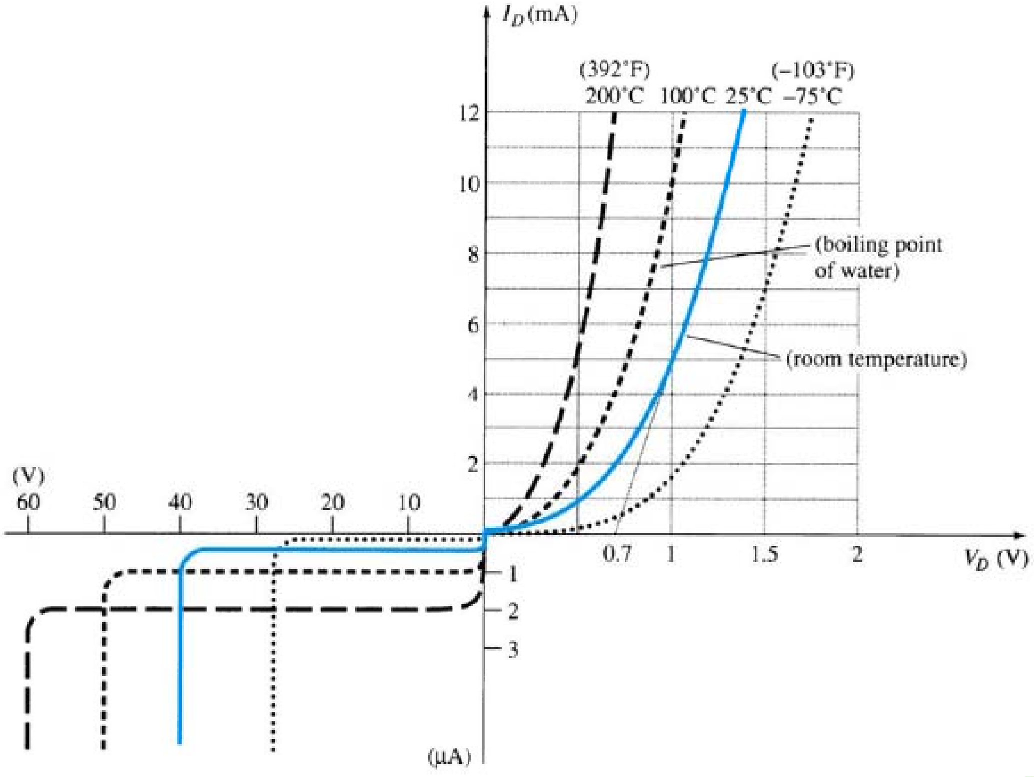
Nesta aula

Seqüência de conteúdos:

1. Efeito da temperatura;
2. Silício versus germânio;
3. Região zener;
4. Resistências do diodo;
5. Modelo ideal do diodo;
6. Modelo simplificado do diodo;
7. Modelo linear por partes do diodo;
8. Características dos diodos;
9. Testes de diodos com multímetros.

Efeito da temperatura na junção P-N

A corrente de saturação reversa I_S terá sua amplitude praticamente dobrada para aumento de 10 ^{o}C na temperatura.



Efeito da temperatura na junção P-N

Exemplo 2.6 – Eletrônica, vol. 1:

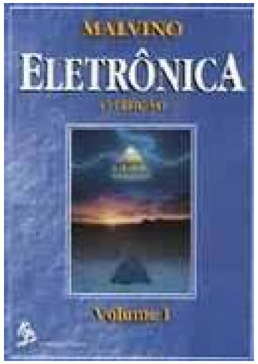
- Qual a barreira de potencial de um diodo de silício quando a temperatura na junção for de 100 ^oC.

<u>Solução:</u> Se a temperatura na junção aumentar para 100 ^oC, a barreira de potencial diminui para:

$$\left(100^o C - 25^o C\right) \cdot 2\,mV = 150\,mV = 0{,}15V$$

A barreira de potencial passa a ser:

