Scintilla Session 3
Electronic Basics 2.0

17-10-2019

Abstract

The third session of Scintilla was held on 17th of october 2019. It was about introducing the basic circuits using BJT.For the first year students a brief explanation of the theory was also provided.The session was held under the guidance of Prof.Vinod G and Lab instructor Sabarinath Sir.All the crew members were there to make the session a success.

1 Objective of the Session

This session was conducted to impart a basic knowledge about the transistor for a beginner and to develop a circuit which resembles the switching application of the transistor.The students were provided a detailed description on the transfer and switching characteristics of transistor. The proper biasing of transistor for different operating regions were also discussed.

2 Participation

Details about attendees here.

List of Participants

No. of First year attendees: 18
No. of Second year attendees: 12
No. of Third year attendees: 3
No. of Fourth year attendees: 0

Total No. of attendees: 33

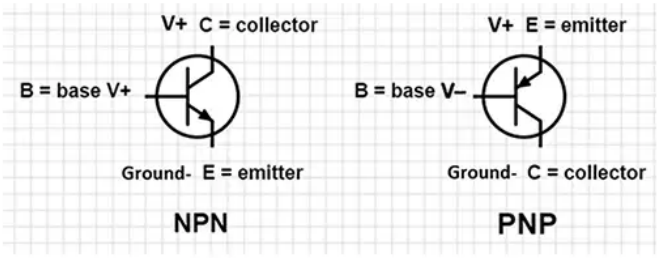

Figure 1: Transistor type

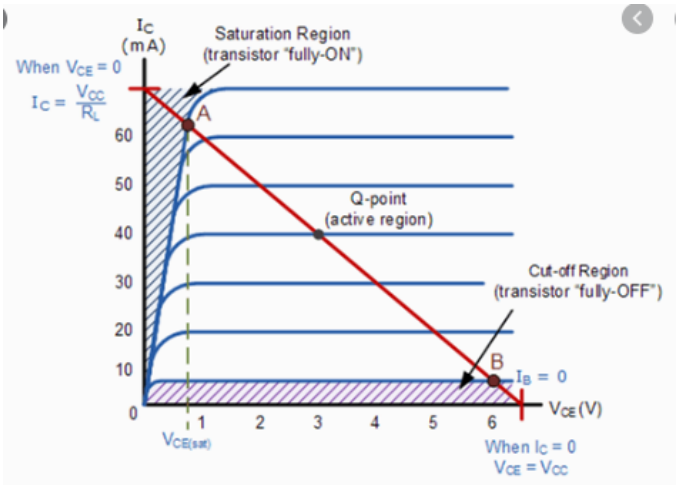

Figure 2: Transfer chara

3 Technical details

3.1 Transistor Basics

A transistor, also known as a BJT (Bipolar Junction Transistor), is a current driven semiconductor device which can be used to control the flow of electric current in which a small amount of current in the Base lead controls a larger current between the Collector and Emitter. They can be used to amplify a weak signal, as an oscillator or as a switch.An NPN transistor is driven (or turned on) by positive current biased at the base to control the current flow from Collector to Emitter. PNP type transistors are driven by a negative current biased at the base to control the flow from Emitter to Collector.

3.2 Transistor biasing

An NPN transistor is driven (or turned on) by positive current biased at the base to control the current flow from Collector to Emitter. PNP type transistors are driven by a negative current biased at the base to control the flow from Emitter to Collector.If a signal of very small voltage is given to the input of BJT, it cannot be

