

zener diode as voltage regulator numericals calculate the total current, load current and zener current in the calendrierdelascience.com will these values be affected if source voltage be increased to 70v? given that source voltage 40 to 70 v, series resistance 3 kilo ohm zener voltage 50v and load resistance 2 kilo ohm.

Other diodes Zener diodes are used in many circuits in a variety of ways. The most common Zener diode circuit is one in which the Zener diode is used as a voltage reference element. This type of circuit uses the constant voltage as a reference in one of a variety of forms of power supply circuit. There are other Zener diode circuits and applications. They can be used to limit voltages, preventing surges from damaging electronics circuits. Simple Zener diode circuit for voltage regulator When used in a regulator circuit, the Zener diode must have the current entering it limited. If a perfect voltage source was placed across it, then it would draw excessive current once the breakdown voltage had been reached. To overcome this the Zener diode must be driven by a current source. This will limit the current to the chosen value. In a practical circuit, the simplest form of current source is a resistor. This will limit the current taken by the Zener diode and ensure that the operating position of the diode remain approximately constant. Simple circuit of a Zener diode shunt regulator The value of the series resistor is simple to calculate. It is simply the voltage across the resistor, divided by the current required. The level of Zener current can be chosen to suit the circuit and the Zener diode used. V_1 is the input voltage V_2 is the Zener diode voltage This form of regulator circuit is known as a shunt regulator, where the regulating element in the circuit is placed in parallel with the load. The voltage appearing across the load is controlled by the Zener diode allowing a portion of the current to flow through the Zener and bypass the load to maintain the voltage across it. Shunt regulators are normally seen as being very inefficient for large levels of power, but for low power levels they are very effective. The Zener diode can be used as a shunt regulator to produce a stable reference voltage, which can then be used by a series regulator to produce the required stable voltage output. This technique is effectively used in analogue regulated power supplies. Zener diode circuit for PSU with series transistor The very simple shunt regulator shown above is not particularly efficient and is not practicable for many higher current applications. The solution is to utilise a Zener diode circuit that uses a series pass transistor. A simple circuit is shown below and here the transistor is used as an emitter follower. Zener diode circuit for a simple regulated power supply When utilising this circuit, the current required from the Zener resistor potential divider should be calculated. This is the emitter current from the transistor divided by the gain. When choosing the Zener diode voltage, it should be remembered that the emitter voltage will be lower than the Zener voltage by the amount of the base-emitter voltage - 0. Zener diode circuit for overvoltage protection Another form of Zener diode circuit is an overvoltage protection circuit. While power supplies are normally reliable, the effects of the series pass transistor or FET can be catastrophic if it fails by forming a short circuit. In this case the full unregulated voltage would be placed onto the circuits using the regulated power. This could destroy all the chips being powered. One solution is to use a crowbar circuit. When this form of circuit detects an overvoltage situation it fires an SCR. This quickly holds down the output voltage and in the instance shown, it blows a fuse that disconnects the input source power. The Zener diode is chosen to have a voltage above the normal operating voltage - sufficient margin not to fire under normal operating conditions, but small enough to allow current to flow quickly when the fault condition is detected. Under normal operating conditions the output voltage is below the reverse voltage of the Zener diode and no current flows through it and the gate of the SCR is not fired. However, if the voltage rises above the allowed voltage, the Zener diode will start to conduct, the SCR will fire and the fuse will be blown. Circuit tips The Zener diode is a very flexible and useful circuit component. However, like any other electronics component, there are a few hints and tips which enable the best to be made of the Zener diode. A number are listed below. Choose correct voltage for best stability: In applications where stability with temperature changes is required, the Zener voltage reference diode should be chosen to have a voltage of around 5. The nearest preferred value is 5. Where different levels of voltage are required, the 5. Buffer the Zener diode circuit with an emitter or source follower: To keep the voltage from the

