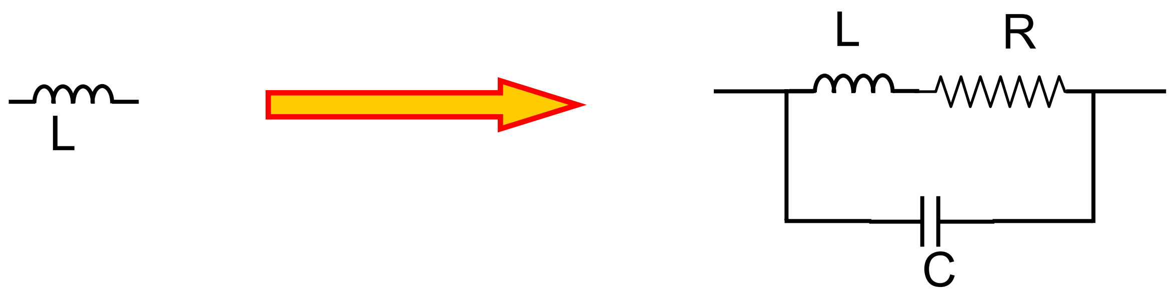
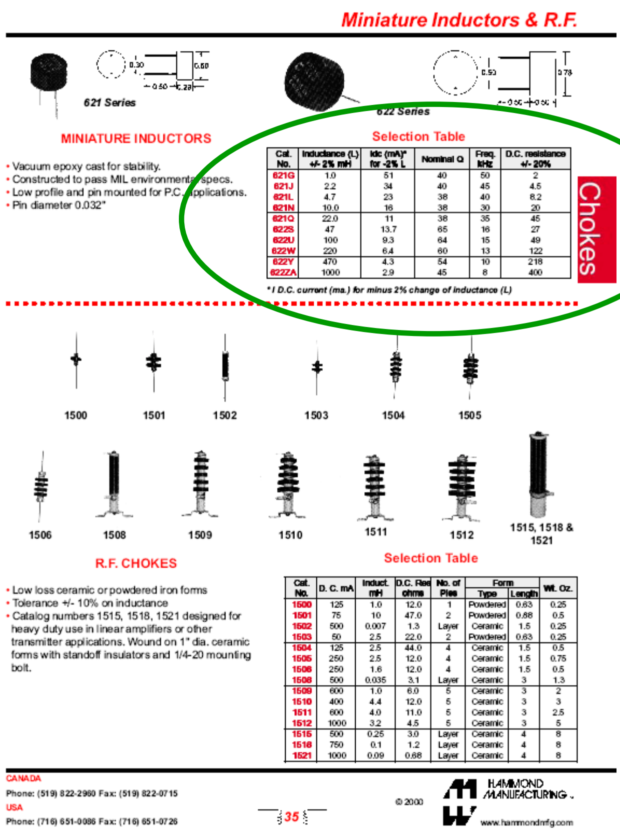
Inductors: equivalent circuit model





Miniature Inductors & R.F.

621 Series

622 Series

MINIATURE INDUCTORS

- Vacuum epoxy cast for stability.
- Constructed to pass MIL environmental specs.
- Low profile and pin mounted for P.C. applications.
- Pin diameter 0.032"

Selection Table

Cat. No.	Inductance (L) +/- 2% mH	Idc (mA)* for -2% L	Nominal Q	Freq. kHz	D.C. resistance +/- 20%
621G	1.0	51	40	50	2
621J	2.2	34	40	45	4.5
621L	4.7	23	38	40	8.2
621N	10.0	16	38	30	20
621Q	22.0	11	38	35	45
622S	47	13.7	65	16	27
622U	100	9.3	64	15	49
622W	220	6.4	60	13	122
622Y	470	4.3	54	10	218
622ZA	1000	2.9	45	8	400

** I D.C. current (ma.) for minus 2% change of inductance (L)*

Chokes

1500 1501 1502 1503 1504 1505

1506 1508 1509 1510 1511 1512 1515, 1518 & 1521

R.F. CHOKES

- Low loss ceramic or powdered iron forms
- Tolerance +/- 10% on inductance
- Catalog numbers 1515, 1518, 1521 designed for heavy duty use in linear amplifiers or other transmitter applications. Wound on 1" dia. ceramic forms with standoff insulators and 1/4-20 mounting bolt.

