ECE 2300

Electronics Circuits
and
Electronics Devices Laboratory

Gregg Chapman

Laboratory 6

Diodes

Background

- Diodes
  - Small Signal
  - Rectifiers
    - Half wave
    - Full Wave
  - Zener Diodes
  - Light Emitting Diodes (LED)

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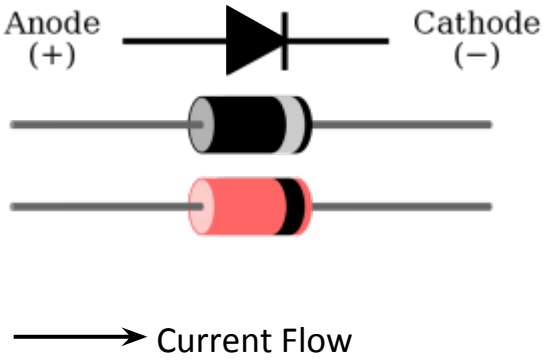
Diodes



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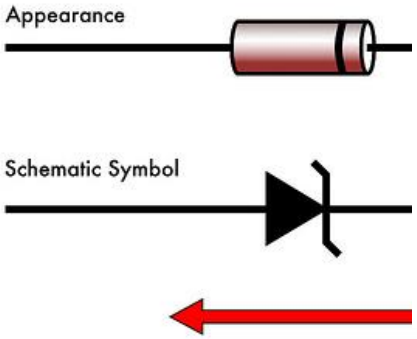
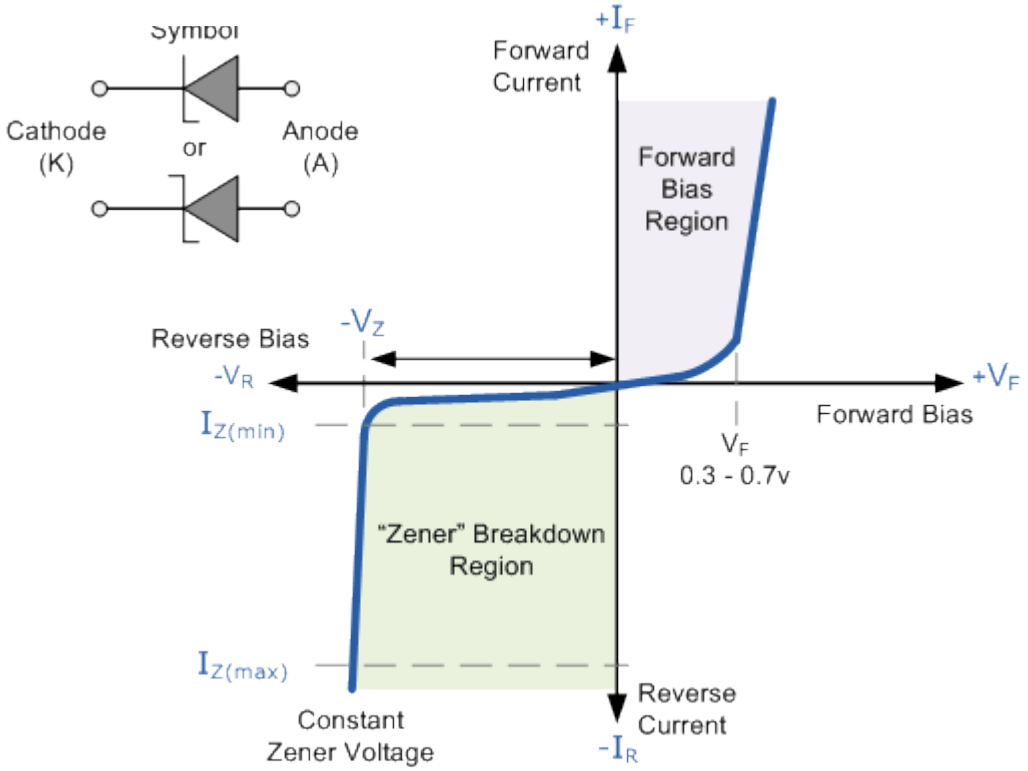
Zener Diodes