Zener diode as stable as possible, the current flowing through the Zener diode must be kept constant. Any variations in current drawn by the load must be minimised as these will change the current through the Zener diode and cause slight voltage variations. The changes caused by the load can be minimised by using an emitter follower stage to reduce the current taken from the Zener diode circuit and hence the variations it sees. This also has the advantage that smaller Zener diodes may be used. Drive with constant current source for best stability: Another way of improving the Zener stability is to use a good constant current source. A simple resistor is adequate for many applications, but a more effective current source can provide some improvements as the current can be maintained almost regardless of any variations in supply rail. Ensure sufficient current for reverse breakdown: It is necessary to ensure that sufficient current is passed through the diode to ensure that it remains in reverse breakdown. For a typical mW device a current of around 5 mA must be maintained. For exact values of minimum current, the datasheet for the particular device and voltage should be consulted. Ensure maximum limits of current are not exceeded for the Zener diode: While it is necessary to ensure sufficient current is passed through the Zener diode, the maximum limits must not be exceeded. This can be a bit of a balancing act in some circuits as variations in load current will cause the Zener diode current to vary. Care should be taken not to exceed the maximum current or the maximum power dissipation $Zener\ voltage \times Zener\ diode\ current$. If this appears to be a problem, an emitter follower circuit can be used to buffer the Zener diode and increase the current capability. When used to their best, Zener diodes can provide very high levels of performance. They often exceed the performance required, but in view of their ease of use and low cost, they provide a very effective option to use.

Chapter 2 : How to Build a Zener Diode Voltage Regulator

A Zener diode is a very useful device for regulating voltage. By connecting it in the right way in a circuit, it can act as a voltage regulator, to regulate how much voltage it feeds to a device. To connect a zener diode in a circuit to provide voltage regulation, the zener diode should be connected.

Notice the change of voltage scale between the forward biased positive direction and the reverse biased negative direction. Temperature coefficient of Zener voltage against nominal Zener voltage. A conventional solid-state diode allows significant current if it is reverse-biased above its reverse breakdown voltage. When the reverse bias breakdown voltage is exceeded, a conventional diode is subject to high current due to avalanche breakdown. Unless this current is limited by circuitry, the diode may be permanently damaged due to overheating. A Zener diode exhibits almost the same properties, except the device is specially designed so as to have a reduced breakdown voltage, the so-called Zener voltage. By contrast with the conventional device, a reverse-biased Zener diode exhibits a controlled breakdown and allows the current to keep the voltage across the Zener diode close to the Zener breakdown voltage. For example, a diode with a Zener breakdown voltage of 3. The Zener diode is therefore ideal for applications such as the generation of a reference voltage e . In silicon diodes up to about 5. Modern manufacturing techniques have produced devices with voltages lower than 5. The IV curve for Zeners above 5. At the atomic scale, this tunnelling corresponds to the transport of valence band electrons into the empty conduction band states; as a result of the reduced barrier between these bands and high electric fields that are induced due to the relatively high levels of doping on both sides. While tolerances within 0. Breakdown voltage for commonly available Zener diodes can vary widely from 1. For diodes that are lightly doped the breakdown is dominated by the avalanche effect rather than the Zener effect. Consequently, the breakdown voltage is higher over 5. The NPN transistor structure can be employed as a surface Zener diode, with collector and emitter connected together as its cathode and base region as anode. In this approach the base doping profile usually narrows towards the surface, creating a region with intensified electric field where the avalanche breakdown occurs. The hot carriers produced by acceleration in the intense field sometime shoot into the oxide layer above the junction and become trapped there. The same effect can be achieved by radiation damage. The emitter-base Zener diodes can handle only smaller currents as the energy is dissipated in the base depletion region which is very small. Partial damage of the junction can shift its Zener voltage. The hot carriers then lose energy by collisions with the semiconductor lattice before reaching the oxide layer and cannot be trapped there. The Zener walkout phenomenon therefore does not occur here, and the buried Zeners have voltage constant over their entire lifetime. Most buried Zeners have breakdown voltage of 5â€”7 volts. Several different junction structures are used.