Selection Table

Cat. No.	D. C. mA	Induct. mH	D.C. Res ohms	No. of Pies	Form		Wt. Oz.
					Type	Length	
1500	125	1.0	12.0	1	Powdered	0.63	0.25
1501	75	10	47.0	2	Powdered	0.88	0.5
1502	500	0.007	1.3	Layer	Ceramic	1.5	0.25
1503	50	2.5	22.0	2	Powdered	0.63	0.25
1504	125	2.5	44.0	4	Ceramic	1.5	0.5
1505	250	2.5	12.0	4	Ceramic	1.5	0.75
1506	250	1.6	12.0	4	Ceramic	1.5	0.5
1508	500	0.035	3.1	Layer	Ceramic	3	1.3
1509	600	1.0	6.0	5	Ceramic	3	2
1510	400	4.4	12.0	5	Ceramic	3	3
1511	600	4.0	11.0	5	Ceramic	3	2.5
1512	1000	3.2	4.5	5	Ceramic	3	5
1515	500	0.25	3.0	Layer	Ceramic	4	8
1518	750	0.1	1.2	Layer	Ceramic	4	8
1521	1000	0.09	0.68	Layer	Ceramic	4	8

CANADA
Phone: (519) 822-2960 Fax: (519) 822-0715
USA
Phone: (716) 651-0086 Fax: (716) 651-0726