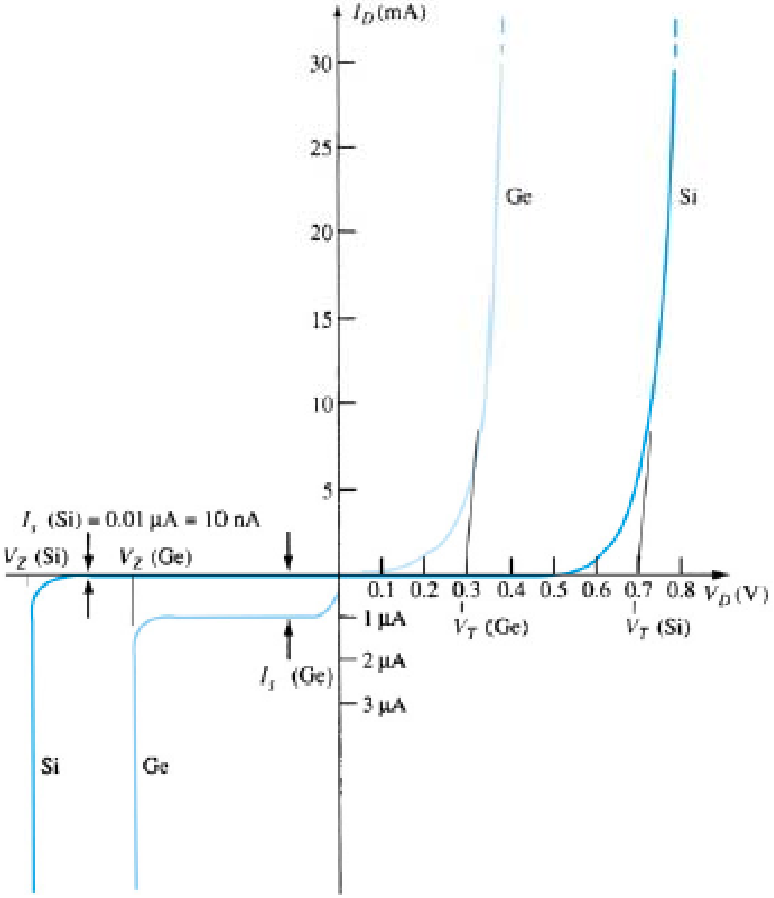
$$V_B = 0{,}7V - 0{,}15V = 0{,}55V$$



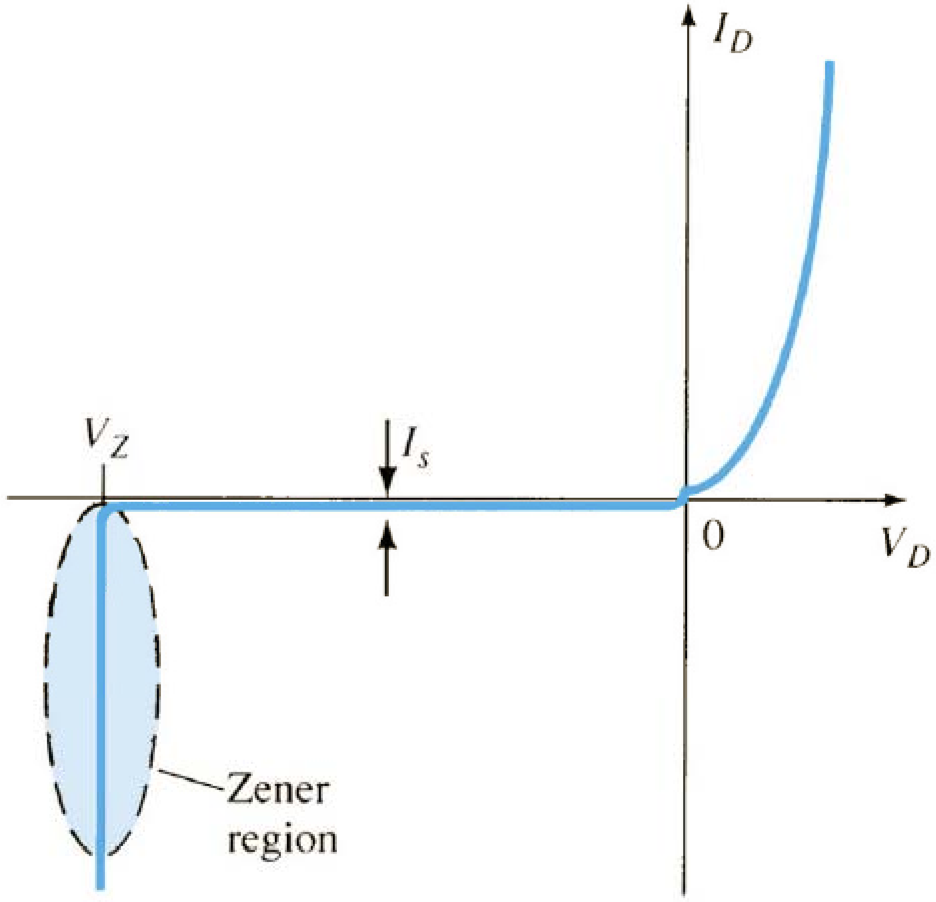
Exemplo 2.6 do Malvino.

Silício versus germânio

- Tensão reversa:
  - Silício: 1000 V;
  - Germânio: 400 V.
- Temperatura de operação:
  - Silício: 200 ºC;
  - Germânio: 100 ºC.
- Queda de tensão direta:
  - Silício: 0,7 V;
  - Germânio: 0,3 V.



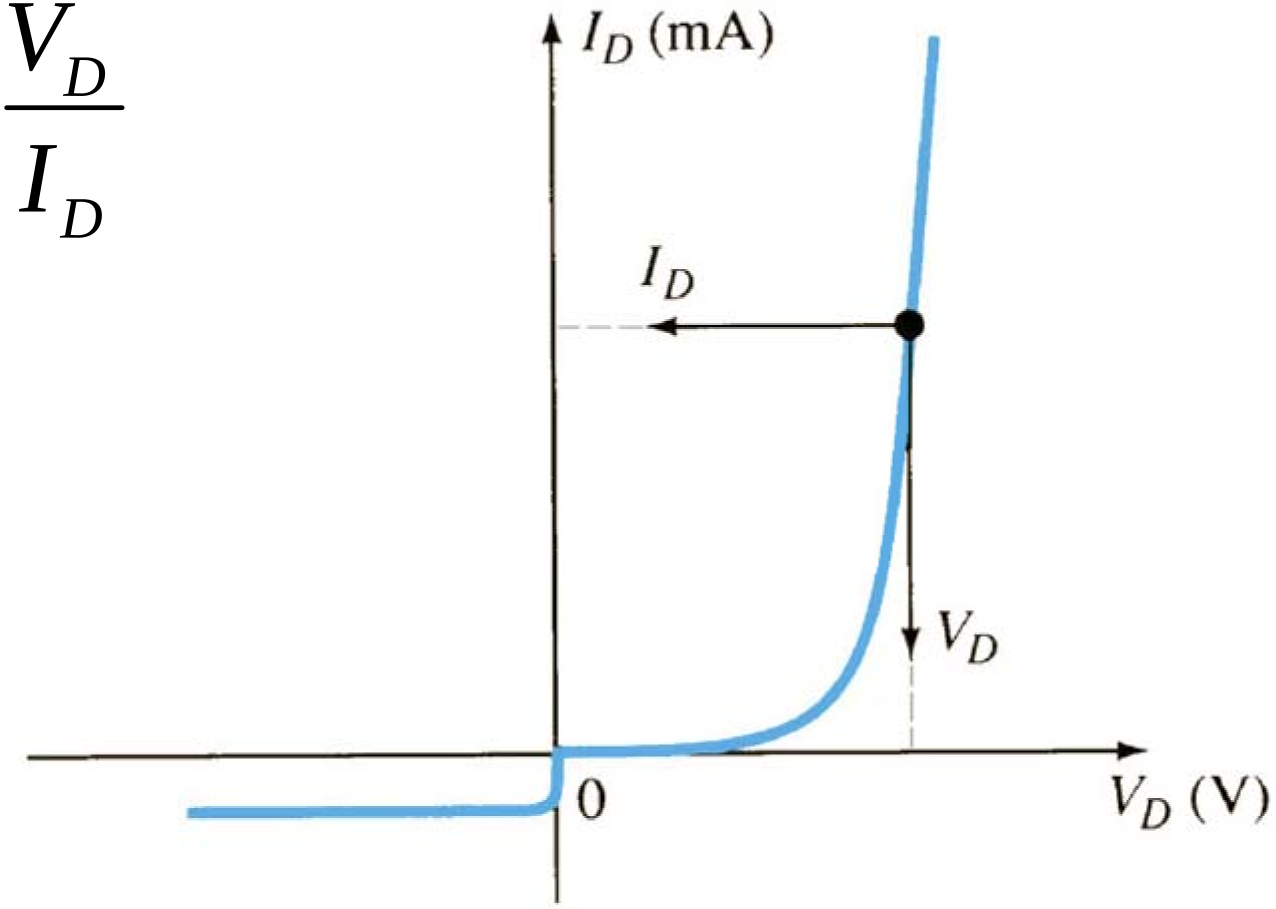
Diodo – Região zener



Resistências do diodo

Resistência CC ou estática:

