Zener diode characteristics experiment pdf

Projects V.I. Features of zener diode download Zener Diode Features.epb Objective Trace the VI characteristics of a Zener diode. Components Name EDWin Components used Description number of the necessary components RES RC05 Resistor 1 ZENER 1N3828 Zener Diode 1 VGEN SMB_VGEN Ac voltage source 1 Theory The circuit diagram to trace the VI characteristics of a zener diode is shown. Zener doide is a special diode with greater amount of doping. This is to compensate for the damage that occurs in the case of a pn junction diode when the reverse bias exceeds the breaking voltage and thus the current increases at a fast speed. The application of a positive potential to the anode and a negative potential to the conate of the zener diode establishes a condition of forward bias. The front characteristic of the zener diode is the same as that of a pn junction diode, that is, as the applied potential exponentially increases the current. The application of a negative potential to the anode and positive potential to the dew reverses the zener diode. As the reverse bias increases the current increases rapidly in a direction opposite to that of the positive stress region. Thus, under the breaking of the condition of reverse bias occurs. It occurs because there is an electrical fort filed in the junction region that can disrupt the binding forces within the atom and generate carriers. The tension depends on the amount of doping. For a heavily doped diode depletion layer it will be thin and the break will occur at low reverse voltage and the decomposition voltage is accentuated. Whereas a lightly doped diode has a higher breakdown voltage. This explains the characteristics of the zener diode in the reverse bias region. The maximum reverse bias potential that can be applied before entering the zener region is called the Inverse Peak Stress referred to as piv classification or the Peak Reverse Stress Rating (PRV classification). EDWin Procedure 2000 -> Schematic Editor: The circuit diagram is drawn by library loading components. Wiring and proper liquid assignment were made. The R resistor is assigned an appropriate value. For reverse bias, the anode and the caulde of the zener diode are exchanged. EDWin 2000 -> Mixed Mode Simulator: The circuit is pre-processed. Vi characteristics can be obtained by performing dc scan analysis. The current waveform marker is placed in the diode's caudy. The scan parameter (voltage) for input source is set in the Analysis window. The applied voltage is swept from an initial value of 0 to the final value of 1V in 1mV steps. To obtain VI characteristics, the currents corresponding to varied input voltages are noted. Graph VI is seen in Waveform Viewer. Result The output waveform can be observed in the waveform viewer. The Zener diode operates mainly in inverse biased conditions. We use Zener diodes for voltage regulation and stabilization of They provide a low cost and no-frills method for voltage regulation. The critical parameter of this of diodes is the zener collapse voltage. The zener break voltage is the minimum reverse bias voltage below which the diode blocks the reverse current through it and above which causes a significant amount of reverse bias current to flow through it. Once the reverse voltage reaches the zener breaking voltage, the voltage through the device remains constant at that level. So we can use zener diode for voltage regulation. The voltage versus current graph of a diode is called its characteristic. Below you can see the feature. Here Vz is the zener collapse voltage. Let's learn about an experiment to discover the zener breaking stress and draw the characteristics of the Zener diode. Why should we do this experiment? For the correct regulation of the voltage, we need to find out precisely what the voltage should be through the Zener diode. The zener fault voltage should be approximately close to the desired voltage we want. Therefore, we have to figure out the Zener voltage to use this diode properly in voltage regulation. For the experiment, we will follow the diagram of the circuit below. We need the following equipment:Zener diodeMilliammeterVoltmeterVariable DC supplyResisresistors We need to connect the circuit as given in the diagram above. The experiment is quite simple to perform. First, let's plot the curve in reverse bias mode. For this, we increased the tension of reverse bias slowly and in small steps. When you do this, keep looking at the amimeter reading and the voltmeter reading. There are two amometers here, one connected in series with the Zener diode and the other connected in series with the resistance of 3.3k Ω. Let's call the first as A1 and the second as A2. If you keep doing this, after a certain reverse bias voltage value, the current value at A1 will suddenly increase. Write down the voltmeter reading at this point. The voltmeter reading is the zener break voltage. Continue to further increase the tension of reverse bias. We will see that the voltage through the diode remains constant while the current through it continues to increase. Observe amometers and voltmeter readings at different reverse bias voltage values. Tabulate the current and voltage values. Do the same experiment by connecting the Zener diode to the front bias. Note the current and voltage reading. Your table should look like the one shown above. Fill in the values in the table. Then draw the chart corresponding to these values. You will have the characteristic curve of the Zener diode. Notice the value at which the current increases rapidly when in reverse bias mode. The voltage at this value is the zener breaking voltage. Write this voltage down separately. Different Zener diodes have a different decomposition voltage. We should select a Zener diode with a decomposition voltage approximately equal to the voltage we need throughout the device. Doing this experiment, discover the zener breaking voltage in a simple way. Simple. diodes are forward-biased and work in the front direction. They have a large front current flowing through them with an insignificant voltage drop through them. If we operate a common diode in reverse bias, it conducts negligible current until the voltage applied through them exceeds the reverse recomposition voltage. Once this happens, large current flows through the junction and the diode can be destroyed. The Zener diode is a particular type of diode that solves this problem. We operate a Zener diode in reverse biased conditions, and this diode is not damaged even when the voltage through it exceeds the reverse recomposition voltage. Let's learn about this kind of exciting and unique diode. Zener diodes are heavily doped than ordinary diodes. They have a region of extra fine exhaustion. When we apply a voltage more than the zener fault voltage (can range from 1.2 volts to 200 volts), the depletion region disappears, and large current begins to flow through the junction. There is a crucial difference between a common diode and a Zener diode. The exhaustion region regains its original position after removing the reverse voltage in the Zener diode, while in regular diodes, they do not, and are therefore destroyed. Here is the zener diode symbol Let's now look at the zener diode feature: A current graph through vs the voltage through the device is called the Zener diode feature. The first quadrant is the region of advanced bias. Here the Zener diode acts as a common diode. When a front voltage is applied, the current flows through it. But due to the higher concentration of doping, higher current flows through the Zener diode. In the third quadrant, magic happens. The graph shows the current vs. voltage curve when we apply a reverse bias to the diode. The zener decomposition voltage is the reverse bias voltage after which a significant amount of current begins to flow through the Zener diode. Here in the diagram, VZ refers to the zener break stress. Until the voltage reaches the zener breaking level, a small amount of current flows through the diode. Once the reverse bias voltage becomes more than the zener breaking voltage, a significant amount of current begins to flow through the diode due to Zener's breakage. The voltage remains at the zener break voltage value, but the current through the diode increases when the input voltage increases. Due to the unique property of the Zener diode, the exhaustion region regains its original position when the reverse voltage is removed. The Zener diode is not damaged despite this huge amount of current flowing through it. This unique functionality makes it very useful for many applications. As the voltage remains in the zener fault voltage, we use Zener diodes for voltage regulation. We use them in voltage stabilizers and various other protection circuits. We also use them in clipping and fixing circuit. They provide a low-cost solution for voltage regulation. Regulation. Regulation.