HAMMOND MANUFACTURING
www.hammondmfg.com

Cat. No.	Inductance (L) +/- 2% mH	Idc (mA)* for -2% L	Nominal Q	Freq. kHz	D.C. resistance +/- 20%
621G	1.0	51	40	50	2
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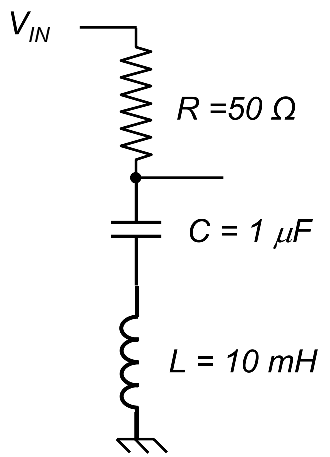
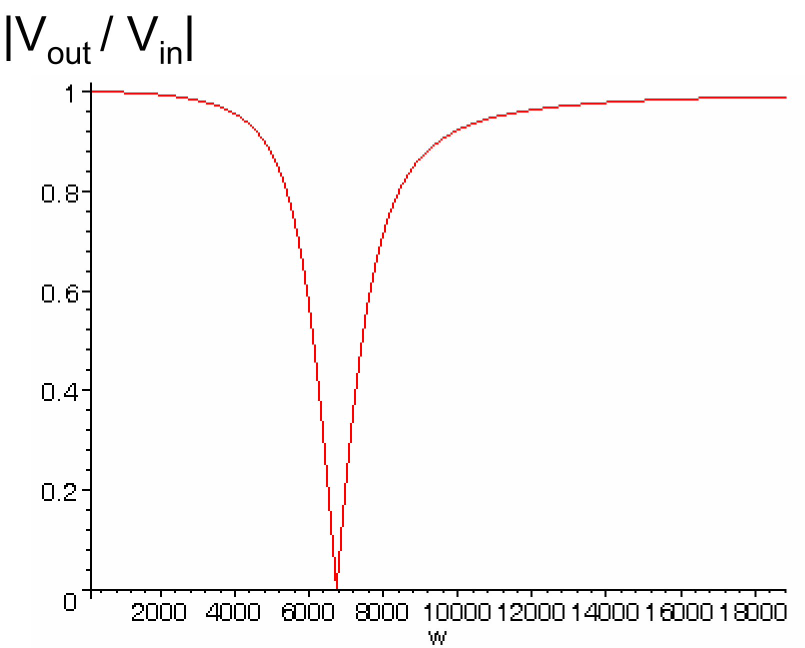
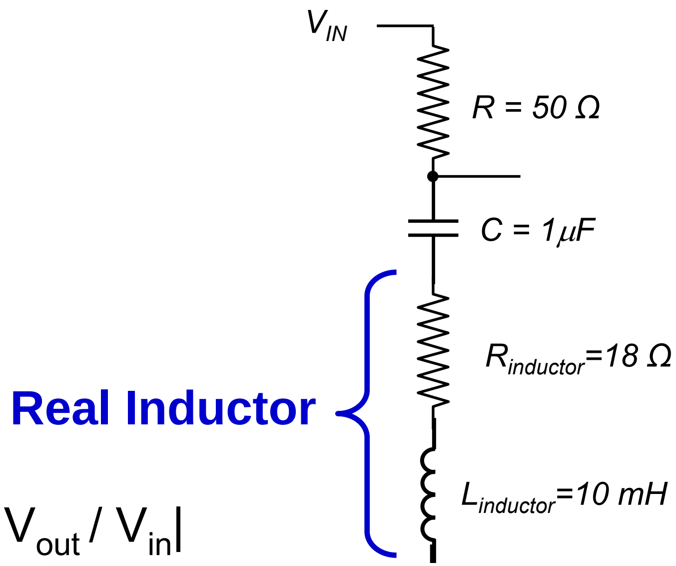
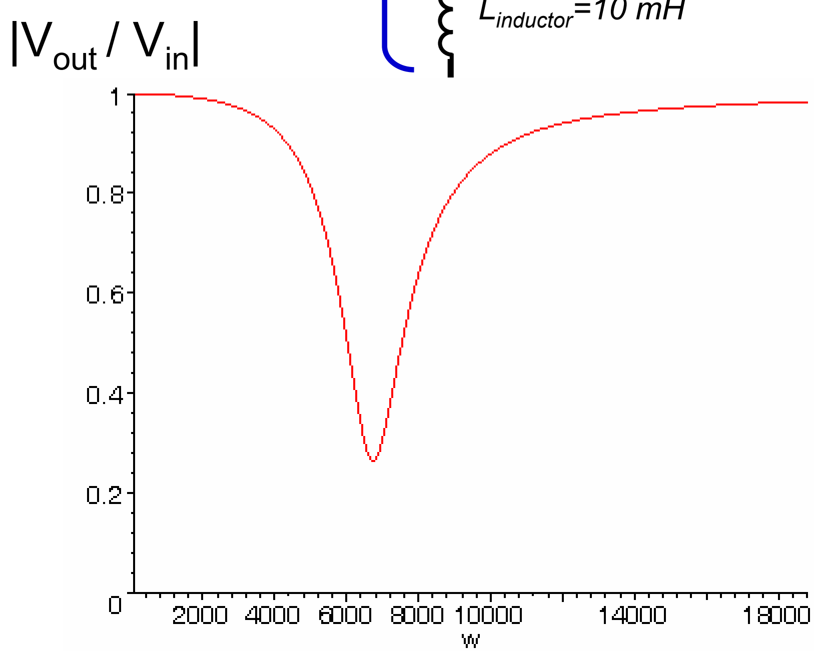
622S	47	13.7	65	16	27
622U	100	9.3	64	15	49
622W	220	6.4	60	13	122
622Y	470	4.3	54	10	218
622ZA	1000	2.9	45	8	400

RLC notch filter
Ideal L vs. Real L



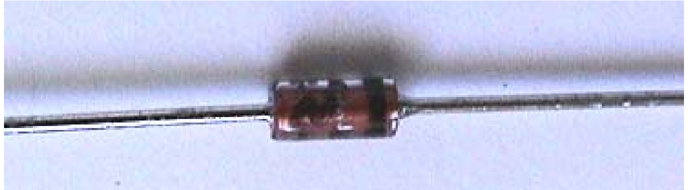






Diodes

a non-linear circuit element



- 2-terminal **quantum** device
- ***A diode only conducts in one direction !!!***
- **Non-linear** → ***Ohm's Law*** doesn't apply !

  → There is no Z_{diode} !

  → ***Thevenin's theorem*** doesn't apply !

- **Calculus:** you can linearize a function/system in the vicinity of some V0 or I0.

  → ***Ohm's law***, Z_{diode}, and ***Thevenin's theorem*** can only be used locally around some value of V0 and I0.

  → i.e. you can still write down a differential equation for your circuit.