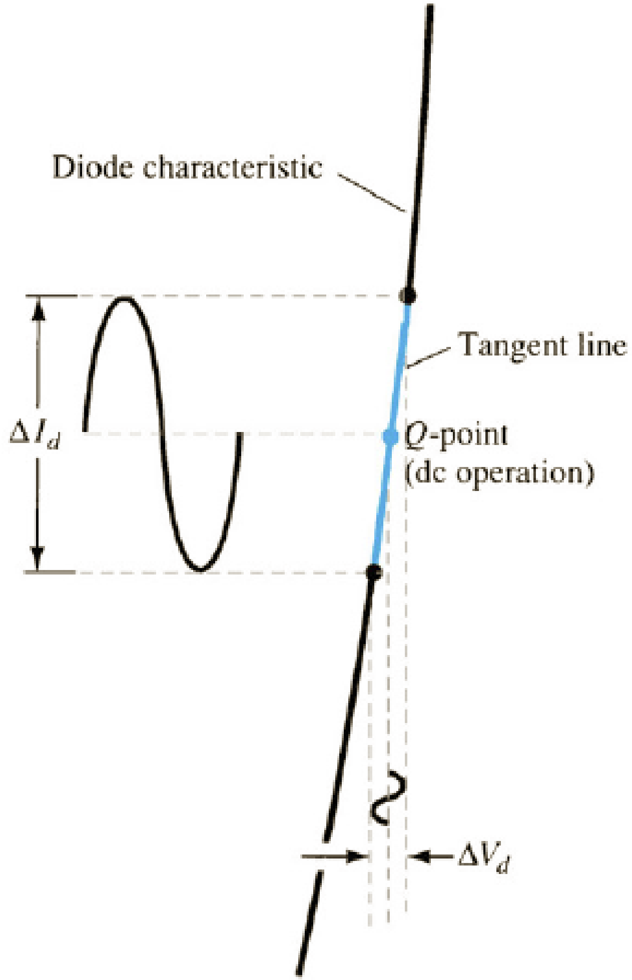
$$R_D = \frac{V_D}{I_D}$$

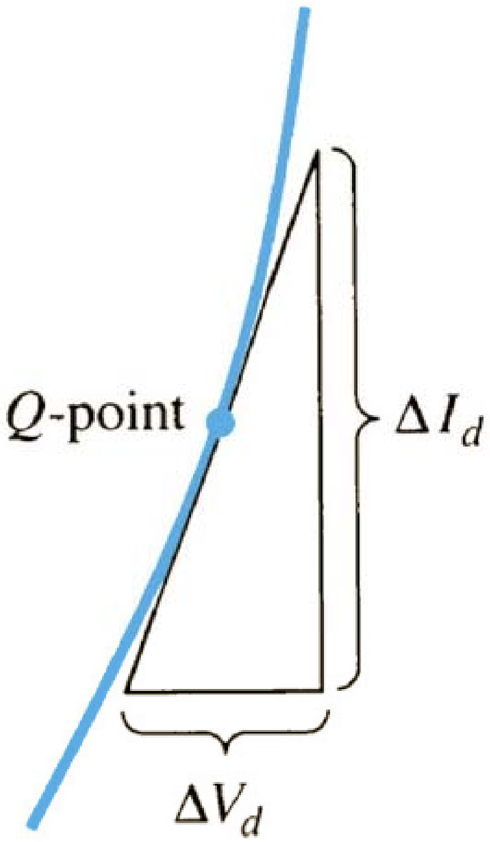


Resistências do diodo

Resistência CA ou dinâmica:

$$r_D = \frac{\Delta V_D}{\Delta I_D}$$

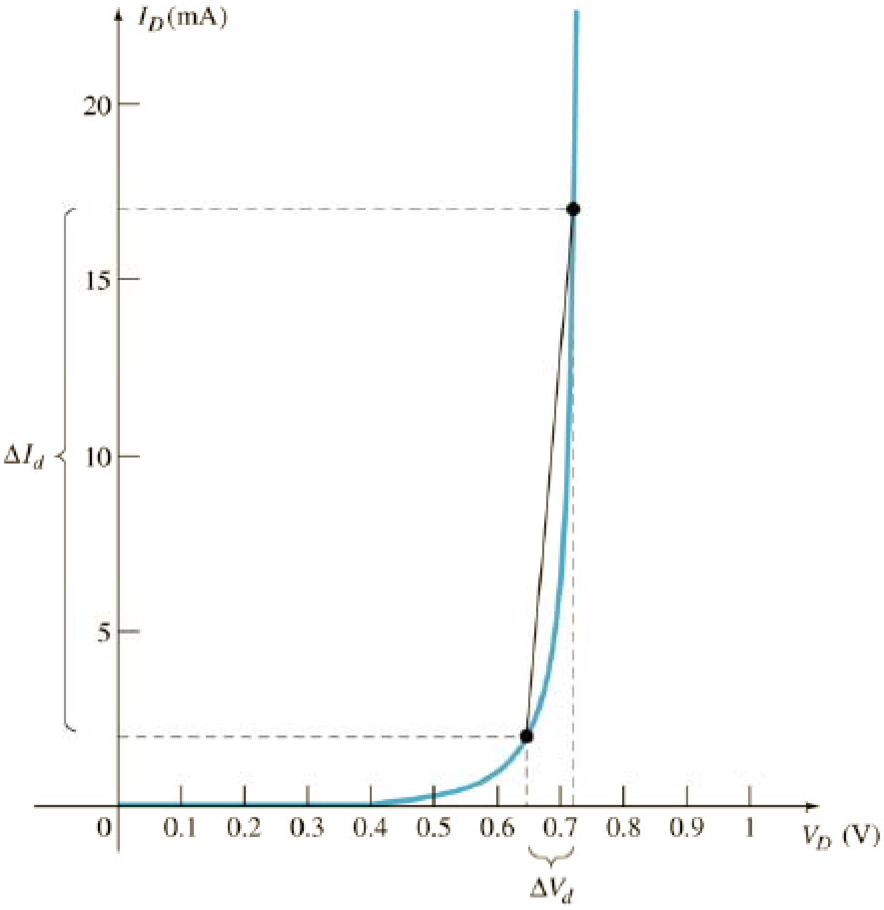




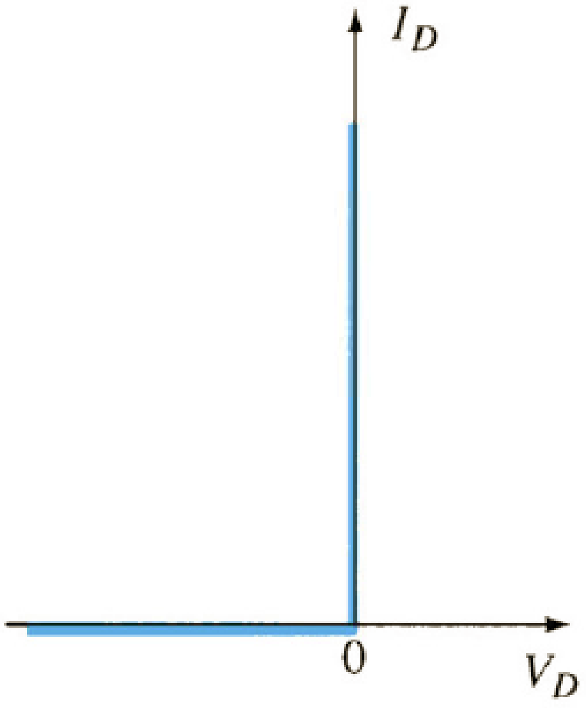
Resistências do diodo

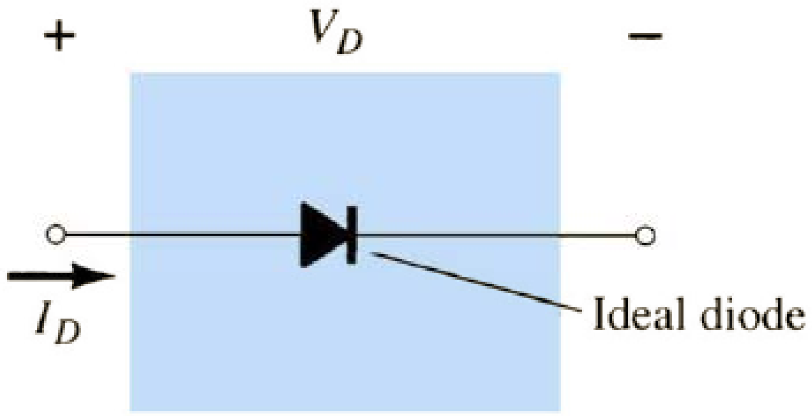
Resistência CA média ou resistência de corpo:

$$r_{av} = \frac{\Delta V_d}{\Delta I_d}$$



Modelo ideal do diodo

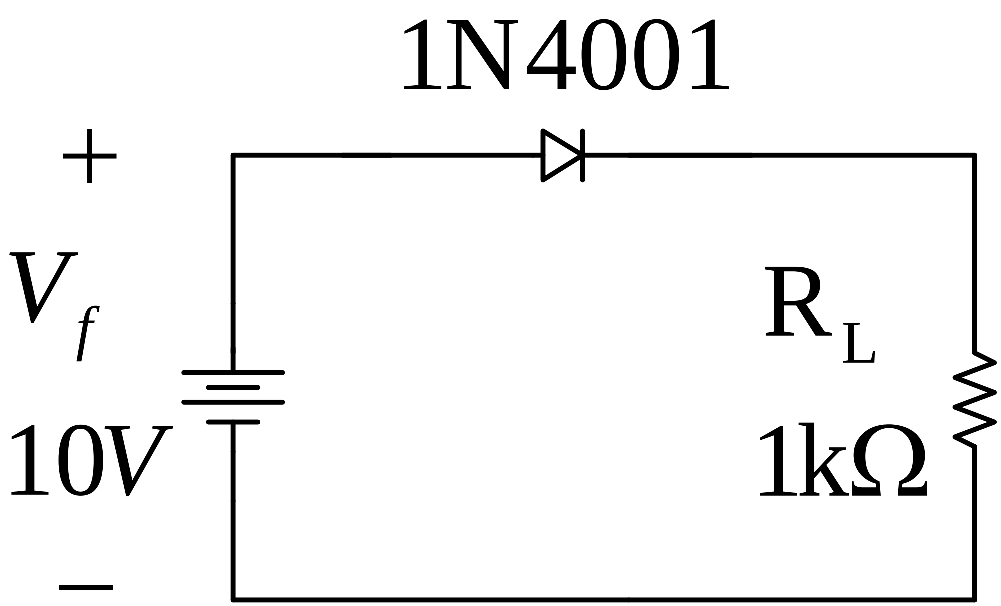


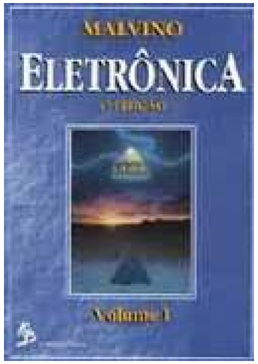


Modelo ideal do diodo

Exemplo 3.4 – Eletrônica, vol. 1:

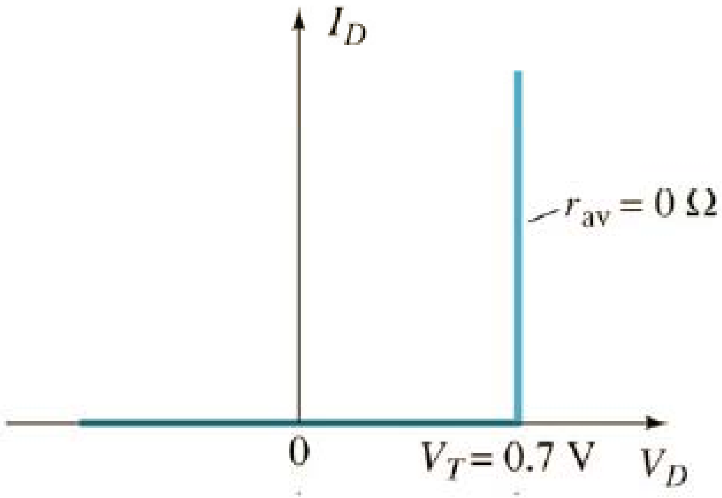
- Use a aproximação do diodo ideal para calcular a corrente de carga, a tensão na carga, a potência na carga, a potência no diodo e a potência total no circuito da figura abaixo.

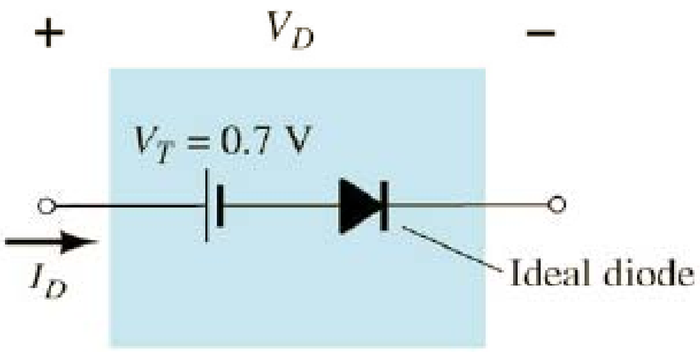




Exemplo 3.4 do Malvino.

