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Semiconductor devices

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Abstract:- As We knows today world is approaching towards usage of better reliable compact and portable devices semiconductor device is all about the advancement of old version of devices and the controlling of the operation as per the need of modern world.

I. INTRODUCTION

Semiconductor devices are well-known equipment of power electronics which helps us to rebuild and transform our lives in such a manner so that the operation of a bigger devices is to be reduced and the multi operational function can be possible.

Is semiconductor is a device that lies between the conductivity of then of a conductor and conductivity of insulator a semiconductor material has conductivity between the extreme of the conductor energy gap of a semiconductor is a very is from 0.5 to 1 electron volt that for Silicon that is of 1.21

II. POWER DIODE

In power diode be used in - layer to increase the depletion layer so that it blocks very high negative voltage. Non-Punch through diode have lesser depletion region n-region while in punch through diode depletion region is almost equal to the n- region.

III. CONDUCTIVITY MODULATION

In case of 5 through diode because of conductivity modulation the excess charge present in then and negative lead the overall resistance decreases then power loss decreases. This is only present for the minority carrier charges.

IV. SILICON CONTROL RECTIFIER

Silicon controlled rectifier is also termed as a thyristor it is a semi-controlled switch that only it controlled by the people during on state a person doesn't control the locking or see the ending capacity or when its thyristor has to stop.

V. TRIGGERING METHODS OF THYRISTORS

A. forward voltage triggering triggering.

In this method we used to keep on increasing the voltage at its peak value so that the test thyristor gets on by itself this result use loss of power in the circuit so usually this method will not be preferable for the triggering method.

B. Gate triggering

In this method we create and path for anode current to flow at higher rate is used by providing Anode current path through it get current will keeps on increasing the density of the conduction of current through the circuit and the anode current will flow through it so this method will be helpful for the gate triggering purposes and the thyristor will get on.

C. dv/dt triggering.

this type of the triggering method we used to increase the depletion region of semiconductor so that it behaves like capacitance once it behaves like a capacitor then we can control on its voltage to get control on the current as we have an control on the current so we have to decide now when to home on the SCR.

D. Light triggering

In this method light area was creating more number of charges that helps to move on the flow of electron and the flow of electron will get generate the current.

This is called a light activated silicon-controlled rectifier this method is more important and more useful for this system where we have to get on the Many thyristors simultaneously at a particular time. Light activated silicon-controlled rectifier (LASCR) is more convenient and reliable.

VI. SOME IMPORTANT PARAMETERS

Latching current- when we applied Gate signal when the anode signal reaches to the latching state the regeneration process starts and win until theReaches state there will be no reason reason so I can say that in latching current is the minimum current at which the regeneration will start.

Holding current- holding current is the maximum current at which the the thyristor circuit will turn off for their communication process beyond this limit that is the holding current there will not be no computation circuit process going on.

Q- What Does Means Computation Failure

Ans- commutation feels when the circuit turn off time is less than computation time some exercise charge still presents at the junction even after removing negative voltage because of this exercise charge silicon-controlled rectifier losing its blocking capability that is silicon-controlled rectifier is not able to block the positive voltage and just behave like diode.

VII. COMMUTATION HAS 2 ROLES

- bring down auxiliary current to 0
- apply reverse voltage at least for a single period to remove the Stored voltage to regain blocking capability.

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VIII. PROTECTION OF THYRISTORS

A. Overcurrent Protection

Over current problem in thyristor is very common for overcurrent protection we generally use and fuse or circuit breaker in series with silicon-controlled rectifier to overcome with the problem of over current.

B. Over voltage protection-

Over voltage protection is major problem in a thyristor we add varistor in parallel with thyristor to get overcome with this problem varistor is a non-linear resistor for example zinc oxide. All Metal oxide resistor behaves as a varistor.

C. dv/dt protection-

At high dv/dt silicon-controlled rectifier turn on without gate pulse. dv/dt protection is needed in order to avoid false turn on of the silicon-controlled rectifier we add a capacitor in parallel as it does not allow the sudden voltage change

Snubber ckt- snubber circuit is a combination of resistor and capacitor which is connected in parallel with thyristor. Here important point to notice is that the resistor present in the snubber circuit will control the discharging current while the capacitor present in the number circuit will control the dv/dt rating of the thyristor.

Snubber circuit is used for limiting the electrical stress that appeared even during switching behavior electrical stress means experiencing sudden voltage and current changes that happens during switching these are called snubber circuits.

D. di/dt protection

When anode current is greater than the spreading area then it leads to the formation of hotspots. Hotspots stands for high density that is results to permanently damage the device.

For limiting di/dt rating we have to add inductor in series with silicon-controlled rectifier.

Q-what is di/dt rating

Ans- The maximum with stand capability of device in terms of changes in current so that it will not get damaged. For safe working we add inductance so that with the help of inductance the di/dt rating we designed to the protection of the thyristor.

E. Gate protection

a) Over current protection-

For over current protection we must connect a resistance in series in series to limit the current this is the way to protect the over current of thyristor power by gate protection method.

b) Over voltage protection-

For over voltage protection in the thyristor based connect a Zener voltage diode with the thyristor to clamp its voltage up to a specified limit Zener diode does not allow maximum voltage if it occurs then the general breakdown is occurred.

c) Protection against noise.

In thyristor there will be a noise signal turn on in the device this is a common noise problem in the signal we must connect a parallel RC circuit across Gate cathode terminal to protect against noise.

IX. PROBLEMS RELATED WITH SERIES CONNECTED THYRISTORS

- unequal sharing of voltage
  - **Reason-** due to difference in forward blocking characteristic
  - **Rectification-** for this reason we use a static equalizing circuit to get overcome this problem **Reason-** due to difference in Reverse recovery characteristic. **Rectification-** For this problem we connect a dynamic equalizing circuit
  - **Problems related with parallel connected thyristor**
  - **Unequal sharing of current**
  - **Reason-** due to difference in forward conduction characteristic.
  - **Rectification-** connect a current equalizing circuit to get overcome this problem
  - **Reason-** due to temperature difference in the parallel connected thyristor.
  - **Rectification-** Connect a common symmetrical heat sink for all the parallel connected thyristor together.

X. CONCLUSION

So, all the points to be concluded in such a manner that in modern world the power electronics please a vital role so all our survival depends on the power electronics so that we can conclude in future power electronics must kind of area where we have to focus a lot.

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