Intro to Semiconductors

- Semiconductors have a modest resistivity:

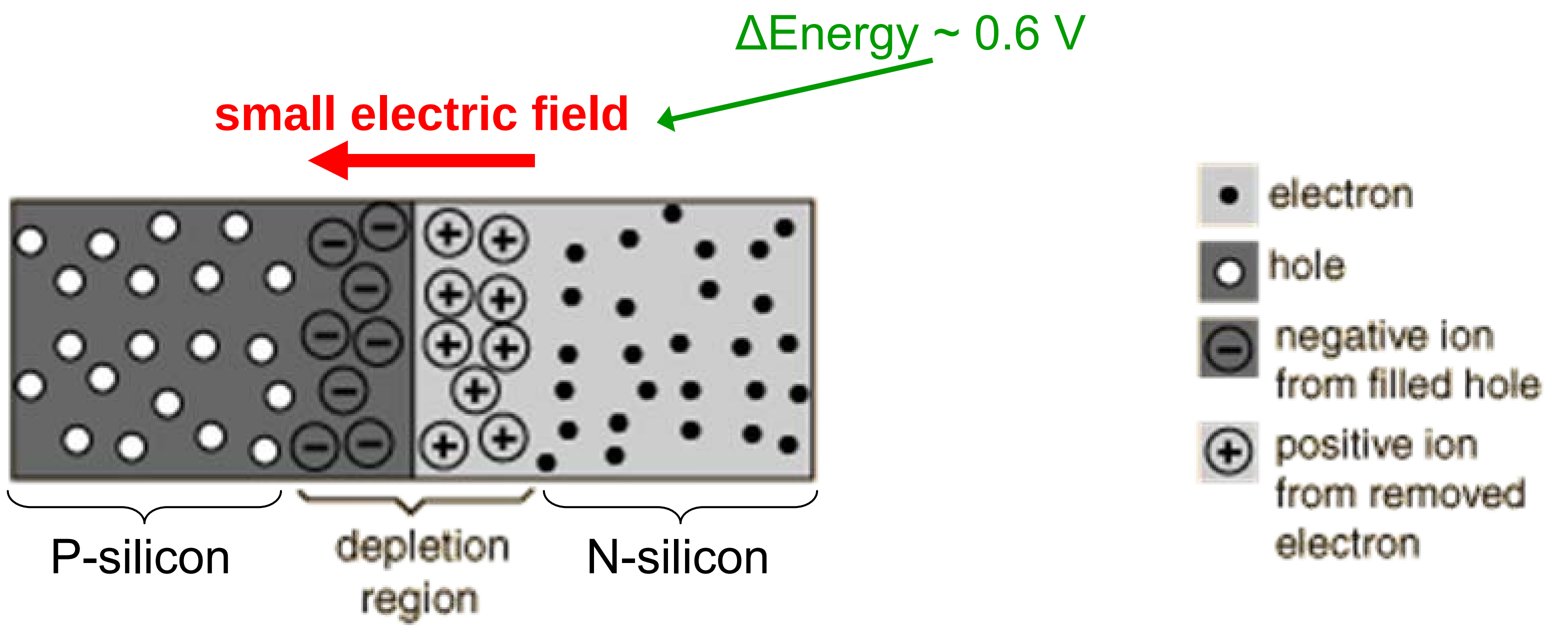
Material	Resistivity
Copper	1.70x10-8 Ω.m
Silicon	6400 Ω.m
Rubber	~10^{13} Ω.m

- Normally we think of electrons moving in a circuit

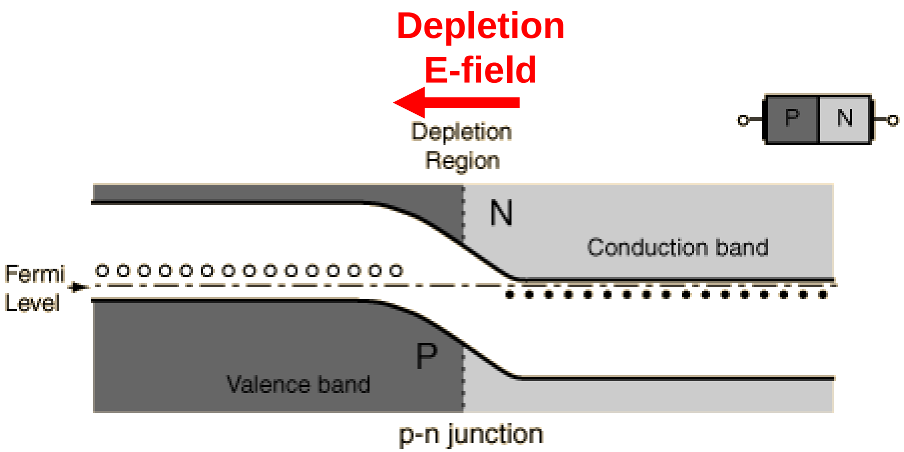
- In a semiconductor things are a little different
  → We think of either holes or electrons.
    - Holes (+ charge)
    - Electrons (- charge)

