

# Study of Zener Diode Characteristics and Clipping Circuits

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## ARTICLE DETAILS

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## ABSTRACT

"Breakdown Diode" or perhaps zener Diode, as they're occasionally referred to, are fundamentally the same as the conventional PN junction diode though they're especially created to get a specified and low Reverse Breakdown Voltage which uses any reverse voltage put on to it.

The Zener diode behaves the same as an ordinary general purpose diode comprising of a silicon PN junction and once biased in the forward direction, that's Anode beneficial with regard to the Cathode of its, it behaves the same as a typical signal diode passing the rated today's.

Nevertheless, contrary to a standard diode which hinders some flow of present throughout itself when reverse biased, that's the Cathode gets to be more optimistic compared to the Anode, when the reverse voltage gets to a pre determined benefit, the Zener diode starts conducting in the reverse path. This's as when the reverse voltage used throughout the Zener diode exceeds the rated voltage of the unit a procedure known as Avalanche Breakdown happens in the semiconductor depletion level along with a present begins to run through the diode to restrict the increased voltage.

## 1. Introduction

The present currently streaming through the Zener diode increases considerably to the highest circuit value (which is generally restricted by a sequence resistor) and also when achieved, this reverse saturation current stays pretty constant over a broad range of reverse voltages. The voltage point at which the voltage across the Zener diode becomes steady is known as the "Zener voltage", ( $V_z$ ) and also for Zener diodes, this particular voltage is able to vary from less than a single volt to just a few 100 volts.

The stage at what the Zener voltage activates today's to run through the diode is usually extremely effectively controlled (to somewhat less than one % tolerance) in the doping phase of the diode semiconductor construction offering the diode a certain Zener Breakdown Voltage, ( $V_z$ ) for instance, 4.3V or perhaps 7.5V. This Zener breakdown voltage over the I V curve is practically a vertical straight line.

The Zener Diode is utilized in the reverse bias of its or even reverse breakdown function, i.e. the diode anode links to the damaging source. From the I V attributes curve earlier, we are able to realize that the Zener diode possesses an area in the reverse bias characteristics of its of virtually a continuous negative voltage no matter the valuation of the present streaming through the diode and is still almost continual despite having big changes in current so long as the Zener diodes today's stays in between the breakdown current  $I_{z(min)}$  and the maximum current rating  $I_{z(max)}$ .

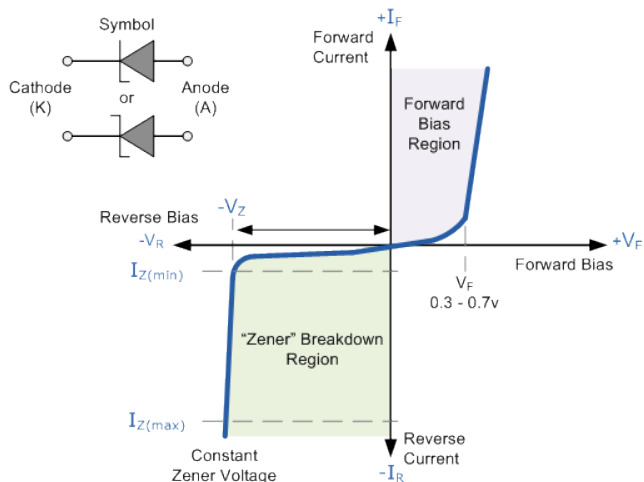
## 2. Zener Diode Clipping Circuits:

So far we've checked out the way a Zener diode could be utilized to regulate a frequent DC supply but what if the input signal wasn't constant state DC but an alternating AC waveform, exactly how would the Zener diode respond to a continuously changing signal.

Diode clipping and also clamping circuits are circuits which are used-to form or maybe change an input AC waveform (or even some sinusoid) creating an otherwise shape output waveform based on the circuit agreement. Diode clipper circuits may also be known as limiters since they restrict or maybe clip off the beneficial (or perhaps negative) a part of an input AC signal. As Zener clipper circuits limit or maybe cut off component of the waveform throughout them, they're primarily employed for circuit protection or perhaps in waveform shaping circuits.

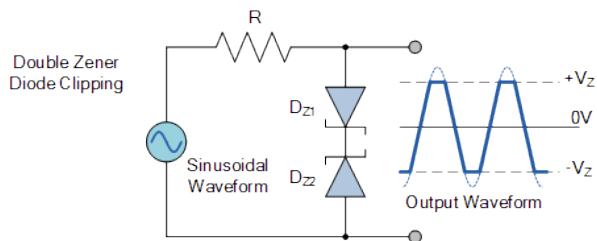
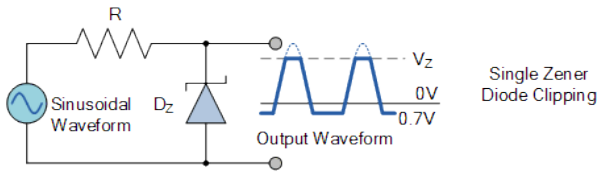
For instance, in case we wish clip an output waveform at +7.5V, we will utilize a 7.5V Zener diode. Whenever the paper waveform tries to go over the 7.5V limit, the Zener diode is going to "clip-off" the surplus voltage from the enter producing a waveform with a flat top still maintaining the paper constant at +7.5V. Remember that in the forward bias state a Zener diode is nevertheless a diode when the AC waveform output

### 1) Zener Diode I-V Characteristics



goes unfavorable under 0.7V, the Zener diode turns "ON" like every regular silicon diode would and also clips the paper at 0.7V as shown below.

### Square Wave Signal



The back to again connected Zener diodes will be utilized as an AC regulator creating what's jokingly known as a "poor male's square wave generator". To us this particular plan we are able to clip the waveform between an optimistic value of +8.2V and a bad worth of 8.2V for a 7.5V Zener diode.

Therefore for instance, in case we wish clip an output waveform between 2 distinct maximum and minimum values of say, -6V and +8v, we'd just employ 2 differently rated Zener diodes. Remember that the paper will in fact cut the AC

waveform among +8.7V as well as 6.7V because of the inclusion of the forward biasing diode voltage.

Put simply a peak-to-peak voltage of 15.4 volts rather than anticipated fourteen volts, as the forward bias volt decline throughout the diode gives an additional 0.7 volts in every course.

This particular kind of clipper configuration is pretty typical for safeguarding an electronic circuit from over voltage. The 2 Zener's are usually positioned throughout the power cord input terminals and also during regular operation, among the Zener diodes is "OFF" as well as the diodes have minimal or maybe no influence. Nevertheless, if the input voltage waveform surpasses the limit of its, then the Zener diodes turn "ON" and clip the input to safeguard the circuit.

### 3. Conclusion

This ability to manage itself may be utilized to effect that is better to regulate or maybe stabilize a voltage supply against supply or even load variations. The simple fact that the voltage throughout the diode at the description region is just about constant happens to be a crucial characteristic of the Zener diode because it may be utilized in the easiest kinds of voltage regulator apps.

The functionality of any regulator is providing a frequent output voltage to some load attached in parallel with it in spite of the ripples in the source voltage or maybe the variation in the load present and also the Zener diode will remain to regulate the voltage until the diodes present falls below the minimum  $I_Z(\min)$  worth in the reverse breakdown area.

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