Backwards current flow too, but only past the "zener" breakdown voltage



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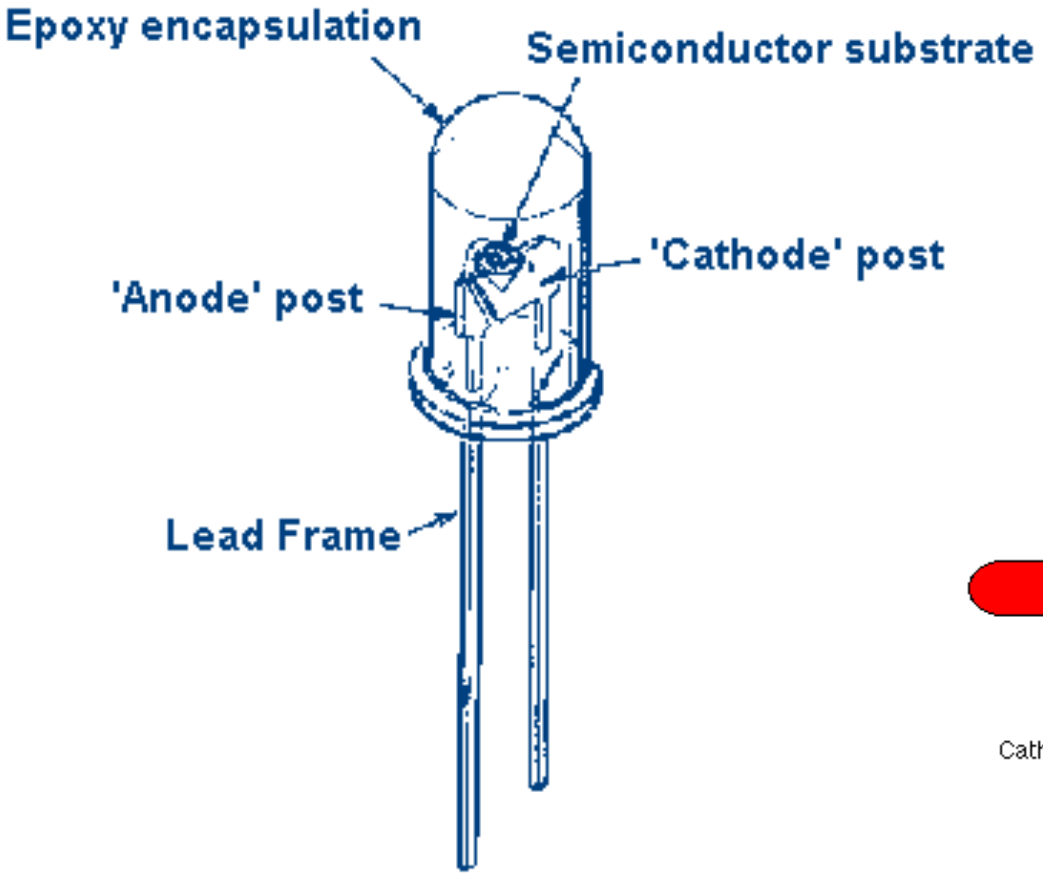
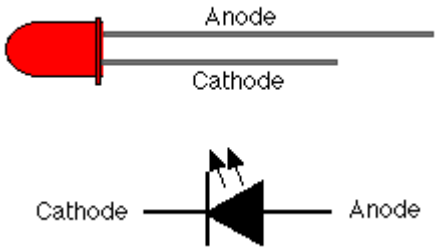
Light Emitting Diodes





$$V_F = 2.2\ V$$

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Lab Supplies

- Resistors

1	150 Ohm
1	1.00 Kohm
1	4.99 KOhm
1	10.0 Kohm

- Diodes

1	1N4001-T
4	1N4148G
2	1N5231BTR
1	WP3A8GD (Green LED)

- Transformer (From Lab Monitors)