Modelo simplificado do diodo



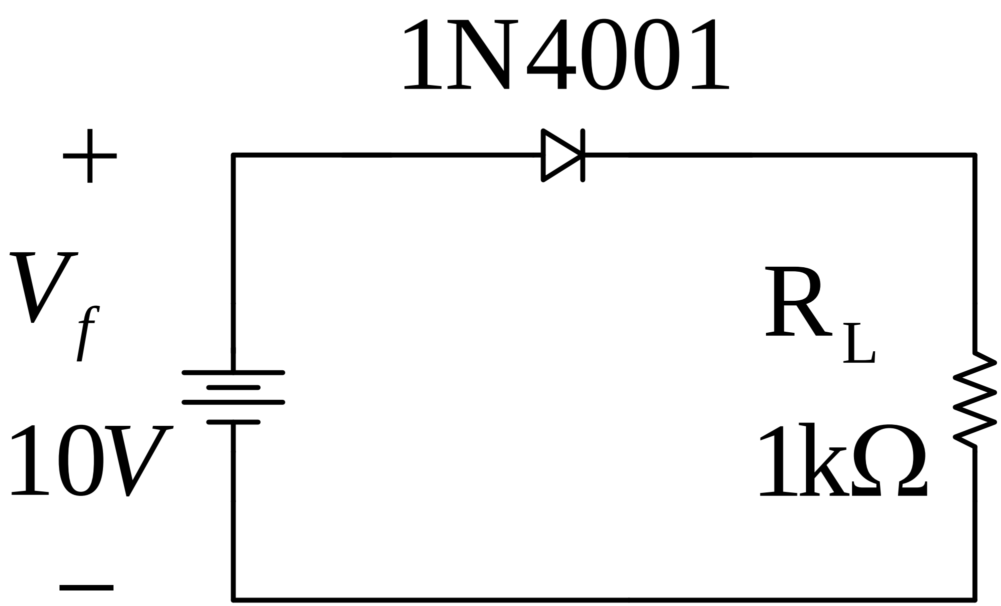


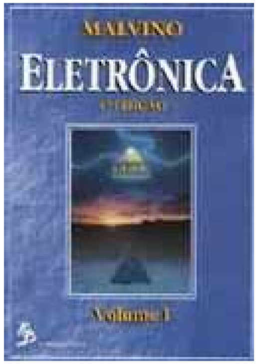
Exemplo 3.5 do Malvino.

Modelo simplificado do diodo

Exemplo 3.5 – Eletrônica, vol. 1:

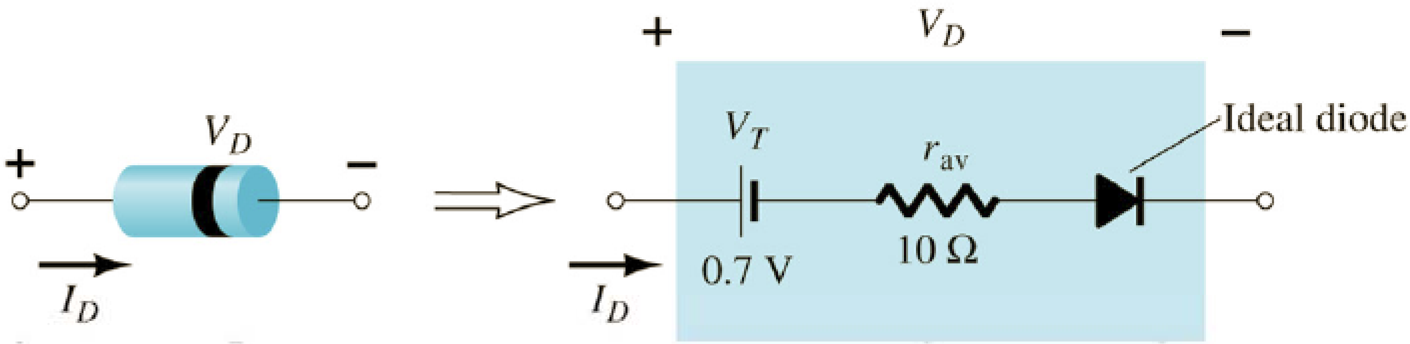
- Use a segunda aproximação para calcular a corrente na carga, a tensão na carga, a potência na carga, a potência no diodo e a potência total para o circuito abaixo.

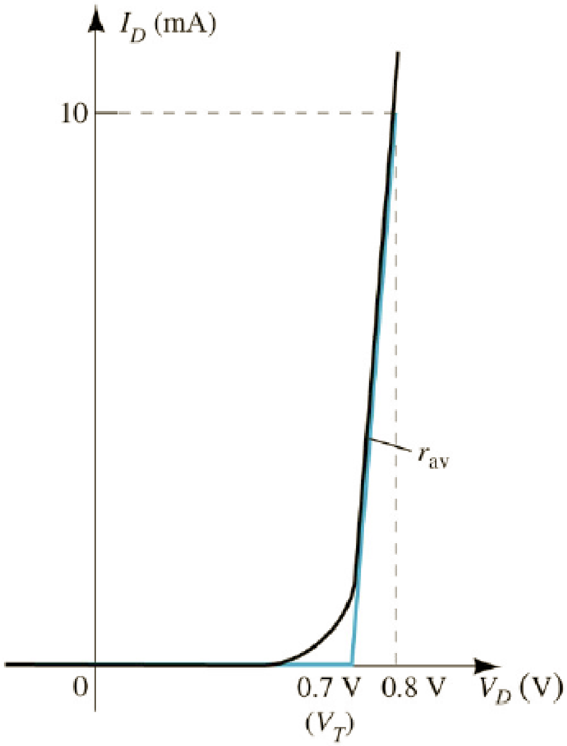




Exemplo 3.5 do Malvino.