Chapter 3 : Basics: Introduction to Zener Diodes | Evil Mad Scientist Laboratories

The fact that the voltage across the diode in the breakdown region is almost constant turns out to be an important application of the zener diode as a voltage regulator. Characteristics Figure 2 shows the current versus voltage curve for a Zener diode.

January 12, Zener diodes are a special type of semiconductor diode— devices that allow current to flow in one direction only —that also allow current to flow in the opposite direction, but only when exposed to enough voltage. Diodes usually come in glass or plastic cylindrical packages, marked with a stripe on one side to indicate polarity. In a perfectly ideal diode, current flows in one direction only, from the anode positive side to the cathode negative side which is marked with the stripe. The schematic symbol is a triangle pointing towards a bar, where the current flows in the same direction, towards the barred striped end. Surface mount versions of diodes tend to follow the same labeling convention, where the cathode end is marked with a broad stripe. If we hook up a diode in a simple circuit with a variable voltage source and a current-limiting resistor, we can measure the current I through the diode when a given voltage V is applied across it. For an ideal diode, no current at all passes when the voltage is less than zero: The amount of current that flows is actually exponential with increasing voltage. The threshold where an appreciable amount of current flows is typically around 0. Of course, no diode is truly ideal. In real diodes, when the voltage is reversed, a very small amount of current leakage may flow. And, more significantly, each diode is rated for a certain maximum amount of reverse voltage. For a regular diode, we would say that the diode has failed if it begins to conduct current in that direction. The actual physics of what happens at breakdown is quite interesting; two separate effects, the Zener effect and Avalanche breakdown both contribute to this behavior. The schematic symbol for a Zener diode is shown above— it is very similar to that of a regular diode, but with bent edges on the bar. The Zener still conducts electricity in the forward direction like any other diode, but also conducts in the reverse direction, if the voltage applied is reversed and larger than the Zener breakdown voltage. A typical application might be as above: A 10 V Zener diode type 1N is placed in series with a resistor and a fixed 12 V power supply. The resistor value is chosen such that several mA flow through it and through the Zener, keeping it in its breakdown region. In the circuit above, there is 10 V across the Zener diode, and 2 V across the resistor. With 2 V across a ohm resistor, the current through that resistor and the diode, in series is 5 mA. Zener voltage references The fixed voltage property of Zener diodes makes them extremely handy as quick voltage references. The basic circuit looks like this: There are a couple of requirements to consider. First, the input voltage has to be higher than the Zener voltage. Second, the resistor value must be chosen such that there is always current flowing through the Zener. This is not necessarily a good power supply for all purposes— the resistor limits how much current can be drawn. It is also not necessarily a precision voltage reference; the voltage will depend on the amount of current drawn. That is to say, for the voltage to be steady, the load driven by that reference voltage must be consistent. The voltage also depends upon the temperature. Zeners in the range V have the best temperature stability, and there are high-precision Zener diodes like the LM that include their own temperature-stabilized oven to further keep the diode temperature as steady as possible. Taking this idea a bit further, you can actually build a full multi-rail power supply using nothing more exotic than a set of Zener diodes to generate all the voltages that are needed, provided that the current requirements are modest on the different supply voltages. The circuit above is part of a working laboratory instrument. Limiting signals with Zener diodes A varying analog signal can be constrained to a fairly narrow range of voltages with a single Zener diode. If you wanted to constrain the signal to never go negative— e. Then, the output signal range would be constrained to the range of 0. Another neat trick is to use two Zener diodes, oppositely oriented, in series. This can provide a symmetric limit on the excursion of a signal from ground, for example. This is also a common configuration for using Zener diodes as transient suppressors. We have a TLL05, which is a type of 5 V output linear regulator, which can source up to mA output, and its load will be variable. We need to drive it from a 36 V source. Unfortunately, the maximum input voltage of the TLL05 is 26 V. Our output load can be as high as mA and as low as 10 mA. So, what value resistor will work for us?

