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PRACTICE N°3

“Zener diode and regulators of voltage”

Date

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# INTRODUCTION

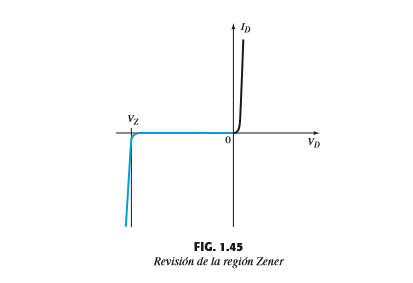
In this paper, we show the theoretical, practical and simulated results obtained from the practice done. These are shown in the tables, and analyzed in the conclusions.

'Zener diode and voltage regulators' gave us an overview of the structure and function of the different types of voltage regulators, such as voltage regulators fixed and variable, both positive and negative.

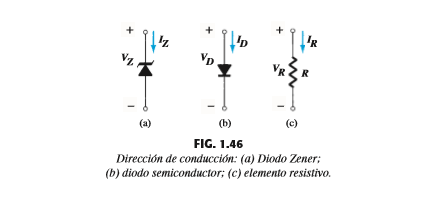
# THEORICAL FRAMEWORK

Zener diodes

The Zener region in Figure 1.45 was analyzed with detail in section 1.6. The feature falls almost vertically with a potential bias in reverse denoted VZ. The fact that the curve falls away and the horizontal axis instead of rising and away in the region of positive VD, reveals that the current in the zener region has an opposite of a diode polarized in the forward direction. The slight slope of the curve in the Zener region reveals that there is a level of resistance that has to be associated with the Zener diode conduction mode.



This unique characteristics region used in the design of zener diodes, whose graphic symbol is shown in Figure 1.46a. The semiconductor diode and the Zener diode are presented one by side in figure 1.46 to ensure that the driving direction of each clearly understood along with the required polarity of the applied voltage. In the case of semiconductor diode the "on" state it’ll support a current in the direction of the arrow symbol. For the Zener diode driving direction is opposite to the arrow symbol, as noted in the introduction to this section. Note also that the polarity of VD and VZ is the same as would be obtained if each were a resistive element as shown in Figure 1.46c.



Voltage Regulators

A voltage regulator provides a constant voltage output that is essentially independent of the input voltage, the output load current and temperature. The voltage regulator is part of a power supply; its input voltage comes from the filtered output of a rectifier produced by an AC voltage or a battery, in the case of portable systems. Most voltage regulators fall into two broad categories: regular linear and switching regulators. In the category of linear regulator, two general types are the series regulator and the regulator in parallel. These are normally available for positive or negative voltage output. A double regulator provides both positive and negative outputs. In the category of switching regulator, three general configurations are the gearbox, the truck and the investment. There are many types of integrated regulators available. The most popular types are fixed voltage regulator and three-terminal adjustable voltage regulator three terminals. Switching regulators are also widely used. This chapter devices are presented in specific integrated as representative of the wide variety of devices available circuit.  
Two basic categories of voltage regulation are line regulation and load regulation. The purpose of line regulation is to maintain a constant output voltage almost when the input varies. The purpose of the charge control is to maintain a voltage.

Principio del formulario

# OBJETIVE

* To analyze the voltage of break of a zener diode
* To analyze the principal circuits with Zener diode
* To help and to analyze the different integrated circuits that are used as regular sources of voltage
* To help and to analyze the types of sources: hinges and variables

# Materials

* 1 Slat of experimentation (protoboard)
* 2 Zener diode of 3.3V 1/2W
* 2 Zener diode of 5.1V 1/2W
* 2 Zener diode of 9.0V 1/2W
* 2 Resistance of 27 Ώ to 2W
* 2 Resistance of 27 Ώ to 2W
* 2 Resistance of 27 Ώ to 2W
* 2 Resistance of 27 Ώ to 2W
* 2 Resistance of 27 Ώ to 2W
* 4 Resistance of 27 Ώ to ¼ W
* 2 Resistance of 27 Ώ ¼ W
* 2 Potentiometer of Ώ 10Kohms
* 2 Resistance of 100 ohms to 10W
* 4 Capacitors of 0.1 f a 50 V
* 1 Regulator LM7805
* 1 Regulator LM7812
* 1 Regulator LM7905
* 1 Regulator LM7912
* 1 Regulator LM317
* 1 Regulator LM337

