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SOLAR BASED 11 LEVEL INVERTER

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Abstract -: *Inverter plays a very important role in converting the DC power obtained from renewable energy resources into AC, Conventional inverters produce a square wave with THD of 48.34%. The proposed inverter topology works inn two operation steps; the 1st for generating level and the 2nd for generating polarity. These inverter is lay down between the wind turbine and the grid, and which is able to regulate active and reactive power transferred to the grid. Multilevel inverter offers high power capability. The performance of multilevel inverter is highly superior to that of conventional 2-level inverter due to many reasons such as reduced harmonic distortion, lower electromagnetic interference , higher DC link voltage. For the first time (SHEPWM) Selective harmonic elimination pulse width modulation method is systemically applied to Multi-level series-connected voltage source PWM inverters and the theoretical predictions are validated using MATLAB Simulink tool box.*

Key Words :-Inverter, Multilevel Inverter, Triple Boost Inverter, Photovoltaic Source, Harmonic reduction, MLI, PWM, Capacitor clamped, Diode clamped, multilevel inverter, H-Bridge.

1. INTRODUCTION

Now a days, due to load sharing more power cut is happening in the residential areas because of unbalancing of the phases. Due to this using inverters to stop the power cut problems in our houses. And due to charging and discharging of inverters there is a huge amount of electricity bills are paid by the customers. And cost of the electricity is more therefore inverters are not affordable to use. Hence nowadays peoples are turning towards the solar energy. The main benifit is that it is a renewable, clean source of electricity. When it's used on a small scale, extra electricity can be stored in a battery or feedback into electricity grid.

The technology of multilevel power conversion is very rapidly growing in area of power electronics with good potential for future. [1] They are giving some clear advantages over two level inverters, such as, Stepped waveform with less distortion;

1. Lower switching frequency;

2. Higher efficiency;

3. Lower voltage power devices.

The multilevel inverter requires a high number of power switches that must be commuted in a precisely determined sequence by a dedicated (and complex) control circuit[1**].**

2. LITRATURE SURVEY

1. In 2013, William christophers, Dr. R. Ramesh, M. Vishnupriya, described that the simulation model of a 1-phase. Simplified 11-level inverter with resistive load using Matlab Simulink tool box. Also, the inverter model developed was shown to provide accurate not only results but also Valuable insight Into 11-level inverter performances. (Modulling & simulation of single phase simplified Eleven level inverter)

2. In 2018, Girish Ganesan R, Mahadevan Bhashakar, Narayan K, proposed that a novel topology with a reduced number of switches to obtain a similar performances to that of existing Cascaded H-Bridge configuration which use Carrier-Based Sinusoidal Pulse Width Modulation (CBSPWM) technique. Also the designed power & pules generater circuit their output are presented by simulation.(Novel 11-level Multilevel inverter.)

3. In 2014, Pedram Sotoodeh, Ruth Douglas Millar, explained that the aim of this paper to Introduced a new ways to increase the penetration of renewable energy system into distribution system. In this paper presents a moduler multilevel converter is used as a desired topology to all requirements of single phase system such as compbility IEEE stand, (THD) & total cost of system. The proposed control statergy neglectes the active & reactive power using power angle & modulation index respectively.(Design & Implementation of an 11-level inverter with FACTS Capability for Distributed Energy system.)

4. In 2018, Wira Adhitama, Cahyosaputro, Leonardus Heru, described that a single phase 11-level inverter modulated with 5 –buck DC-DC Converter & also H-bridge inverter topology with Simple Pulse Modulation Method. Also these paper presents the Complete system is simulated using power simulator software for simulation results & hardware results are generated to chek performance of inverter in laboratory.(A single phase 11-level Inverter for Photovoltaic Applications.)

5. In 2000, Dariusz Czarkowski, P. Pillay, explained that the Multilevel Selected harmonic eliminations PWM method had estabilished. Also, a new reduced order method of Mirror harmonic suppression is a double-cell series Connected PWM inverter is also Suggested. Simulation results for 11-level inverter are also presented for the Multilevel (SHEPWM) Method. (Multilevel selective harmonic elimination PWM Technique in series connected voltage inverters.)

6. In 2020, Ahmad ismail M. Ali, Mahmoud A. Sayed, Takaharu Takeshita, Alaaeldien M. M. Hassan, Ahmed M. Azmy, explained that the proposed MLI & PWM Techniques effectiveness are investigated using Matlab /Simulink as well as experimental prototype. Experimental results proves the Validity of the MLI & the effectiveness of the two PWM techniques at different values of HI.A single phase modulator multilevel inverter based on controlled DC-Cells under 2 SPWM (Sinusoidal pulse width modulation) techniques for renewable energy applications.

7. In 2007, G. Brando, A. Dannier, R. Rizzo, has been proposed a sensorless control of H-bridge Multilevel Converter for MPPT in grid-connected Photovolatic systems. The simulation results confirm that the MPP & to stabilize in the new steady state condition.(A sensorless Control of H-bridge Multilevel converter for Maximum Power Point Tracking in Grid connected photovoltaic systems.)

3. PROPOSED METHODOLOGY

a) Multilevel Inverter (MLI) :

Inverter or Power Converter is an electronic device that changes (AC). The input & output voltage, frequency & overall power handaling depend on the design of the specific device.

So, the importance of Multilevel Inverters has been increased. Since last few decades these new types of inverters are suitable for high voltage & high power applications due to their ability to synthesize waveforms with better harmonic spectrum & with less total harmonic Distortion (THD).