1	PE-5156XNL

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Lab Supplies

- Breadboard
- Oscilloscope
- Function Generator
- Power Supply
- BNC-to-Mini-grabber (2)
- BNC Cable
- BNC T-Adapter
- Banana to Mini-grabber, black (3)
- Banana to Mini-grabber, red (3)

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Cabling

Screencast: 4:06

Test Set-up

- BNC T-Adapter on output of Function Generator
- BNC cable from T-Adapter to Channel 1 of the Oscilloscope
- BNC to Mini-clip from T-Adapter to the input
- BNC to Mini-clip from Channel 2 of the Oscilloscope to the output

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Circuits

1. Half Wave Rectifiers (positive)
2. Half Wave Rectifier (negative)
3. Full Wave Rectifier
4. LED
5. Zener Diode
6. Zener Clipping Circuit

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Function Generator Setup 1a

- Sine Wave
- Begin with 5V peak-to-peak amplitude
- Offset should remain at 0V
- Begin with 100 Hz

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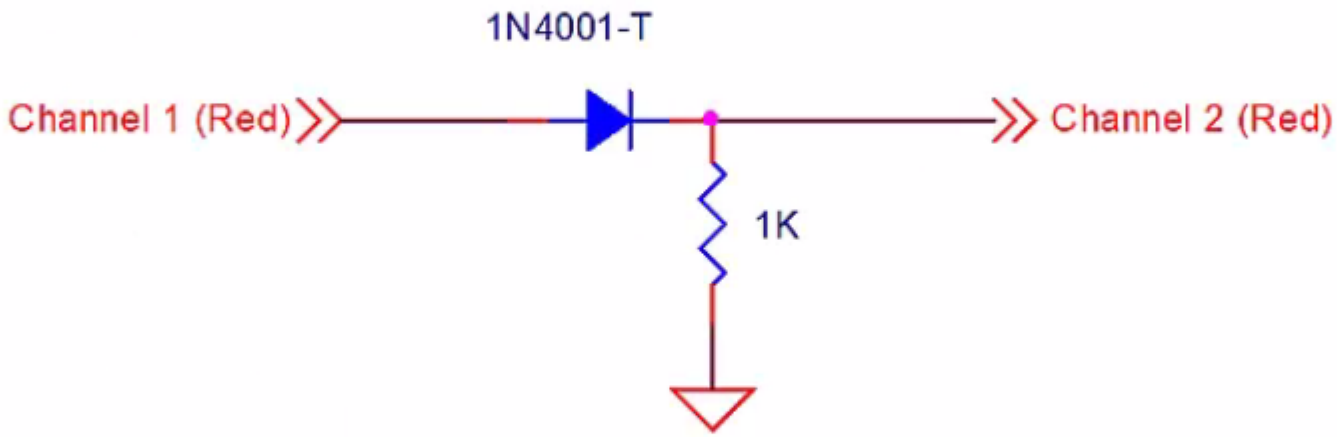
Half Wave Rectifier 1a



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Function Generator Setup 1b & 2

- Sine Wave
- Begin with 5V peak-to-peak amplitude
- Offset should remain at 0V
- Change frequency to 100 Kilohertz

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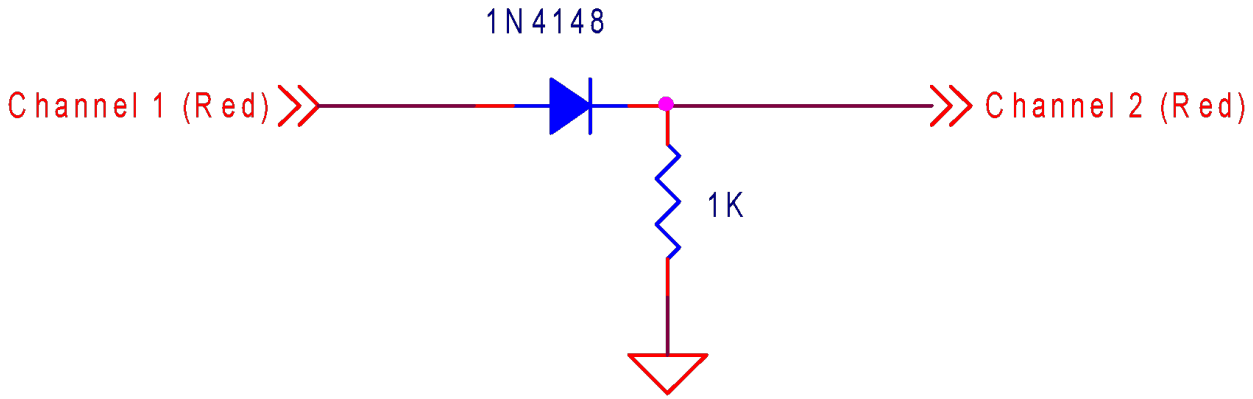
Half Wave Rectifier 1b