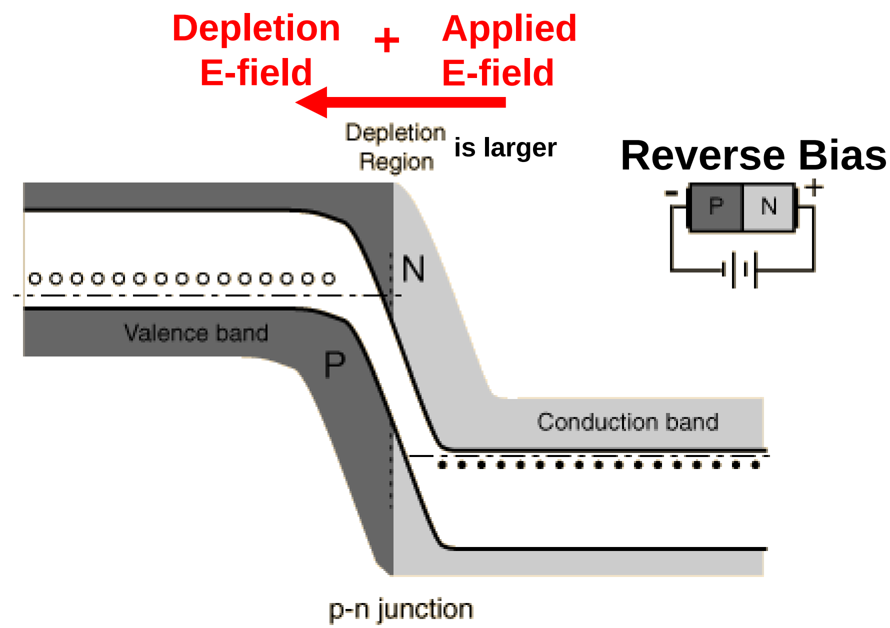
The PN junction

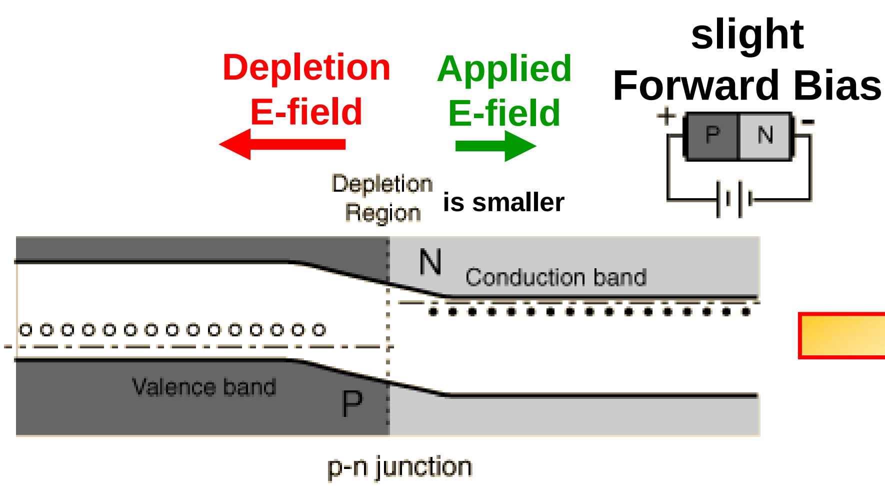
- Made from differently doped silicon
  - → N region has more electrons
  - → P region had more holes
- At the **PN junction** the holes & electrons recombine to form small insulating **depletion region**.