Modelo linear por partes do diodo



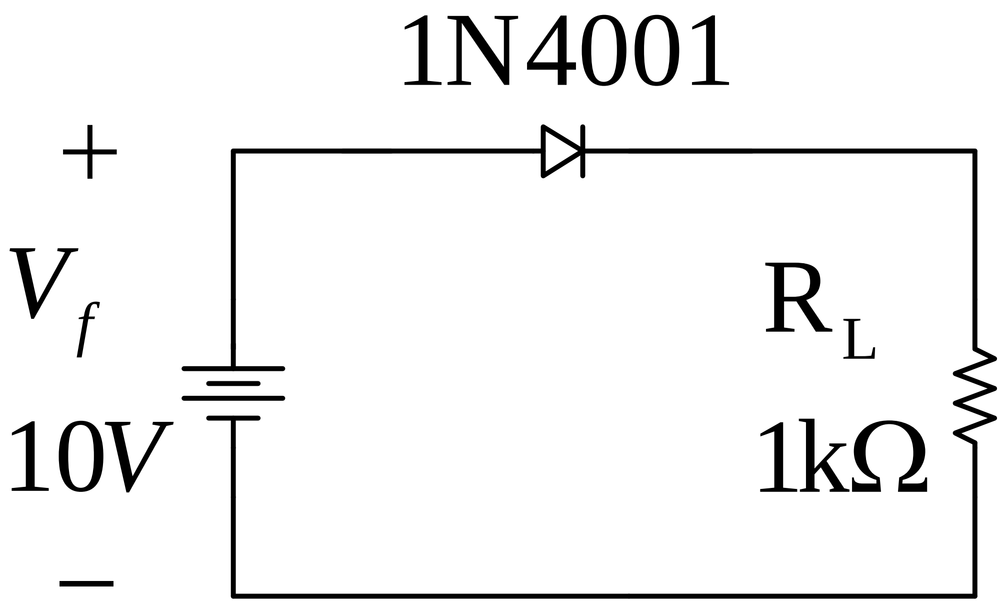


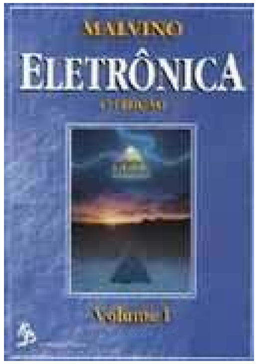
Exemplo 3.6 do Malvino.

Modelo linear por partes do diodo

Exemplo 3.6 – Eletrônica, vol. 1:

- Use a terceira aproximação para calcular a corrente na carga, a tensão na carga, a potência na carga, a potência no diodo e a potência total para o circuito abaixo. A resistência de corpo do diodo 1N4001 é 0,23Ω.





Exemplo 3.6 do Malvino.

Características dos diodos

As principais características (grandezas) são:

1. Corrente máxima direta (I_F ou I_o);
2. Tensão de ruptura reversa:
    - VRRM = Tensão de pico inverso repetitivo;
    - VRWM = Tensão de pico inverso de trabalho;
    - VR = Tensão de bloqueio CC.
3. Queda de tensão direta (v_F);
4. Corrente reversa máxima (I_R).
5. Entre outras ....

Características dos diodos

VISHAY

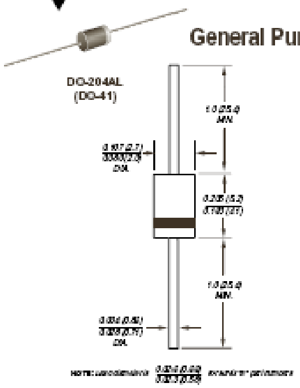
1N4001 thru 1N4007

Vishay Semiconductors
formerly General Semiconductor

General Purpose Plastic Rectifier

Reverse Voltage
50 to 1000V
Forward Current 1.0A

DO-204AL
(DO-41)



Dimensions in inches and (millimeters)

Features

- Plastic package has Underwriters Laboratories Flammability Classification 94V-0
- Construction utilizes void-free molded plastic technique
- Low reverse leakage
- High forward surge capability
- High temperature soldering guaranteed: 350°C/10 seconds, 0.375" (9.5mm) lead length, 5 lbs. (2.3kg) tension

Mechanical Data

Case: JEDEC DO-204AL, molded plastic body
Terminals: Plated axial leads, solderable per MIL-STD-750, Method 2026
Polarity: Color band denotes cathode end
Mounting Position: Any
Weight: 0.012 oz., 0.3 g

Maximum Ratings & Thermal Characteristics
Ratings at 25°C ambient temperature unless otherwise specified.

Parameter	Symb.	1N 4001	1N 4002	1N 4003	1N 4004	1N 4005	1N 4006	1N 4007	Unit
Maximum repetitive peak reverse voltage	V_{RRM}	50	100	200	400	600	800	1000	V
* Maximum RMS voltage	V_{RMS}	35	70	140	280	420	560	700	V
* Maximum DC blocking voltage	V_{DC}	50	100	200	400	600	800	1000	V
* Maximum average forward rectified current 0.375" (9.5mm) lead length at T_A = 75°C	$I_{F(AV)}$	1.0							A
* Peak forward surge current 8.3ms single half sine-wave superimposed on rated load (JEDEC Method) T_A = 75°C	I_{FSM}	30							A
* Maximum full load reverse current, full cycle average 0.375" (9.5mm) lead length T_L = 75°C	$I_{R(AV)}$	30							µA
Typical thermal resistance[1]	$R_{θJA}$ / $R_{θJL}$	50 / 25							°C/W
* Maximum DC blocking voltage temperature	T_A	+150							V
* Operating junction and storage temperature range	T_J, T_{STG}	–50 to +175							°C

Electrical Characteristics
Ratings at 25°C ambient temperature unless otherwise specified.

Parameter	Symb.	Value	Unit
Maximum instantaneous forward voltage at 1.0A	V_F	1.1	V
* Maximum DC reverse current at rated DC blocking voltage, T_A = 25°C / T_A = 125°C	I_R	5.0 / 50	µA
Typical junction capacitance at 4.0V, 1MHz	C_J	15	pF

Note: (1) Thermal resistance from junction to ambient at 0.375" (9.5mm) lead length, P.C.B. mounted   *JEDEC registered values

Bulletin PD-20731 rev. C 12/03

International
IOR Rectifier

MUR820
MURB820
MURB820-1

Ultrafast Rectifier

Features

- Ultrafast Recovery Time
- Low Forward Voltage Drop
- Low Leakage Current
- 175°C Operating Junction Temperature

t_{rr} = 25ns
$I_{F(AV)}$ = 8Amp
V_R = 200V

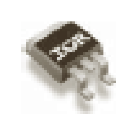
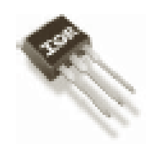
Description/ Applications

International Rectifier's MUR.. series are the state of the art Ultra fast recovery rectifiers specifically designed with optimized performance of forward voltage drop and ultra fast recovery time.
The planar structure and the platinum doped life time control, guarantee the best overall performance, ruggedness and reliability characteristics.
These devices are intended for use in the output rectification stage of SMPS, UPS, DC-DC converters as well as free-wheeling diode in low voltage inverters and chopper motor drives.
Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