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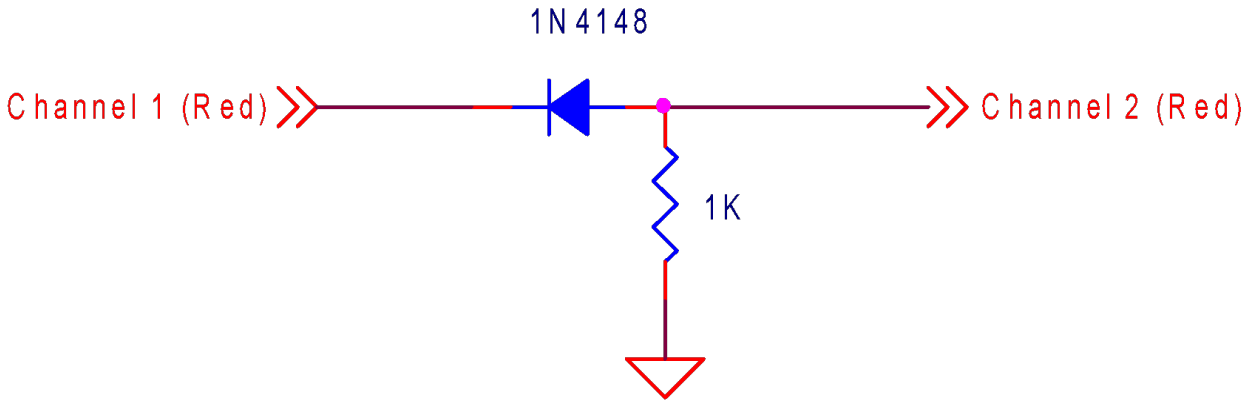
Half Wave Rectifier 2



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Measurements

- Circuits 1a ,1b and 2 (Half wave rectifiers):
  - Peak voltages (input, output and difference) at specified frequencies (100 HZ or 100 KHz. See table)

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Function Generator Setup 3

- Sine Wave
- Begin with 5V peak-to-peak amplitude
- Offset should remain at 0V
- Change frequency to 10 Kilohertz

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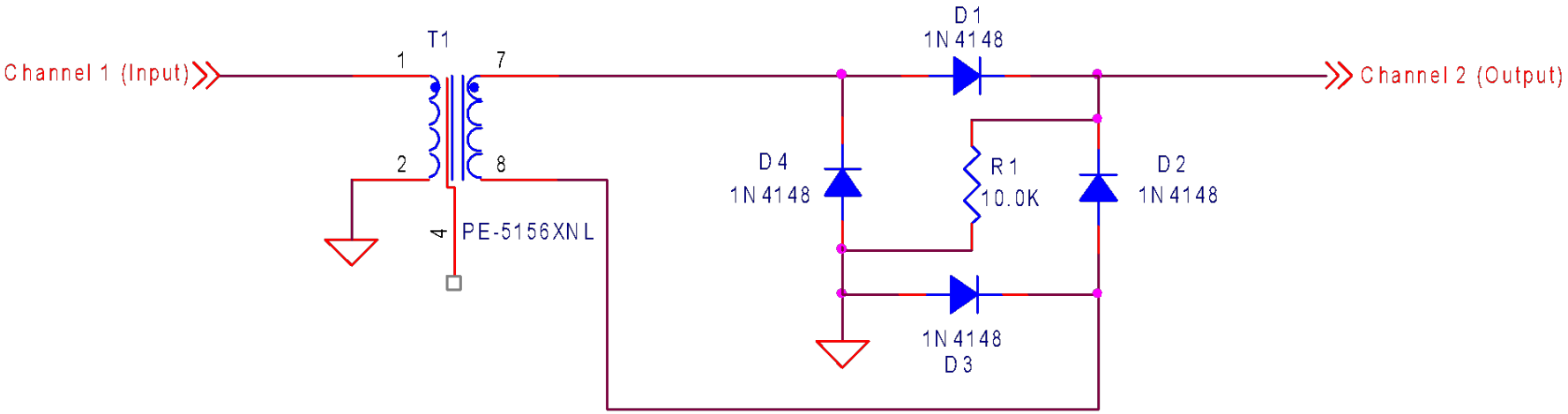
Full Wave Rectifier