Suppose that we assume mA load. In order to be safe for the 10 mA load, we should pick a resistor that gives us at least an 11 V drop, for 25 V input to the regulator. Clearly, there is no resistor value that you can pick that actually will work for both the low and high current cases. Then, the output on the anode of the Zener is just 16 V, well within the safe input range of the regulator. At 20 V and.

Chapter 4 : What Are Zener Diodes? | Diodes and Rectifiers | Electronics Textbook

A zener diode voltage regulator is inefficient when the supply is used with equipment that draws high current. When a supply must deliver a lot of current, a power transistor is used along with the Zener diode as shown below.

A Zener diode is a special type of rectifying diode that can handle breakdown due to reverse breakdown voltage without failing completely. Here we will discuss the concept of using diodes to regulate voltage drop and how the Zener diode operates in reverse-bias mode to regulate voltage in a circuit. How Diodes Regulate Voltage Drop If we connect a diode and resistor in series with a DC voltage source so that the diode is forward-biased, the voltage drop across the diode will remain fairly constant over a wide range of power supply voltages as in Figure below a. The current through a forward-biased PN junction is proportional to e raised to the power of the forward voltage drop. Because this is an exponential function, current rises quite rapidly for modest increases in voltage drop. Another way of considering this is to say that voltage dropped across a forward-biased diode changes little for large variations in diode current. Forward biased Si reference: Conversely, a decrease in power supply voltage would result in an almost equal decrease in resistor voltage drop, with just a little decrease in diode voltage drop. In a word, we could summarize this behavior by saying that the diode is regulating the voltage drop at approximately 0. The Use of Voltage Regulation Voltage regulation is a useful diode property to exploit. Suppose we were building some kind of circuit which could not tolerate variations in power supply voltage, but needed to be powered by a chemical battery, whose voltage changes over its lifetime. We could form a circuit as shown above and connect the circuit requiring steady voltage across the diode, where it would receive an unchanging 0. This would certainly work, but most practical circuits of any kind require a power supply voltage in excess of 0. One way we could increase our voltage regulation point would be to connect multiple diodes in series so that their individual forward voltage drops of 0. For instance, in our example above b , if we had ten diodes in series, the regulated voltage would be ten times 0. We know that diode forward voltage is a fairly constant figure under a wide range of conditions, but so is reverse breakdown voltage. Breakdown voltage is typically much, much greater than forward voltage. This is shown in the figure below a. However, it is possible to build a special type of diode that can handle breakdown without failing completely. This type of diode is called a Zener diode, and its symbol is shown in the figure above b. When forward-biased, Zener diodes behave much the same as standard rectifying diodes: In reverse-bias mode, they do not conduct until the applied voltage reaches or exceeds the so-called Zener voltage, at which point the diode is able to conduct substantial current, and in doing so will try to limit the voltage dropped across it to that Zener voltage point. However, this stability and accuracy is generally good enough for the Zener diode to be used as a voltage regulator device in common power supply circuit in Figure below. So long as the power supply voltage remains above the Zener voltage Like any semiconductor device, the zener diode is sensitive to temperature. Interestingly enough, when Zener diodes fail due to excessive power dissipation, they usually fail shorted rather than open. A diode failed in this manner is readily detected: A Zener diode with a power rating of 0. If excessive power dissipation is detrimental, then why not design the circuit for the least amount of dissipation possible? Why not just size the resistor for a very high value of resistance, thus severely limiting current and keeping power dissipation figures very low? Less power dissipation means lower operating temperatures for both the diode and the resistor, and also less wasted energy in the system, right? A higher resistance value does reduce power dissipation levels in the circuit, but it unfortunately introduces another problem. Remember that the purpose of a regulator circuit is to provide a stable voltage for another circuit. What it is supposed to do is maintain However, as we will see, it cannot accomplish this task. If we actually had This load current would have to go through the series dropping resistor as it did before, but with a new much larger! The situation is easier to comprehend if we temporarily remove the Zener diode from the circuit and analyze the behavior of the two resistors alone in Figure below. Non-regulator with Zener removed. With a total voltage of 45 volts and a total resistance of Thus, the diode ceases to regulate voltage. The analytical technique of removing a Zener diode from a circuit and seeing whether or not enough voltage is present to make it conduct is a sound one.

