



Science

## STUDY AND PERFORMANCE TESTING OF TRANSISTOR WITH COMMON EMITTER AMPLIFIER CIRCUIT

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DOI: 10.5281/zenodo.61170

### ABSTRACT

*The transistor has ranking in 20th century technology. It is finding the application in all electronic devices as radios, computers. Integrated circuits are containing various transistors, which are made by silicon. The transistors are used to handle large current and/or large voltages. As example, the final audio stage in the stereo system used a power transistors amplifier to drive the various speakers. Transistors are device, which are utilizes a change in current to produce a large change in voltage, current, or power.*

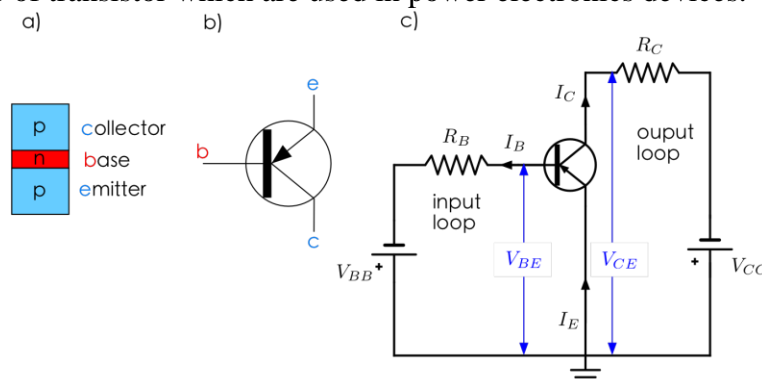
#### Keywords:

*primary winding turns, secondary winding turns, transformer core.*

**Cite This Article:** Prof. G.R. Kumrey, and Dr. S. K. Mahobia, “STUDY AND PERFORMANCE TESTING OF TRANSISTOR WITH COMMON EMITTER AMPLIFIER CIRCUIT” International Journal of Research – Granthaalayah, Vol. 4, No. 8 (2016): 100-103.

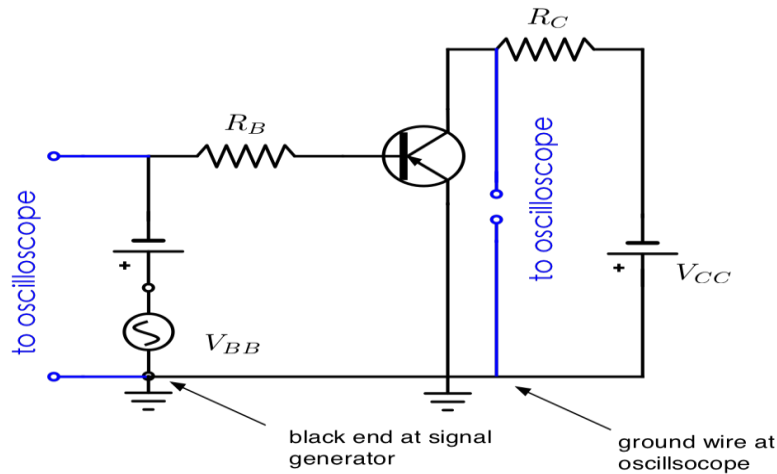
### 1. INTRODUCTION

There are two type of transistor which are used in power electronics devices.



**Figure 1:** a) The schematics diagram of PNP Transistor  
b) Circuit symbol c) common emitter circuit

The PNP transistors are shown in figure. These are consisting of a p-type emitter, an n-type base and a p-type collector, which are together form two PN junctions. In this amplifier circuit, voltages are supplied, so that the emitter base junctions are forward-biased and the collector base junction is reverse-biased. This means  $V_{CE} > V_{BE}$ . Common emitter circuit, so called because the emitter is common to the input circuit on the left and the output circuit on the right.



**Figure 2:** AC amplifier circuit

Consider the first of the entire forward-biased emitter-base junction. It is also very narrow ( $< 1 \mu\text{m}$ ) making it easy for a large fraction,  $\alpha$ , of the holes to diffuse across to the collector-base junction where the junction voltage accelerates them into the collector region to form the collector current,  $I_C$ .