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Measurements

- Circuits 1a ,1b and 2 (Half wave rectifiers):
  - Peak voltages (input, output and difference) at specified frequencies (100 HZ or 5 KHz. See table)

- Circuit 3 (Full Wave Rectifier)
  - Peak voltages (input, output and difference) at 10 KHz
  - Ripple voltage with 0.1 uF capacitor in parallel with 10 Kohm Resistor

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Test Set-up

- +12V from Power Supply (+ output of dual section)
- Ground from Power supply (Black connector of dual section)
- Digital Multi-meter

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Rigol DP1308A
Triple Power Supply

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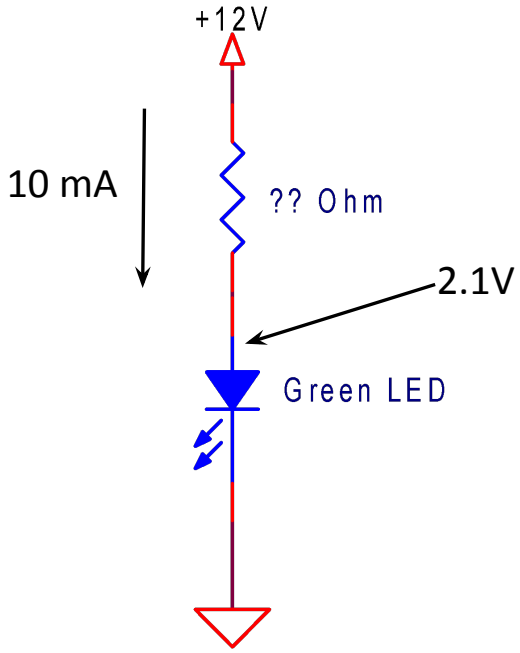
LED Circuit



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Calculations

- Circuit 4 (LED)
  - Calculate resistor required for 10mA in the LED. Assume 2.1V for voltage drop across LED. (Use closest resistor value available in kit for circuit).

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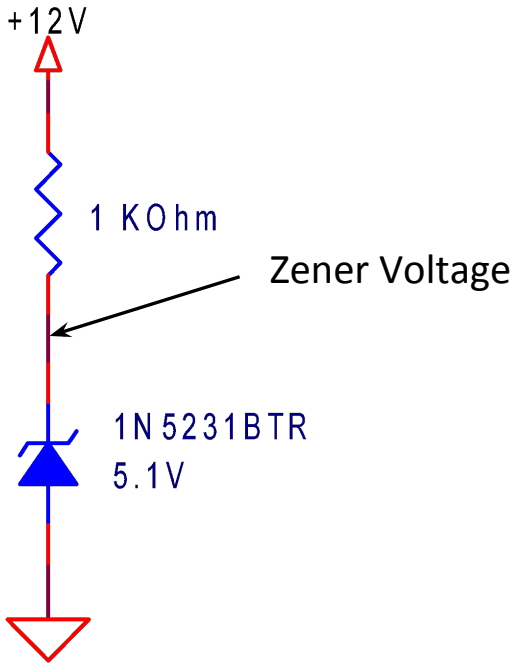
Zener Diode



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Measurements

- Circuits 1a ,1b and 2 (Half wave rectifiers):
  - Peak voltages (input, output and difference) at specified frequencies (100 HZ or 5 KHz. See table)

- Circuit 3 (Full Wave Rectifier)
  - Peak voltages (input, output and difference) at 10 KHz
  - Ripple voltage with 0.1 uF capacitor in parallel with 10 Kohm Resistor

- Circuit 4 (LED)
  - Measure current through LED

- Circuit 5 (Zener diode)
  - Measure current and voltage across Zener for resistor values of 150, 1.00K and 4.99 K Ohms.