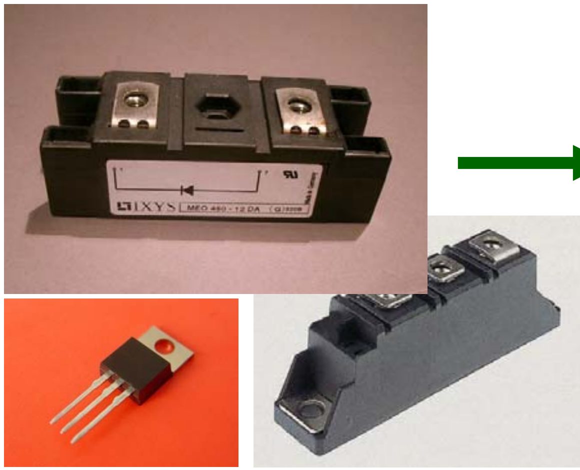
Absolute Maximum Ratings

	Parameters	Max.	Units
V_{RRM}	Peak Repetitive Peak Reverse Voltage	200	V
$I_{F(AV)}$	Average Rectified Forward Current Total Device, (Rated V_R), T_C = 150°C	8	A
I_{FSM}	Non Repetitive Peak Surge Current	100	
I_{FM}	Peak Repetitive Forward Current (Rated V_R, Square wave, 20 KHz), T_C = 150°C	16	
T_J, T_{STG}	Operating Junction and Storage Temperatures	-65 to 175	°C