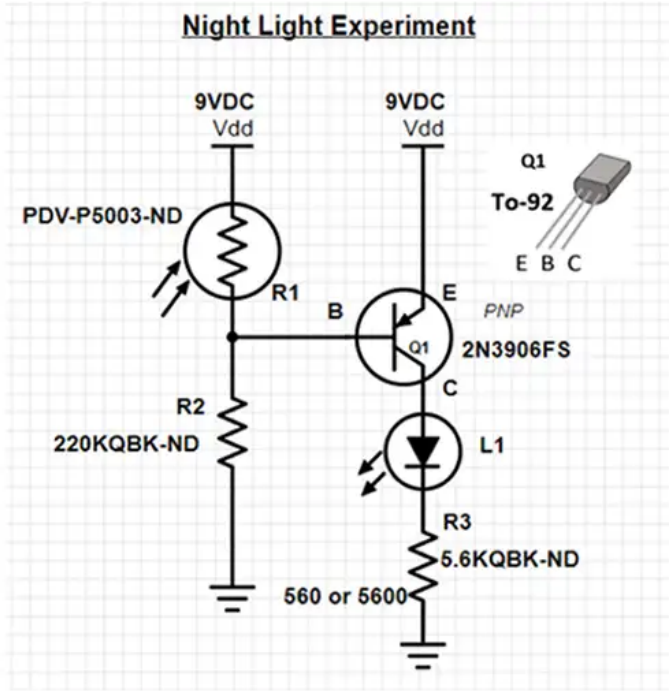

Figure 3: Application Circuit

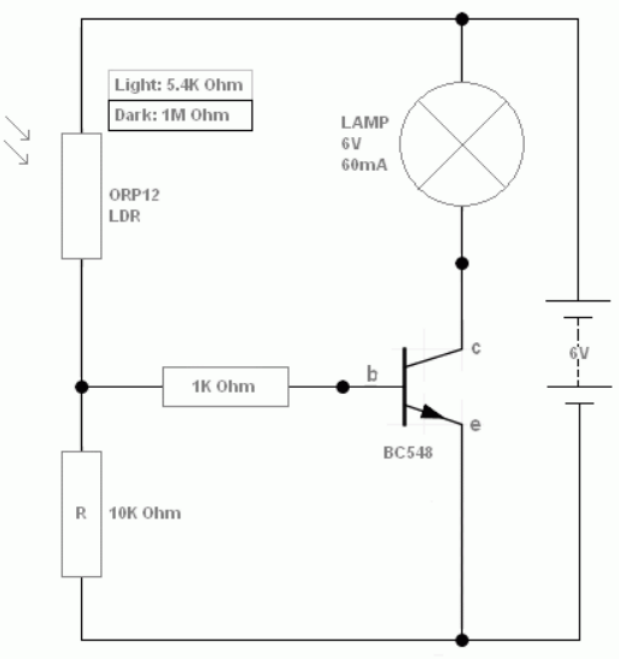

Figure 4: LDR Application Circuit

amplified. Because, for a BJT, to amplify a signal, two conditions have to be met.

The input voltage should exceed cut-in voltage for the transistor to be ON.

The BJT should be in the active region, to be operated as an amplifier.

If appropriate DC voltages and currents are given through BJT by external sources, so that BJT operates in active region and superimpose the AC signals to be amplified, then this problem can be avoided. The given DC voltage and currents are so chosen that the transistor remains in active region for entire input AC cycle. Hence DC biasing is needed.

3.3 Application:Transistor as a Switch

The areas of operation for a transistor switch are known as the Saturation Region and the Cut-off Region. This means then that we can ignore the operating Q-point biasing and voltage divider circuitry required for amplification, and use the transistor as a switch by driving it back and forth between its "fully-OFF" (cut-off) and "fully-ON" (saturation)

3.4 Night lamp circuit

Building a simple light detecting circuit is very easy. It does not need special components and requires only a low-current torch bulb, 4 × 1.5-V dry cells, a BC548 transistor, and an ORP12 LDR. When choosing a suitable NPN transistor, make sure its maximum DC collector current (Ic) is sufficiently large enough to drive the torch bulb you are using. A BC548 can switch up to 100-mA of drive current, the 2N3904 can switch up to 200-mA drive current.

To use a LDR, we usually make it part of a Potential Divider (PD) network consisting of a fixed resistor R. The output voltage of this network, which is taken from the centre connection relative to ground determines the voltage across the base junction. When the resistance of the LDR changes, the voltages across the two resistors changes in a predictable manner, because their sum is always equal to the supply voltage which is 6-V for this circuit. When the LDR resistance decreases, the voltage across it decreases too, but the voltage across R increases. When the LDR resistance increases, the voltage across it increases too, but the voltage across R decreases. Hence when the voltage across one resistor increases, the voltage across the other has to decrease such that the sum of voltages is equal to the supply voltage. Top tip: In these types of circuits, we tend to focus on the voltage formed across the lower resistor because this is also the voltage across the base junction of the transistor. In this circuit configuration, the bulb is ON in the light, and

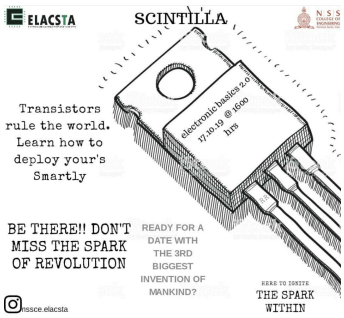

Figure 5: Poster

Figure 6: Lecture on Transistor Basics

OFF in the dark. When light falls on the LDR, its resistance drops, and so does the voltage across it, however the voltage across R increases. Hence the voltage across the base junction increases and the transistor conducts switching ON the bulb.

4 Moments

The moments captured during the session:

Figure 7: Lecture Session

Figure 8: Practical Session

5 Conclusion and suggestions

The attendees were actively participating throughout the session.The topics decided to explain successfully completed. We implemented only one application circuit. So we decided to include more practical circuits from the next session on wards.