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Function Generator Setup 6

- Sine Wave
- 20V peak-to-peak amplitude
- 1000 Hz

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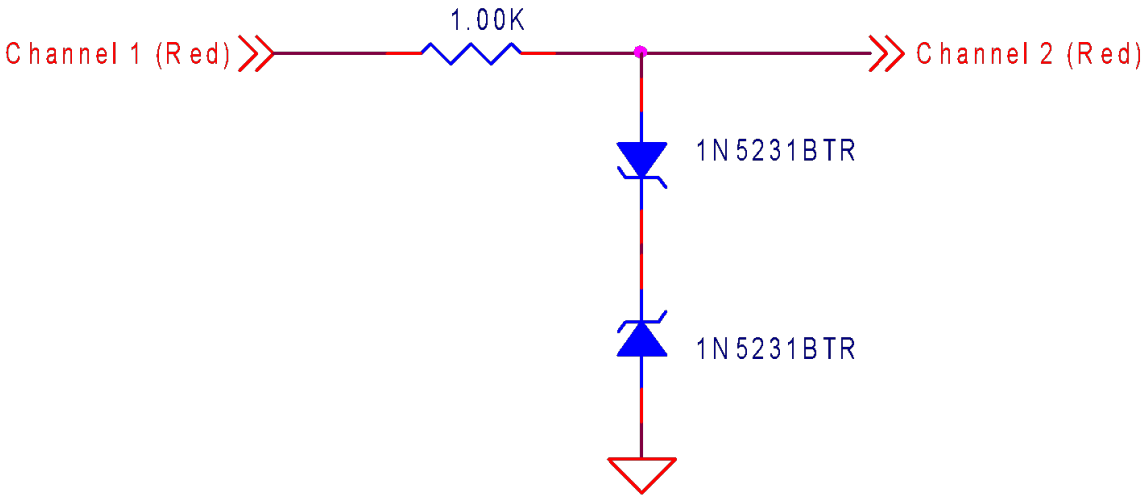
Zener Input Clipping



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Measurements

- Circuits 1a ,1b and 2 (Half wave rectifiers):
  - Peak voltages (input, output and difference) at specified frequencies (100 HZ or 5 KHz. See table)

- Circuit 3 (Full Wave Rectifier)
  - Peak voltages (input, output and difference) at 10 KHz
  - Ripple voltage with 0.1 uF capacitor in parallel with 10 Kohm Resistor

- Circuit 4 (LED)
  - Measure current through LED

- Circuit 5 (Zener diode)
  - Measure current and voltage across Zener for resistor values of 150, 1.00K and 4.99 K Ohms.

- Circuit 6 (Zener clipping circuit)
  - Measure maximum positive voltage and minimum negative voltage.

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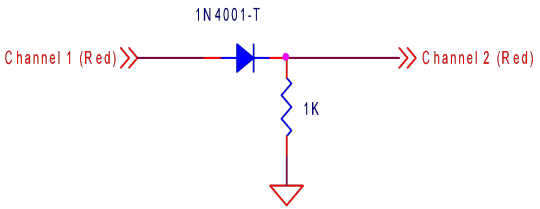
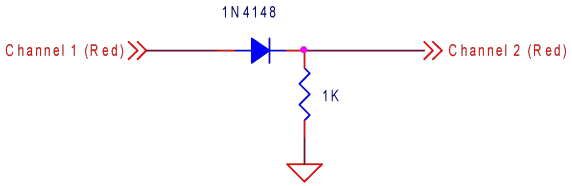
Lab 6 Circuit Schematics

