Experiment No.6

BISTABLE MULTIVIBRATOR

Aim:-To design a bistable multivibrator using BJT and study the waveform at base and collector of the transistor.

Components and Equipments: Resistors, Capacitors, Transistors, Groove Board, Diodes, Function generator, BNC, clips, Patch cards, CRO.

Circuit diagram:-

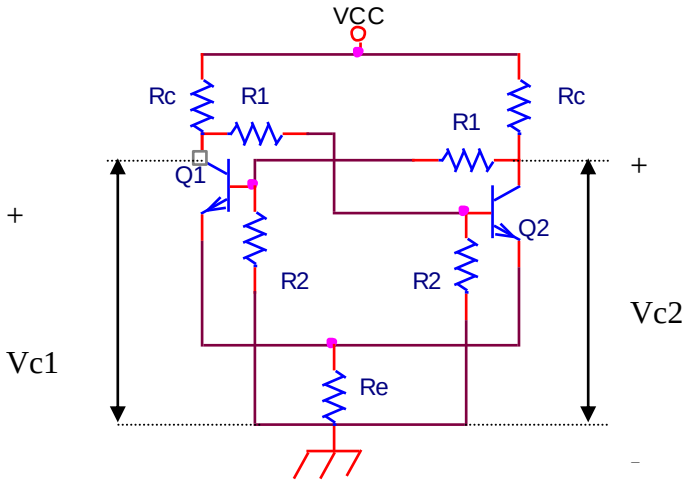

Fig6.1: self biased Transistor binary circuit

Design:-

Let Ics = 3mA and

$Rc_1 = Rc_2 = Rc = (V_{CC}-V_{C2})/Ic$

When Q2 is in saturation,

$Ve = V_{CC}-V_{CEsat}-I_{Csat}R$

To ensure that Q2 be ON, $I_{b2} \geq I_{C2}/h_{fe}$

Re = Ve/I+Ib2

Let I2 = Ics/10

Then $R_2 = V_{bn}/I_2 = (V_{BEsat}+Ve)/I_2$

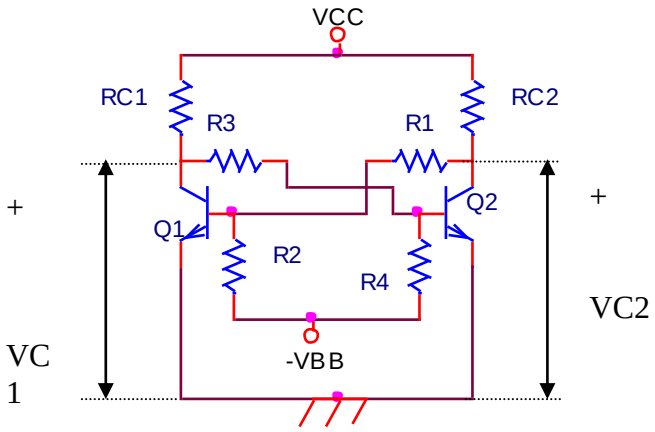

Fig6.2: Fixed Bias Transistor Binary

Stable state I:

Q1 is OFF & Q2 is ON

$I_{C2} = (Vcc\_V_{CE}sat) / Rc2$

$I_{b2sat} \geq I_{C2sat}/B$

$I_3 = (Vcc-V_{b2on})/R_{c1}+R_3$

$I_4 = (V_{b2on}- (-V_{bb}))/R_4$

There fore $I_3 = I_{b2sat} + I_4$

$Vb_2on= V_{BE}sat \approx 0.7V$

$Vb_1off = - (|V_{BE}cuttoff| -Vr)$

Stable state II:

Q1 is ON & Q2 is OFF

$I_{c1sat} = (Vcc-V_{CEsat})/Rc1$

$I_{b1sat} \geq I_{C1sat}/B$

$I_1 = (V_{CC}-V_{\mathbf{B}1on})/(R_1+R_{c2})$

$I_2 = V_{\mathbf{B}1on}- (-V_{BB})/R_2$

$I_1 = I_{b1sat}$ I2

Therefore $V_{B1on}+V_{BEsat} \approx 0.7V$

$V_{B2off} = (|V_{BEoff}| - Vr)$

Procedure:-

- Construct the Bistable Multivibrator circuit in fig6.1 using the component values determined in design
- Connect an electronic voltmeter between ground and the collector of one transistor so that any change of state of the clock may be observed. Then, using another electronic voltmeter, measure and record the voltage levels throughout the circuit.
- Check that the circuit changes state when either the Base of the On transistor or the Collector of the Off transistor is briefly grounded.
- Connect the triggering circuit and commutating capacitors.
- Apply a square wave as triggering input and monitor the inputs on one of the collector waveforms on an oscilloscope. Sketch the triggering and collector waveforms showing their time relationship.
- Monitor the waveform at one of the transistor bases. Sketch this waveform showing its time relationship to the triggering input.

Observations:-

V_{c1} = _____V V_{b1}= _____V

V_{c2} = _____V V_{b2} = _____V

Analysis:-

- Comment on the results of procedures 2 and 3. Compare the measured circuit voltages with the levels used in design.
- Discuss the transistor collector and base waveform and operation of the triggering circuit.