Remember that Zener diodes work by limiting voltage to some maximum level; they cannot make up for a lack of voltage. If the load resistance is too low, it will draw too much current, dropping too much voltage across the series dropping resistor, leaving insufficient voltage across the Zener diode to make it conduct. When the Zener diode stops conducting current, it can no longer regulate voltage, and the load voltage will fall below the regulation point. To find this acceptable load resistance value, we can use a table to calculate resistance in the two-resistor series circuit no diode, inserting the known values of total voltage and dropping resistor resistance, and calculating for an expected load voltage of 45 volts. With 45 volts of total voltage and a series circuit, the current is equal through all components at any given time: Thus, if the load resistance is exactly 45 ohms, the load voltage will be regulated to a maximum of 45 volts. Any load resistance smaller than 45 ohms will result in a load voltage less than 45 volts. With the diode in place, the load voltage will be regulated to a maximum of 45 volts. What we see is a tradeoff between power dissipation and acceptable load resistance. The higher-value dropping resistor gave us less power dissipation, at the expense of raising the acceptable minimum load resistance value. If we wish to regulate voltage for low-value load resistances, the circuit must be prepared to handle higher power dissipation. Zener diodes regulate voltage by acting as complementary loads, drawing more or less current as necessary to ensure a constant voltage drop across the load. This is analogous to regulating the speed of an automobile by braking rather than by varying the throttle position: Despite this fundamental inefficiency of design, Zener diode regulator circuits are widely employed due to their sheer simplicity. In high-power applications where the inefficiencies would be unacceptable, other voltage-regulating techniques are applied. Zener diodes are manufactured in standard voltage ratings listed in Table below. The wattage corresponds to die and package size and is the power that the diode may dissipate without damage.

Chapter 5 : Zener diode - Wikipedia

Zener Diode is a general purpose diode, which behaves like a normal diode when forward biased. But when it is reverse biased above a certain voltage known as zener breakdown voltage or zener voltage or avalanche point or zener knee voltage the voltage remains constant for a wide range of current.

Enter maximum load current in mA. Zener diode power rating: Select a zener diode with a higher rating than the value above Resistor value: Ohms Select a resistor with a value as close as possible to the value above - a little below is better than a little above. Matching the Zener Diode and Resistor to the Situation Here is a hand-worked example which shows how to choose the correct zener diode and resistor for a known load: Choose a Zener Diode Since we need 8 Volts we can choose between a 7. Calculate the Maximum Current in the Circuit Our load device needs mA of current, plus we also need at least 5mA for the zener diode, therefore lets set I_{max} as mA to be safe. Select the Power Rating of the Zener Diode Zener diodes are available in a range of difference power ratings. If a large current flows through a small zener diode it will be destroyed, therefore we calculate the power to be lost in the diode and select a diode rated above that value. Here the zener power rating is equal to the zener voltage multiplied by the maximum current I_{max} calculated above which equals 8. We multiply the full maximum current by the zener voltage since when no current is flowing through the load \hat{e} . If the source voltage is likely to be much over the 12 Volts stated then the voltage dropped across the resistor will be larger and so a resistor with a larger resistance may be required. Select the Power Rating of the Resistor The power dissipated in the resistor is equal to the voltage drop across the resistor multiplied by I_{max} . Renewable Energy System Battery Bank Situation If the above situation is referring to a renewable energy system battery bank, the 12V source voltage could vary from as little as Therefore we need to check that everything still works correctly at the higher and lower voltage. If the source voltage rose to If the source voltage fell to Therefore in both cases we easily have enough current passing through the zener diode to ensure a stable output voltage will be maintained. At maximum voltage we would have 1. We would also have a potential maximum of 1. These just need capacitors on the input and output side to smooth the voltages, and are very reliable. Where an adjustable output voltage is required, the LM is the common choice \hat{e} see our article LM Adjustable Power Supply for details of both low current and high current power supply designs with the LM Where the input voltage is very close to the output voltage, an L or LM for example cannot be used as the output from these ICs is always at least a couple of volts less than the input voltage. In these situations an LM low dropout regulator or an adjustable LM is a better option as the output voltage can less than 0.