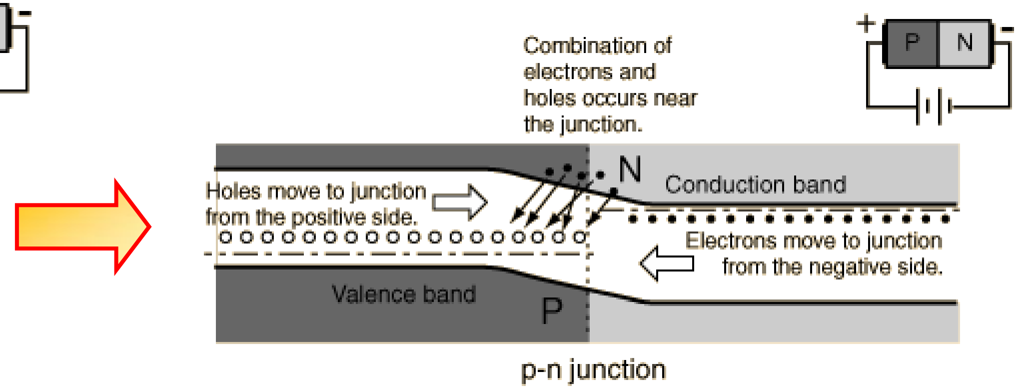


How a diode works

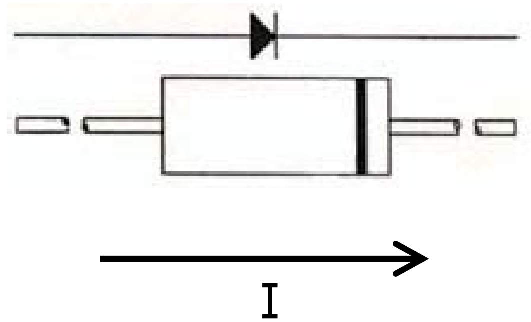


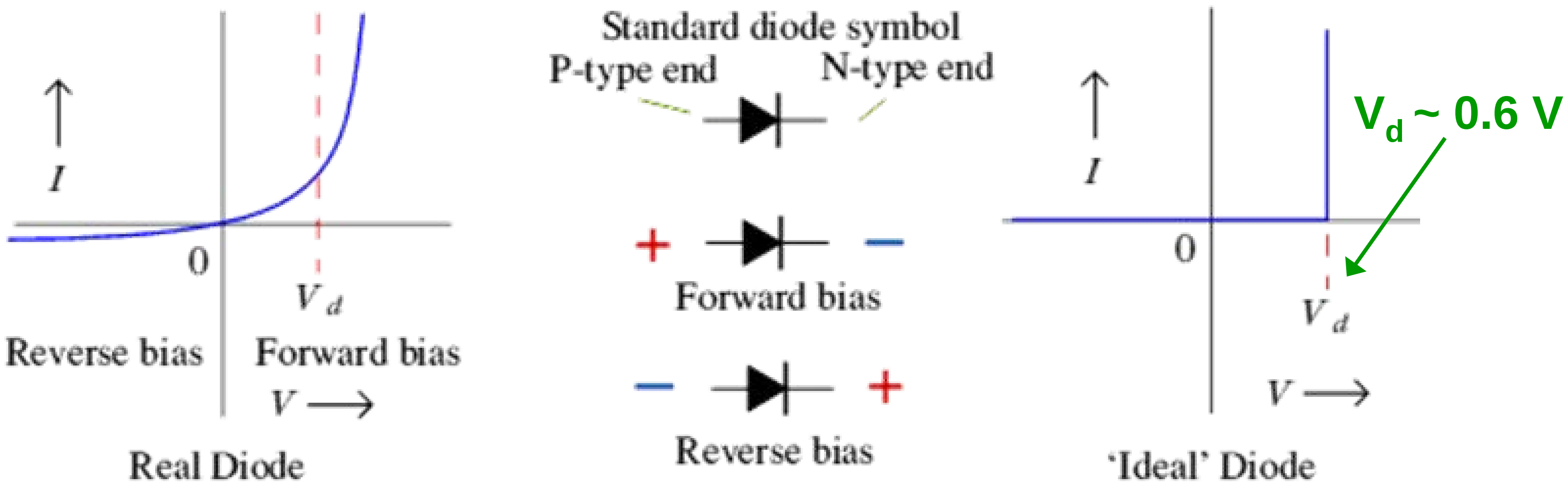






Diode: I-V characteristic curve I

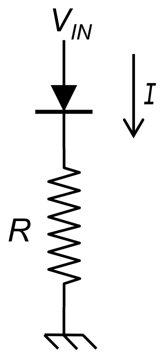




[image from *www.mtmi.vu.lt*]