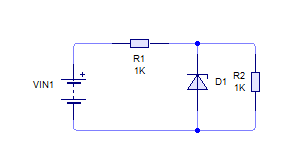
# Equipment

* 2 Digital multimeters
* 2 Games of tops of multimeter
* 1 Feeding source
* 4 Tops banana – cayman
* 4 Tops banana - cayman

# Development

## Circuits of operation of the zener

To arm the following circuit for each of the diodes

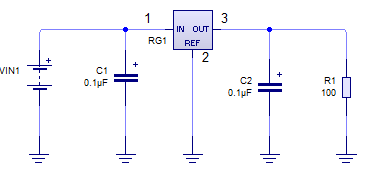


* For the Zener diode of 3.3 V to use a resistance of 83 Ώ in RLim and a resistance of 33 in Rl, changes the voltage of the source like it shows in the table and measure the voltage in the resistance Rl and annotate it in the table
* For the Zener diode of 5.1 V to use a resistance of 56 Ώ in RLim and a resistance of 49 in Rl, changes the voltage of the source like it shows in the table and measure the voltage in the resistance Rl and annotate it in the table
* For the Zener diode of 9.0 V to use a resistance of 27 Ώ in RLim and a resistance of 82 in Rl, changes the voltage of the source like it shows in the table and measure the voltage in the resistance Rl and annotate it in the table

|  |  |  |  |
| --- | --- | --- | --- |
| Voltaje de la Fuente V (V) | Voltaje de la Resistencia Ro | | |
| 3.3 | 5.1 | 9.0 |
| 3 | 0.86 | 0.86 | 0.86 |
| 4 | 1.15 | 1.15 | 1.15 |
| 5 | 1.43 | 1.43 | 1.43 |
| 6 | 1.72 | 1.72 | 1.72 |
| 7 | 2.01 | 2.01 | 2.01 |
| 8 | 2.3 | 2.3 | 2.3 |
| 9 | 2.58 | 2.58 | 2.58 |
| 10 | 2.87 | 2.87 | 2.87 |
| 11 | 3.15 | 3.16 | 3.16 |
| 12 | 3.27 | 3.44 | 3.44 |
| 13 | 3.34 | 3.73 | 3.73 |
| 14 | 3.4 | 4.02 | 4.02 |
| 15 | 3.46 | 4.3 | 4.3 |

## Regulator of fixed positive voltage

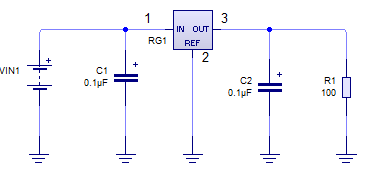
Arm the following circuit and change the voltage of the feeding source with each of the regulators of voltage



|  |  |  |
| --- | --- | --- |
| Voltaje en la Fuente  Vin (Vo) | Voltaje en la resistencia RL | |
| LM7805 | LM7812 |
| 3 | 1.72 | 1.72 |
| 4 | 2.7 | 2.7 |
| 5 | 3.69 | 3.69 |
| 6 | 4.67 | 4.67 |
| 7 | 5 | 5.66 |
| 8 | 5 | 6.65 |
| 9 | 5 | 7.64 |
| 10 | 5 | 8.64 |
| 11 | 5 | 9.63 |
| 12 | 5 | 10.6 |
| 13 | 5 | 11.6 |
| 14 | 5 | 12 |
| 15 | 5 | 12 |
| 16 | 5 | 12 |

