EDC LABORATORY

COURSE BASED PROJECT

BATTERY OVERCHARGING PROTECTION CIRCUIT WITH AUTOMATIC CUT OFF

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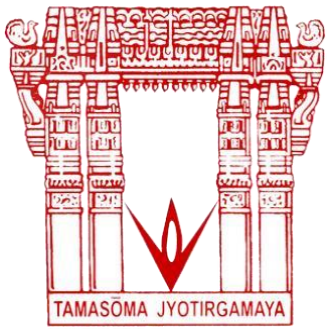

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1. INTRODUCTION

Battery overcharging protection circuits are used to prevent damage to rechargeable batteries caused by excessive charging. These circuits monitor the voltage and current levels of the battery and automatically cut off the charging process when the battery is fully charged. This helps to extend the lifespan of the battery and prevent potential safety hazards.

An automatic cut-off protection circuit typically includes a voltage regulator, a comparator, and a switch. The voltage regulator regulates the voltage level applied to the battery, while the comparator monitors the voltage level of the battery and compares it to a reference voltage. When the battery voltage reaches the reference voltage, the comparator sends a signal to the switch, which disconnects the charging process.

Some protection circuits also include additional features, such as thermal protection, which cuts off the charging process if the battery temperature exceeds a certain threshold, and short-circuit protection, which cuts off the charging process if a short circuit is detected.

Overall, a battery overcharging protection circuit with automatic cut-off provides a reliable and effective way to protect rechargeable batteries from damage and ensure their longevity and safety.

2.COMPONENTS REQUIRED

Semiconductors:

Diode D1 – 1N4007

LED D3

Transistor Q1 - BC547

Resistors :

R1- 5-ohm

R2- 10K-ohm

R3- 1K-ohm

Miscellaneous:

BATTERY B1,B2 -Li-ion 3.7v

RELAY -5V

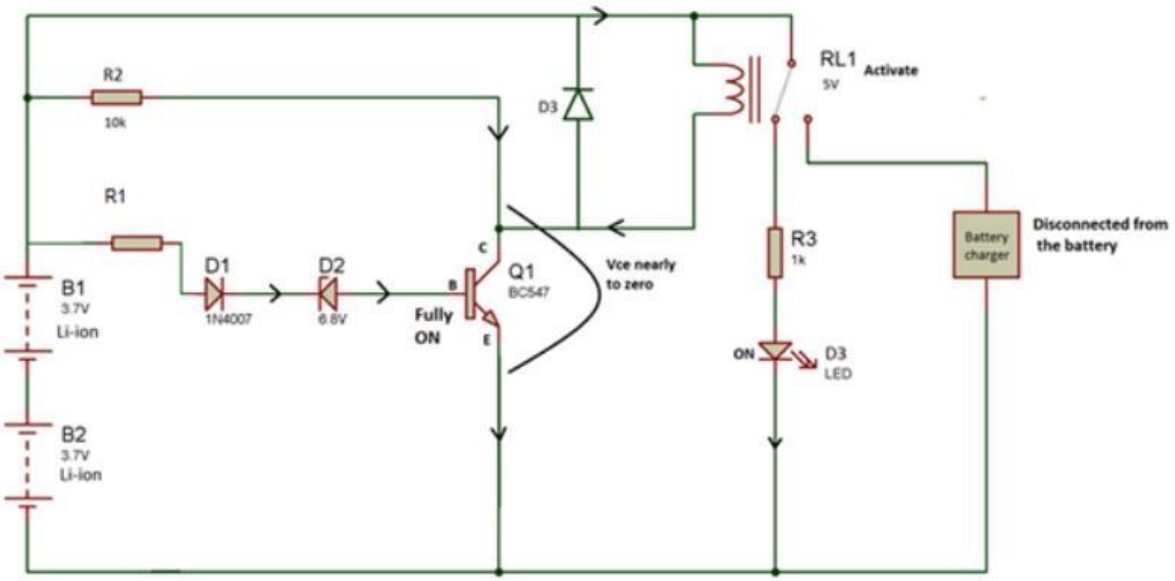
VOLTAGE REGULATOR

3. WORKING

In this electronics project, a power circuit is designed which will detect the upper limit of the terminal voltage by the use of a suitable Zener diode and will cut off the battery connection with the load device by the use of a relay. The circuit includes an LED indicator section also which will light up the LED as the battery charges to peak value and does not require recharging.

Specifically, in this project two Li-ion batteries connected in series will be taken as power supply unit. In most of the commonly used portable electronics devices like laptops, smart phones and others, the Li-ion batteries with 4.2 V of peak limit of the terminal voltage are used. Since in this project, batteries with cut off limit of 4.2 V are used for power supply, so, using two batteries in series set the cut off limit to 8.4 V. Practically, the protection circuit designed in this electronics project cuts off the battery from the charger when the battery voltage goes beyond 8.37V.
So, a zener diode circuit having a drop of 8.4 V in reverse bias condition is used to detect the cut off limit in the design of the circuit. The Zener circuit can be designed multiple ways. A single zener diode can be used or a combination of zener diodes can be used to attain the desired voltage drop in reverse bias condition. Another option is to use a normal diode in combination with the zener diode which is used in this project. The diode circuit will be used to drive a switching transistor which will operate the relay.

Circuit diagram:



As the terminal voltage of the battery will go above the 8.4 V, the diode circuit will go in conduction state, triggering the switching transistor and changing the relay state to cut off the supply from the charger. After understanding the functioning of this project, protection circuits for other cut off limits can also be designed by proper selection of the zener diode and relay with the same circuit.

4. APPLICATIONS

Battery overcharge protection circuit with automatic cut off is used in various devices to prevent overcharging of batteries, which can lead to damage or reduced lifespan of the battery. The following are some common applications of this circuit:

1. Portable devices: Portable devices such as smartphones, laptops, and tablets use battery overcharge protection circuits to prevent overcharging of the built-in batteries.

2. Electric vehicles: Electric vehicles use large batteries that need to be protected from overcharging. The battery overcharge protection circuit in these vehicles ensures that the battery is charged to the optimal level and prevents overcharging.

3. Solar-powered systems: Solar-powered systems use batteries to store the energy generated by solar panels. The battery overcharge protection circuit in these systems prevents overcharging and ensures that the battery operates within its safe operating limits.

4. Uninterruptible Power Supplies (UPS): UPS systems use batteries to provide backup power in case of power outages. The battery overcharge protection circuit in these systems prevents overcharging and ensures that the battery operates at optimal levels.

Overall, battery overcharge protection circuits with automatic cut off play an important role in ensuring that batteries operate within safe limits and prolong their lifespan.

5.CONCLUSION

In conclusion, the battery overcharge protection circuit with automatic cut off is an important component in devices that use batteries to prevent overcharging and extend the battery lifespan. Overcharging of batteries can cause significant damage, reducing the battery's performance and lifespan. The automatic cut-off feature of this circuit ensures that the battery is charged to the optimal level and prevents overcharging. This circuit is widely used in various applications such as portable devices, electric vehicles, solar-powered systems, and uninterruptible power supplies (UPS). Implementing this circuit in battery-powered devices is crucial for ensuring the safety and reliability of these devices.

6.REFRENCES

1) https://www.engineersgarage.com/battery-overcharging-protection-circuit-with-automatic-cut-off-part-4-9/#:~:text=Practically%2C%20the%20protection%20circuit%20designed,the%20design%20of%20the%20circuit.
2) https://www.electronicsforu.com/electronics-projects/hardware-diy/auto-turn-off-battery-charger
3) https://www.electronicsforu.com/electronics-projects/simple-battery-charger-with-overcharge-protection