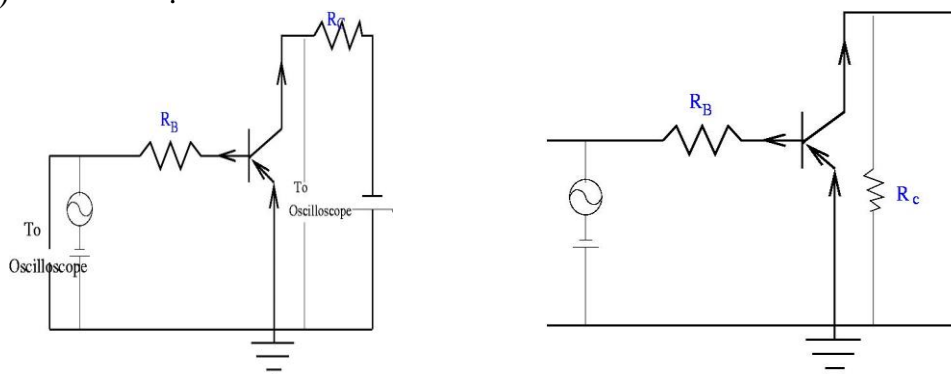
Thus,  $I_C = \alpha I_E$

The remaining fraction,  $(1-\alpha)$ , of holes leave the base through the external connection to form the base current,  $I_B$ , where

$I_B = (1-\alpha)I_E$

The "current gain",  $\beta$ , of the transistor are defined by

$\beta = I_C/I_B$   
 $= \alpha/(1-\alpha)$



**Figure 3:** a) AC amplifier

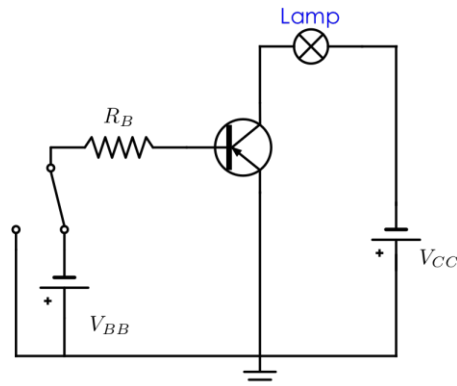
b) equivalent circuit

Figure are shows the transistor used as an AC amplifier to amplify a small signal from a signal generator. Now the two batteries in the circuit behave like large capacitors with impedances  $(1/\omega C) \sim 0$ , so that the equivalent circuit is as shown in figure. The voltage gains are given by equation. However, these are a simplified situation.

## 2. PROCEDURE

The power supply outputs for the voltages  $V_{BB}$  and  $V_{CC}$ . The symbols e, b and c denoting the transistor connections. Use a  $3000 \Omega$  resistor for  $R_B$  and a  $220 \Omega$  resistor for  $R_C$ . Turn the supply outputs to zero then turn on the unit. Set one of the digital meters to the 20 V DC range and connect it to measure  $V_{CC}$  (+ lead to ground on the transistor board). Adjust  $V_{CC}$  to approximately 15 V. Reconnect the meter to measure  $V_{CE}$ . This should also read 15 V, indicating  $I_C = 0$ . Connect the second meter to measure  $V_{BB}$ , also with the + lead to ground. Slowly increase  $V_{BB}$  up to 2 V and note  $V_{CE}$  decreasing, indicating an increasing  $I_C$ . Your amplifier is now working.

## 3. TRANSISTOR AS A SWITCH



**Figure 4:** the transistor as a switch

## 4. AC AMPLIFIER

Increase  $V_{CC}$  to 15 V and turn  $V_{BB}$  down to zero. Increase  $V_{BB}$  until  $V_{CE} = 7.5$  V. Connect the signal generator in series with  $V_{BB}$  and adjust it to 100 Hz. the black leads to ground on the transistor board for both connections. Observe the input and output waveforms. Note that adjusting  $V_{BB}$  causes distortion of the output waveform. From the ratio of peak-to-peak voltages, determine  $A_V$  for frequencies of 100 Hz, 1 kHz, 10 kHz and 20kHz

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