Case Styles

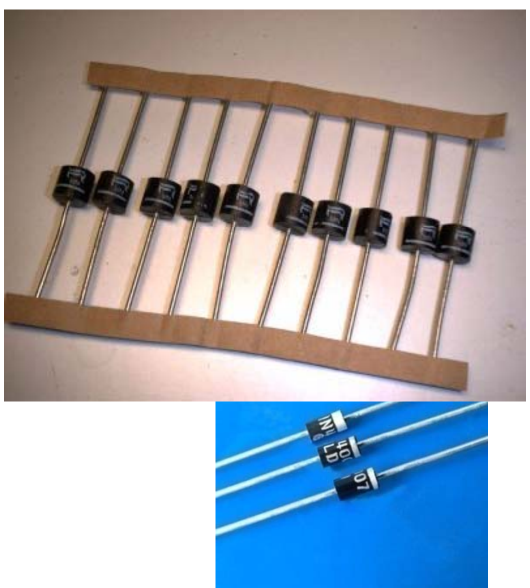
MUR820	MURB820	MURB820-1
		
TO-220AC	D^2PAK	TO-262

Características dos diodos



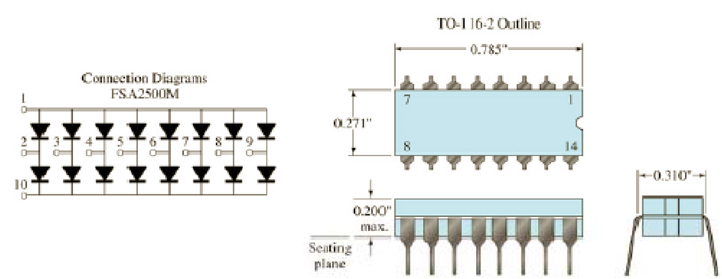
Diodos de potência

Diodos de sinal

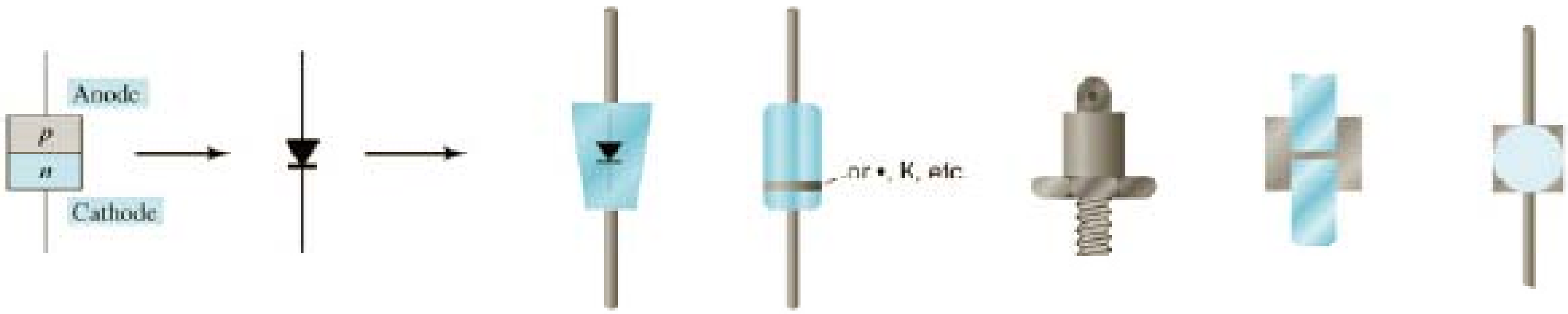


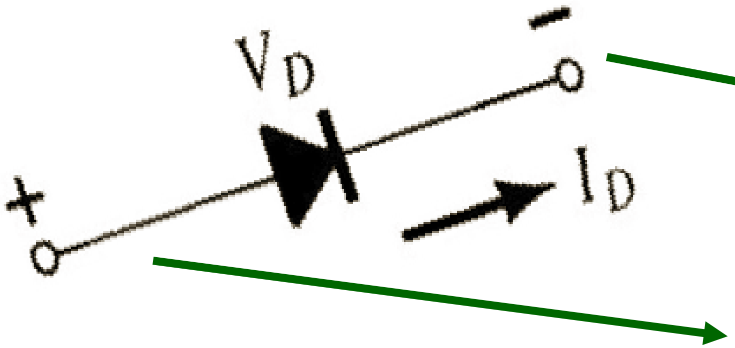
Diodos de uso geral

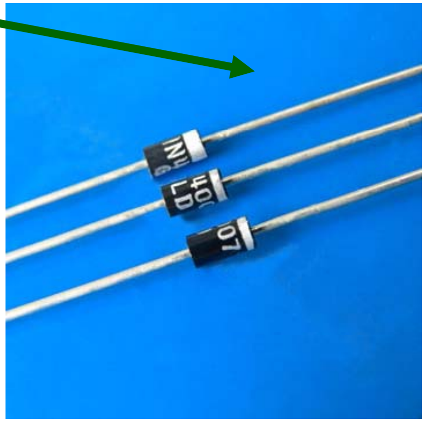
Circuitos integrados de diodos

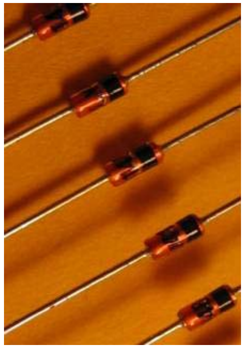


Identificação dos terminais de um diodo









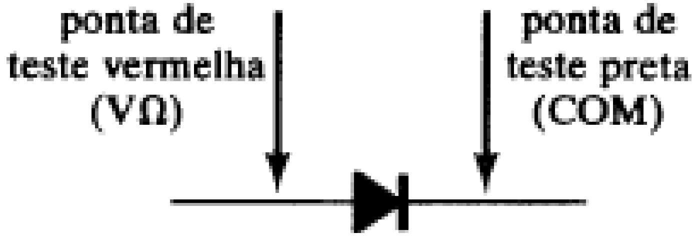
Testando diodos com o multímetro

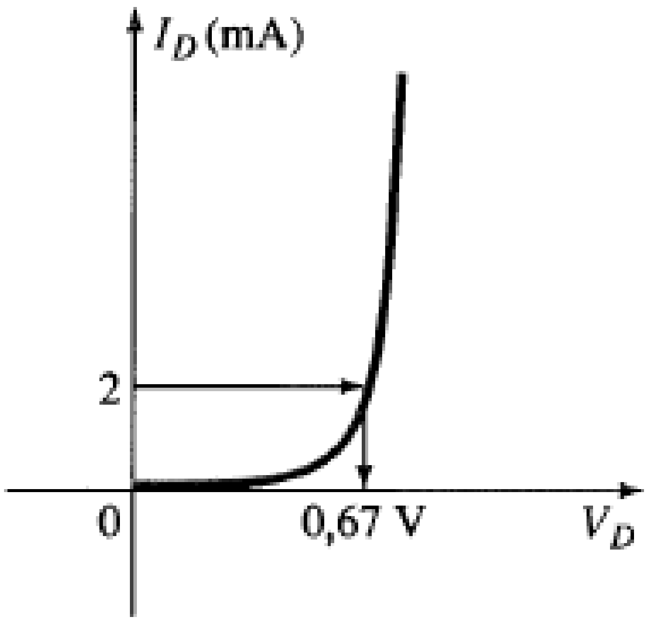
Escala para teste de diodos

Escala para teste de diodos

Testando diodos com o multímetro

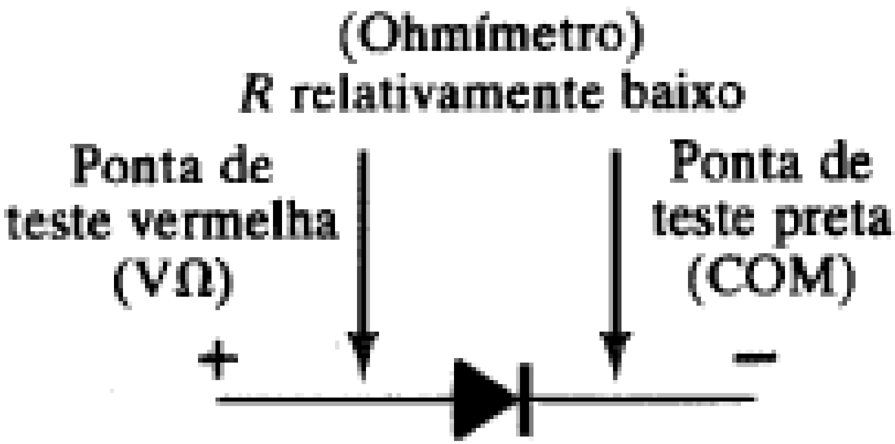
Polarização direta:





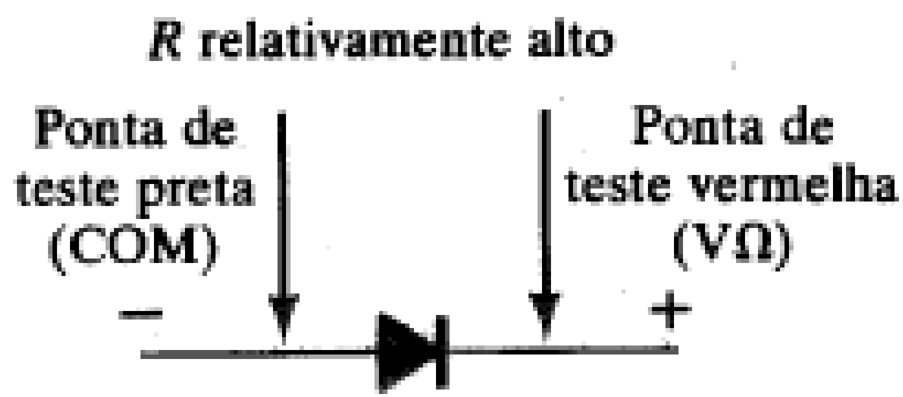
Testando diodos com o multímetro

Testes com ohmímetro:



Condução

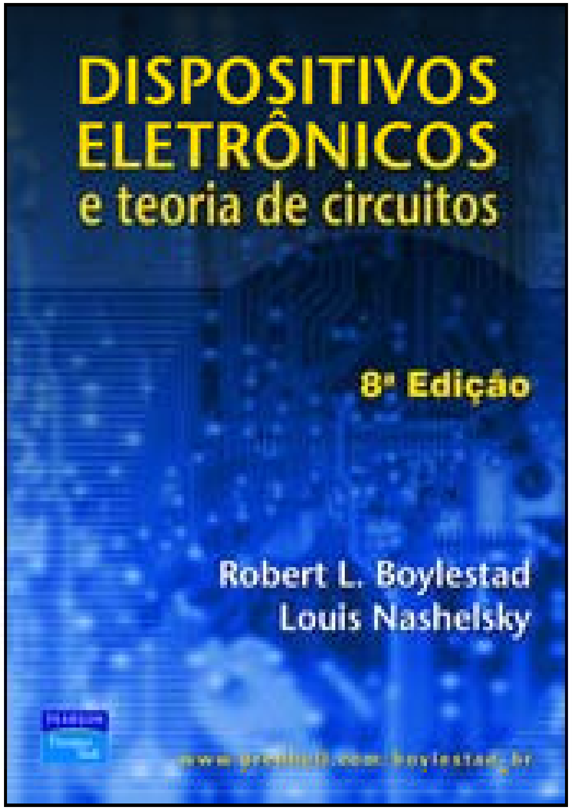
Bloqueio



Na próxima aula

Capítulo 1: Diodos semicondutores

1. Laboratório:
   - Identificação de diodos;
   - Testes de diodos com multímetro.



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