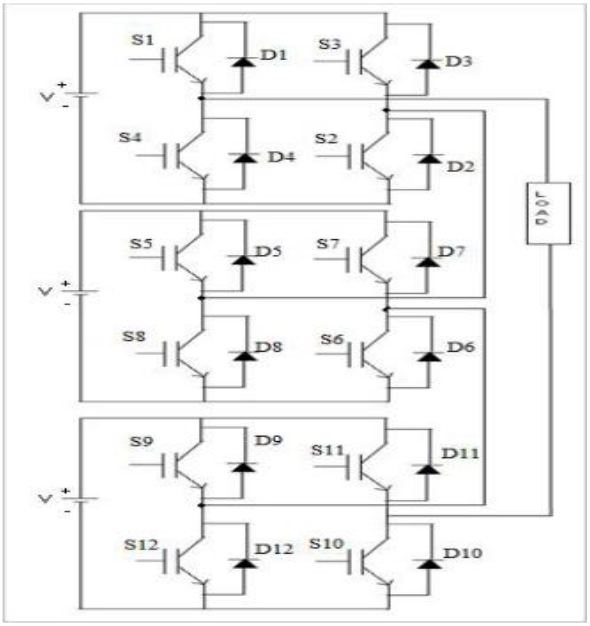

Fig. Circuit diagram of Multilevel Inverter

➢ ADVANTAGES OF MULTILEVEL INVERTER (MLI) :

The multilevel converter has following advantages, that is ,

❖ Common Mode Voltage

The multilevel inverters produce common mode voltage, reducing the stress of the motor and do not damage the motor.

❖ Input current

Multilevel inverters draw input current with low distortion.

❖ Switching Frequency

The multilevel inverter can operate at fundamental switching frequencies that are higher switching frequency as well as lower switching frequency.

It describes that the lower switching frequency means lower switching loss and higher efficiency is achieved.

Reduced harmonic distortion

Selective harmonic elimination technique along with the multi-level topology results the total harmonic distortion become low in the output waveform without using any filter circuit.

i. Insulated –Gate Bipolar Transistor (IGBT):

The IGBT has the output switching & conduction characteristics of a bipolar transistor but is voltage like a MOSFET.

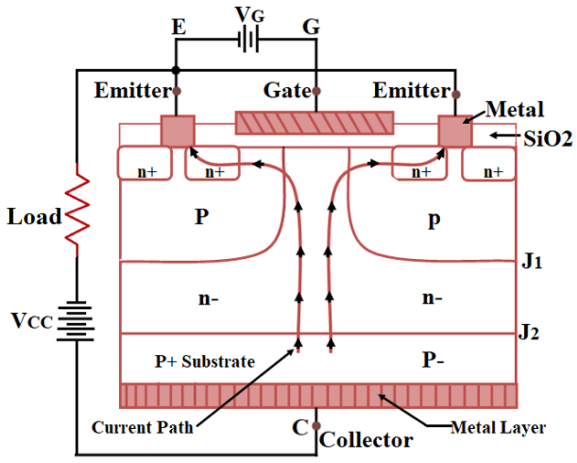

Fig. Insulated-Gate Bipolar Transistor

In general, this means it has the benifit of high-current handling capability of a bipolar with the ease of control of a MOSFET. However, the IGBT still has the drawback of a approximately large current tail and no body drain diode.

ii. Metal Oxide Semiconductor Field Effect Transistor (MOSFET) :

The MOSFET is a device that is voltage controlled devices. MOSFETs have a positive temperature coefficient.

The on-state-resistance has no theoretical limit; so on-state losses can be lower or negligible. The MOSFET also has a body-drain diode, which is especially useful in dealing with limited free wheeling currents.

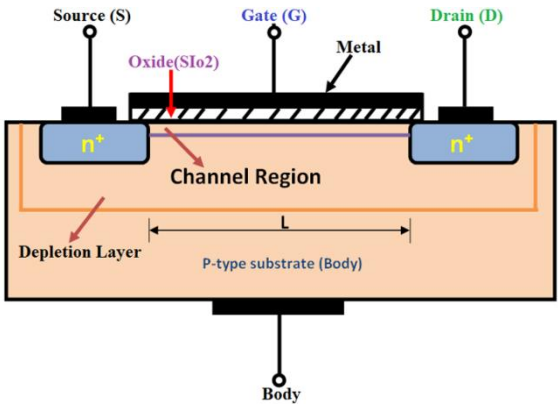

Fig. Metal Oxide Semiconductor Field Effect Transistor

b) Photovoltaic cell (solar cell) :

Solar cell are the systems that are made up of semiconductor materials &they convert the solar energy directly into the current. The total amount of electrical energy which will be obtained when is directly proportional to the intensity of sunlight that falls on the Photovoltaic (PV) panel.

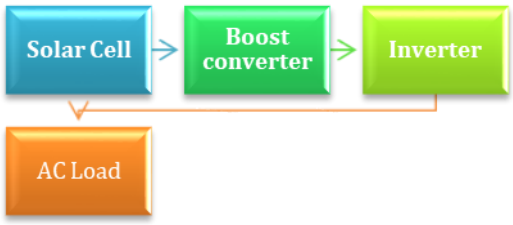

Fig. Block Diagram of Photovoltaic Cell

So, when light photons are absorbed by semiconducting material & electric change carriers are generated. The relation between incident photon energy & frequency is,

$$W=h \cdot \mu$$

Where , **h**=plank constant , **μ** =frequency

4. CONCLUSION

By the use of multilevel inverter, the quality of output of the inverter can be enhanced. As long as we increase the level in inverter the output of inverter becomes more sinusoidal. The threat of power losses cannot be neglected as the increase in switch causes increase in power loss at the time of switching. Inverter is one of the most important components in solar to grid system hence the power loss can be compromised for better quality of electrical supply.

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