Chapter 6 : MMBZBLT3G: mW 12 V $\pm 5\%$ Zener Diode Voltage Regulator

Zener Diode Voltage Regulator Calculator Below is a simple to use zener diode voltage regulator calculator delascience.com any given output voltage and current requirement it will calculate the value of power rating of the current limiting resistor and zener diode.

Theory The Zener diode is like a general-purpose signal diode. When biased in the forward direction it behaves just like a normal signal diode, but when a reverse voltage is applied to it, the voltage remains constant for a wide range of currents. There is a limit for the reverse voltage. Reverse voltage can increase until the diode breakdown voltage reaches. This point is called Avalanche Breakdown region. At this stage maximum current will flow through the zener diode. Zener diode The Zener Diode is used in its "reverse bias". From the I-V Characteristics curve we can study that the zener diode has a region in its reverse bias characteristics of almost a constant negative voltage regardless of the value of the current flowing through the diode and remains nearly constant even with large changes in current as long as the zener diodes current remains between the breakdown current $I_Z \text{ min}$ and the maximum current rating $I_Z \text{ max}$. This ability to control itself can be used to great effect to regulate or stabilise a voltage source against supply or load variations. The fact that the voltage across the diode in the breakdown region is almost constant turns out to be an important application of the zener diode as a voltage regulator Characteristics Figure 2 shows the current versus voltage curve for a Zener diode. Observe the nearly constant voltage in the breakdown region. Zener diode characteristic curve The forward bias region of a Zener diode is identical to that of a regular diode. The typical forward voltage at room temperature with a current of around 1 mA is around 0. In the reverse bias condition the Zener diode is an open circuit and only a small leakage current is flowing as shown on the exaggerated plot. As the breakdown voltage is approached the current will begin to avalanche. The initial transition from leakage to breakdown is soft but then the current rapidly increases as shown on the plot. The voltage across the Zener diode in the breakdown region is very nearly constant with only a small increase in voltage with increasing current. At some high current level the power dissipation of the diode becomes excessive and the part is destroyed. There is a minimum Zener current, $I_z \text{ min}$, that places the operating point in the desired breakdown. There is a maximum Zener current, $I_z \text{ max}$, at which the power dissipation drives the junction temperature to the maximum allowed. Beyond that current the diode can be damaged. Zener diodes are available from about 2. All Zener diodes have a power rating, P_z . Zener diodes are typically available with power ratings of 0. Zener Diode as Voltage Regulators The function of a regulator is to provide a constant output voltage to a load connected in parallel with it in spite of the ripples in the supply voltage or the variation in the load current and the zener diode will continue to regulate the voltage until the diodes current falls below the minimum $I_Z \text{ min}$ value in the reverse breakdown region. It permits current to flow in the forward direction as normal, but will also allow it to flow in the reverse direction when the voltage is above a certain value - the breakdown voltage known as the Zener voltage. The Zener diode specially made to have a reverse voltage breakdown at a specific voltage. Its characteristics are otherwise very similar to common diodes. In breakdown the voltage across the Zener diode is close to constant over a wide range of currents thus making it useful as a shunt voltage regulator. The purpose of a voltage regulator is to maintain a constant voltage across a load regardless of variations in the applied input voltage and variations in the load current. A typical Zener diode shunt regulator is shown in Figure 3. The resistor is selected so that when the input voltage is at $V_{IN} \text{ min}$ and the load current is at $I_L \text{ max}$ that the current through the Zener diode is at least $I_z \text{ min}$. Then for all other combinations of input voltage and load current the Zener diode conducts the excess current thus maintaining a constant voltage across the load. The Zener conducts the least current when the load current is the highest and it conducts the most current when the load current is the lowest. Zener diode shunt regulator If there is no load resistance, shunt regulators can be used to dissipate total power through the series resistance and the Zener diode. Shunt regulators have an inherent current limiting advantage under load fault conditions because the series resistor limits excess current. A zener diode of break down voltage V_z is reverse connected to an input voltage source V_i across a load resistance R_L and a series resistor R_S . The

