

Practical No.23: Check the switch ON and switch OFF condition of LED by using transistor.

I Practical Significance:

The purpose of the Practical is to design and analyse the operation of transistor as a switch. Also, to test a suitable driver circuit and multi vibrators circuits for a given application using transistor.

II Industry/Employer Expected Outcome(s):

Many industrial application uses high frequency switching technique in electronic instruments. Employee should select and test different types of transistors as a high frequency switch.

III Course Level Learning Outcome(s):

Use BJT and FET in various electronic circuits.

IV Laboratory Learning Outcome(s):

Check operation of transistor for ON and OFF condition.

V Relevant Affective Domain related outcome(s):

1. Handle components and equipment carefully.
2. Work in team

VI Relevant Theoretical Background (With diagrams if required):

A transistor can function as a single-pole single-throw switch controlled by an electronic signal driving the base terminal. When the control signal on the base terminal turns the transistor off, it acts like an open switch. When the control signal on the base terminal turns the transistor on, it acts like a closed switch. When transistor is used for switching, it is in one of two states on or off. In the off state, the base bias current is zero and the transistor is in cut off region. In the on state, the base bias current is set large enough to drive the transistor into saturation region.

IX Precautions to be followed:

1. Do not switch ON power supply unless you have checked the circuit connections as per circuit diagram.
2. While doing Practical do not exceed the input voltage of the transistor beyond its rated voltage. This may lead to damaging of transistor.
3. Connection voltmeter and ammeter in correct polarities as shown in the circuit diagram.

X Procedure:

1. Connect the circuit as shown in Figure wave to the base.
2. Apply 5V, 1 kHz square wave to the base.
3. Apply +5V dc voltage to collector.
4. Observe the input and output waveforms simultaneously using oscilloscope.
5. Apply 0V square wave to the base.
6. Observe the input and output waveforms simultaneously using oscilloscope.

XI Required Resources/apparatus/equipment with specifications:

S. No	Instruments/Components	Suggested specification	Quantity
1	CRO	30 MHz	1
2	Function Generator	3 MHz	1
3	Resistor	1k Ω	2
4	LED	3mm, Red/Green	1

XII Actual procedure followed:

1. Connect the circuit as shown in figure wave to the base.
2. Apply 5V, 1k Hz square wave to the base.
3. Apply +5V dc voltage to collector.
4. Observe the input & output waveforms simultaneously using oscilloscope.
5. Apply 0V square wave to the base.

XIII Observations and Calculations:

Sr. No.	Region	Input Voltage	Output Voltage	Switch ON/OFF
1.	Cut-off	0V	0V	OFF
2.	Saturation	5V	5V	ON

XIV Results:

we have studied in this practical to check the switch ON & switch OFF condition of LED by using transistor.

XV Interpretation of Results:

we have studied in this practical to check the switch ON & switch OFF condition of LED by using transistor.

XVI Conclusions & Recommendations:

The purpose of practical is to design & analysis the operation of transistor as switch. Also, to test a suitable driver circuit & multi vibrators circuits for a given application using transistor.

XVII Practical Related Questions:

1. Compare the theoretical and practical values of parameters in cut off and saturation mode.
2. List applications of transistor as a switch.
3. State the operating regions in which a transistor acts as a switch.

[Space for Answers]

Q.1. In cut-off mode, the practical V_{BE} value is slightly higher than theoretical value & the practical I_C value is non-zero due to leakage current.
In saturation mode, the practical V_{BE} value is slightly higher than the theoretical value & the practical I_C value is lower than the theoretical maximum value.

Q.2. 1. Digital logic circuits. 2. Computer systems.
3. Power supplies. 4. Motor control.
5. Industrial control systems. 6. Robotics.

Q.3. A transistor acts as a switch in the following operating regions:

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1. Cut-off Region

2. Saturation Region

XVIII References/ suggestions for further reading ; includes websites:

1. <https://www.electrical4u.com/transistor-characteristics/>
2. <http://nptel.ac.in/courses/117107095/11>

XIX Suggested Assessment Scheme:

Performance Indicators		Weightage
Process Related : 15 Marks		60 %
1	Handling of the components	10%
2	Identification of components	20%
3	Measuring value using suitable instrument	20%
4	Working in teams	10%
Product Related: 10 Marks		40%
5	Calculated theoretical values of given component	10%
6	Interpretation of result	05%
7	Conclusions	05%
8	Product related questions	15%