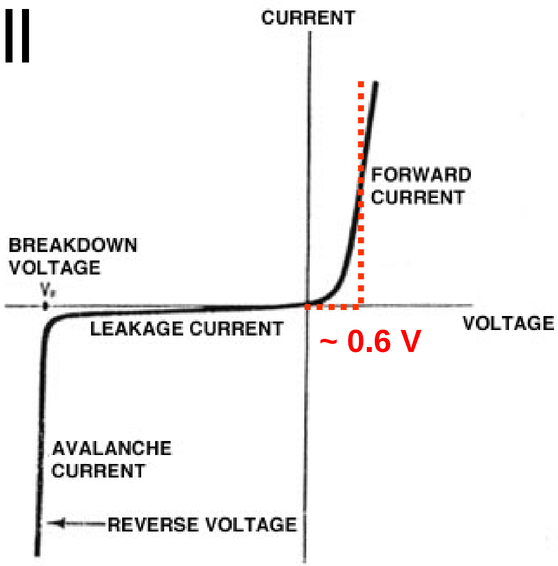
Diode: I-V characteristic curve II

- Simple model
  - → Current can only flow one direction
  - → A 0.6V "diode drop" when conducting
  - → $IR = V_{IN} - 0.6$ V
  - → Useful for designing circuits.



Current only flows in the direction of the arrow.

- More complete model: Ebers-Moll equation.
  - → Not so useful for designing circuits.



- A little negative is OK

  A lot is "bad" – smoke!!!!

Diode Spec Sheet

FAIRCHILD SEMICONDUCTOR®

January 2007

1N/FDLL 914/A/B / 916/A/B / 4148 / 4448
Small Signal Diode

DO-35
Cathode is denoted with a black band

LL-34
THE PLACEMENT OF THE EXPANSION GAP HAS NO RELATIONSHIP TO THE LOCATION OF THE CATHODE TERMINAL

LL-34 COLOR BAND MARKING

DEVICE	1ST BAND	2ND BAND
FDLL914	BLACK	BROWN
FDLL914A	BLACK	GRAY
FDLL914B	BROWN	BLACK
FDLL916	BLACK	RED
FDLL916A	BLACK	WHITE
FDLL916B	BROWN	BROWN
FDLL4148	BLACK	BROWN
FDLL4448	BROWN	BLACK

-1st band denotes cathode terminal and has wider width

1N/FDLL 914/A/B / 916/A/B / 4148 / 4448 Small Signal Diode

Absolute Maximum Ratings* T_a=25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{RRM}	Maximum Repetitive Reverse Voltage	100	V
I_O	Average Rectified Forward Current	200	mA
I_F	DC Forward Current	300	mA
I_f	Recurrent Peak Forward Current	400	mA
I_{FSM}	Non-repetitive Peak Forward Surge Current Pulse Width = 1.0 second Pulse Width = 1.0 microsecond	 1.0 4.0	 A A
T_{STG}	Storage Temperature Range	-65 to +200	°C
T_J	Operating Junction Temperature	175	°C

* These ratings are limiting values above which the serviceability of the diode may be impaired.

NOTES:
1) These ratings are based on a maximum junction temperature of 200 degrees C.
2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

Thermal Characteristics

Symbol	Parameter	Max. 1N/FDLL 914/A/B / 4148 / 4448	Units
P_D	Power Dissipation	500	mW
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	300	°C/W

Diode Spec Sheet

Electrical Characteristics* T_A=25°C unless otherwise noted

Symbol	Parameter		Test Conditions	Min.	Max.	Units
V_R	Breakdown Voltage		I_R = 100µA	100		V
			I_R = 5.0µA	75		V
V_F	Forward Voltage	1N914B/4448	I_F = 5.0mA	620	720	mV
		1N916B	I_F = 5.0mA	630	730	mV
		1N914/916/4148	I_F = 10mA		1.0	V
		1N914A/916A	I_F = 20mA		1.0	V
		1N916B	I_F = 20mA		1.0	V
		1N914B/4448	I_F = 100mA		1.0	V
I_R	Reverse Leakage		V_R = 20V		25	nA
			V_R = 20V, T_A = 150°C		50	µA
			V_R = 75V		5.0	µA
C_T	Total Capacitance					
	1N916A/B/4448		V_R = 0, f = 1.0MHz		2.0	pF
	1N914A/B/4148		V_R = 0, f = 1.0MHz		4.0	pF
t_{rr}	Reverse Recovery Time		I_F = 10mA, V_R = 6.0V (600mA)		4.0	ns
			I_{rr} = 1.0mA, R_L = 100Ω			