voltage across the zener will remain steady at its break down voltage V_Z for all the values of zener current I_Z as long as the current remains in the break down region. Basically there are two type of regulations such as: Output voltage remains the same as long as the input voltage is maintained above a minimum value.

Chapter 7 : Zener Regulators

The Zener diode is often used to create a reference voltage. In tutorials and even college texts, there are mentions of creating a Zener diode based regulator. The idea is that the Zener maintains a known voltage drop.

They are more heavily doped than ordinary diodes, due to which they have narrow depletion region. While regular diodes get damaged when the voltage across them exceeds the reverse breakdown voltage, Zener diodes work exclusively in this region. The depletion region in Zener diode goes back to its normal state when the reverse voltage gets removed. This particular property of Zener diodes makes it useful as a voltage regulator. Let us see how this happens. Let us first comprehend how a Zener diode works before we understand Zener diode as a voltage regulator. When we apply a reverse voltage to a Zener diode, a negligible amount of current flows through the circuit. When a voltage higher than Zener breakdown voltage is applied, Zener breakdown occurs. Zener breakdown is a phenomenon where a significant amount of current flows through the diode with a negligible drop in voltage. When we increase the reverse voltage further, the voltage across the diode remains at the same value of Zener breakdown voltage whereas the current through it keeps on rising as seen in the graph above. Here in the graph V_z refers to the Zener breakdown voltage. Zener breakdown voltage typically can range from 1. The exciting part of this diode is that we can choose the Zener diode with a suitable breakdown voltage to work as a voltage regulator in our circuit. Then we can select a Zener diode with a breakdown voltage of 12 volts and connect it across the load. Then even if the input voltage exceeds that value, the voltage across the load will never exceed 12 volts. Let us try to understand that with a circuit diagram Here the Zener diode is connected across the load R_L . We want the voltage across the load to be regulated and not cross the value of V_z . Depending on our requirement, we choose the suitable Zener diode with a Zener breakdown voltage near to the voltage we require across the load. We connect the Zener diode in reverse bias condition. When the voltage across the diode exceeds the Zener breakdown voltage, a significant amount of current starts flowing through the diode. As the load is in parallel to the diode, the voltage drop across the load is also equal to the Zener breakdown voltage. The Zener diode provides a path for the current to flow and hence the load gets protected from excessive currents. Thus the Zener diode serves two purposes here: Zener diode as a voltage regulator as well as it protects the load from excessive current.

Chapter 8 : Zener Diode as Voltage Regulator

The exciting part of this diode is that we can choose the Zener diode with a suitable breakdown voltage to work as a voltage regulator in our circuit. For example, we want that the voltage across a load in our circuit does not exceed, let's say, 12 volts.

Chapter 9 : Voltage Regulator Using Zener Diode Circuit - Circuits Gallery

The output voltage of regulator system is fixed as the zener knee voltage of the zener diode and can be used in power devices requiring a fixed voltage of firm value. The zener diode will continue in regulating the voltage till the zener diode current falls below the minimum $I_{z\ min}$ value in the reverse breakdown region.