## Regulator of fixed negative voltage

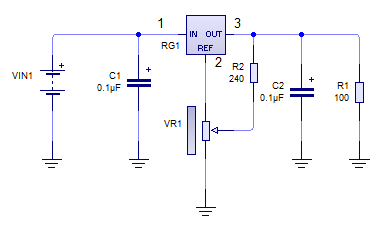
Arm the following circuit and several the voltage of the feeding source with each of the regulators of voltage



|  |  |  |
| --- | --- | --- |
| Voltaje de la fuente  Vin (Vo) | Voltaje de la resistencia RL | |
| LM7905 | LM7912 |
| 3 | -2.23 | -2.23 |
| 4 | -3.21 | -3.21 |
| 5 | -4.2 | -4.2 |
| 6 | -5.02 | -5.19 |
| 7 | -5.02 | -6.17 |
| 8 | -5.02 | -7.16 |
| 9 | -5.02 | -8.15 |
| 10 | -5.02 | -9.14 |
| 11 | -5.02 | -10.1 |
| 12 | -5.02 | -11.1 |
| 13 | -5.02 | -12 |
| 14 | -5.02 | -12 |
| 15 | -5.02 | -12 |
| 16 | -5.02 | -12 |

## Regulator of variable positive voltage

Arm the following circuit

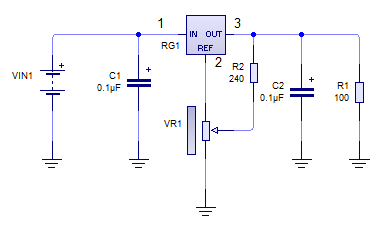


To change the dimmer R2 to obtain the positive minimal voltage of exit and maximum of the source

VoMAX= **18.3** & VoMIN= **1.26**

## Regulator of variable negative voltage

Arm the following circuit



Now to change the dimmer R2 to obtain the minimal and maximum voltage of negative exit of the source

VoMAX= **18.8** y VoMIN= **1.26**

# Questionnaire

1. **Mention which is the principal functioning of a Zener diode.**

His principal functioning is being a voltage regulator, due his functioning in inverse polarization, when the input voltage reaches the voltage from the Zener diode, the voltage or tension will be constant and that’s because the zener diode works in the rupture zone.

1. **What happen with a Zener diode if the source voltage is less than his voltage?**

The Zener diode doesn’t conduct any current.

1. **What is the finality of a voltage regulator?**

Keep a constant output tension and stabilize the continuous current tension. This will permit have a constant tension independent of how much power exists in the input voltage.

1. **What out voltage has in a fixed voltage regulator of 5 volts if the input voltage is 5 volts?**

For what we see in the simulation and the practice, we can say that will have 1.72V.

1. **Why in the variable voltage regulator de minimum voltage is 1.2 volts?**

Due to the voltage of the barrier from the intern semiconductors that make the regulator.

# Simulations

Zener 3.3

../Downloads/Practica3/zener3.3.pdf

Zener 5.1

../Downloads/Practica3/zener5.1.pdf

Zener 9.0

../Downloads/Practica3/zener9.pdf

#### Regulator of fixed positive voltage

../Downloads/Practica3/lm7805.pdfLM7805

../Downloads/Practica3/lm7812.pdfLM7812

#### Regulator of fixed negative voltage

../Downloads/Practica3/lm7905.pdfLM7905

../Downloads/Practica3/lm7912.pdfLM7912

#### Regulator of variable positive voltage

../Downloads/Practica3/lm317.pdfLM317

../Downloads/Practica3/lm337.pdfLM337

# Conclusions

**Konishi Govantes Jorge Agustín**

The Zener diodes, they work like a voltage regulator due his functioning in inverse polarization. Also we could check the functioning of the voltage regulators and his relation with the functioning in inverse polarization of the Zener diode, inasmuch as bought regulate the voltage and need some voltage to regulate the input voltage.

In the case of the Zener diode is needed some voltage that can reach the Zener voltage and this works in his rupture zone, and in the case of the regulator voltage

**Luciano Espina Melisa**

On having observed the results, comparing them with the realized calculations, we can observe that they are a bit different, this I can say that it owes to the resistances or to the source, on having used the different regulators of voltage it was possible to observe that these were working correctly, since each of them was giving the voltage that was waited,

**Mena Ortiz Erick Jafet**

This practice gave us an overview of the zener diod, and it's functioning as voltage regulators. Thanks to the reverse current applied the Zener diod can work as fix or variable voltage regulator; turning ac into dc.

# Calculations

## ../Downloads/Practica3/zener3.3.pdfZener Diode – 3.3V

## ../Downloads/Practica3/zener5.1.pdfZener Diode – 5.1V

## Zener Diode – 9.0

../Downloads/Practica3/zener9.pdf