* Non-recurrent square wave PW = 8.3ms

Typical Characteristics

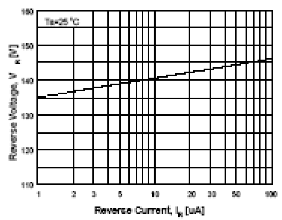
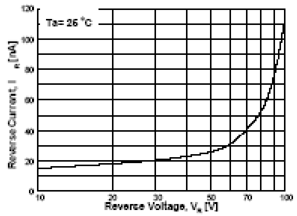


Figure 1. Reverse Voltage vs Reverse Current
BV - 1.0 to 100µA



GENERAL RULE: The Reverse Current of a diode will approximately double for every ten (10) Degree C increase in Temperature

Figure 2. Reverse Current vs Reverse Voltage
IR - 10 to 100V

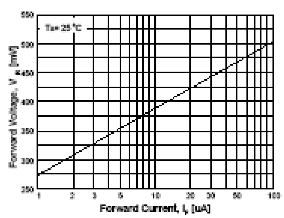


Figure 3. Forward Voltage vs Forward Current
VF - 1 to 100µA

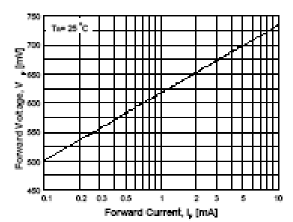


Figure 4. Forward Voltage vs Forward Current
VF - 0.1 to 10mA

Diode Spec Sheet

Typical Characteristics (Continued)

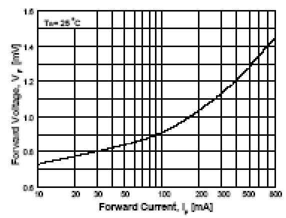


Figure 5. Forward Voltage vs Forward Current
VF - 10 to 800mA

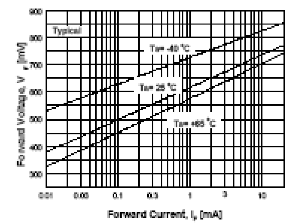


Figure 6. Forward Voltage vs Ambient Temperature
VF - 0.01 - 20 mA (- 40 to +65°C)

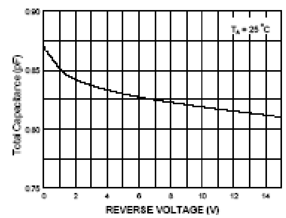
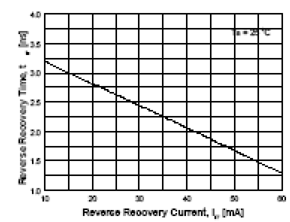


Figure 7. Total Capacitance



IF = 10mA, IRR = 1.0 mA, Rloop = 100 Ohms
Figure 8. Reverse Recovery Time vs
Reverse Recovery Current

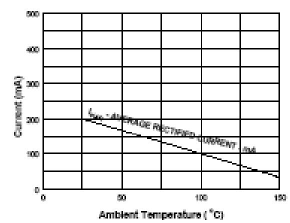


Figure 9. Average Rectified Current ($I_{F(AV)}$)
vs Ambient Temperature (T_A)

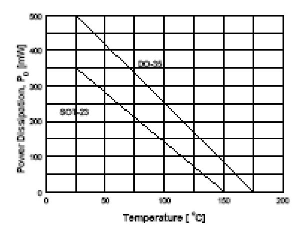


Figure 10. Power Derating Curve

Diode Spec Sheet

FAIRCHILD SEMICONDUCTOR®

1N/FDLL 914/A/B / 916/A/B / 4148 / 4448 Small Signal Diode

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SuperSOT™-6
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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

Rev. I22

Applications

- Circuit Protection
- Rectification
  - → half wave rectifier
  - → full wave rectifier
  - → Power Supplies
- Frequency manipulation
  - → Frequency multiplier
  - → Mixers

Fourier Transform (FFT) of Full Wave Rectifier