1a



1b



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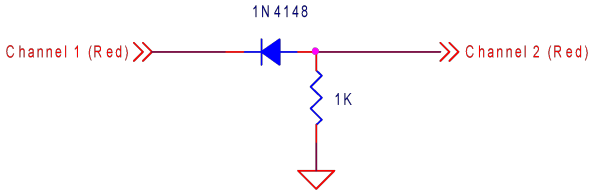

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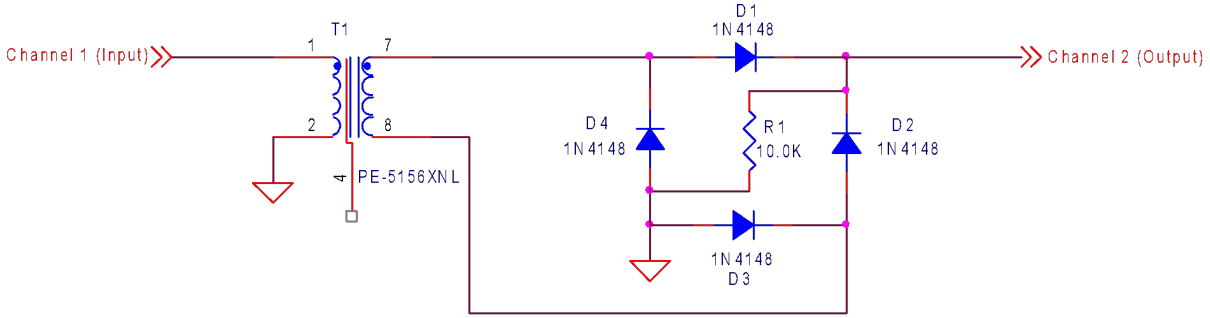

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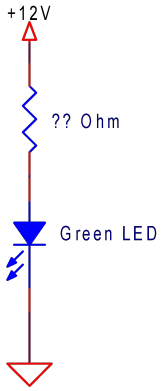

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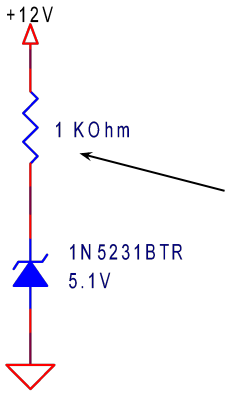
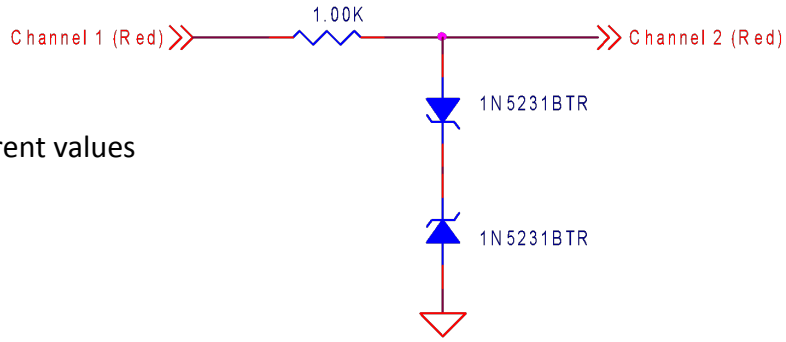


Three different values

6



Lab 6 Results

Rectifiers

Circuit	Test Frequency	Peak Voltage In	Peak Voltage Out	Voltage Difference
Half Wave Rectifier 1a	100 Hz			
Half Wave Rectifier 1b	10 KHz			
Half Wave Rectifier 2	10 KHz			
Full Wave Rectifier	10 KHz			

Circuit	Ripple (milliVolts)
Full Wave Rectifier with 0.1 uF Capacitor	

Zener Diode Results

Resistor Value	Measured Current	Zener Voltage
150 Ohm		
1.00 KOhms		
4.99 KOhms		

Zener Clipping Results

Saturation Voltage	Volts
Positive	
Negative	

LED Circuit

Calculated Resistor (Ohms)	Current (mA)