電子電路實驗 7: Vibrator
實驗預報

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1 Objectives

1. To familiarize various kind of multivibra tors, including bistable, monostable and unstable multivibrators.

2 Procedures

2.1 Multivibrator using the Crystal oscillator

1. Supply voltage signal $V_{CC} = 5\,\text{V}$ to pin 14 of 74LS00 IC and short pin 7 to the ground.

2. Attach `CH1` probe of oscilloscope in the node of the output of second `NAND` gate.

3. Observe whether the frequency of the measured wave is sinusoidal with frequency almost same as that of piezoelectric crystal ($3.5\,\text{MHz}$). Record the frequency f_0.

2.2 Circuits of Sparkling lamp

1. Supply voltage $V_{CC} = 12\,\text{V}$.

2. Apply the values of $R = 220\,\Omega, C_1 = C_2 = 47\,\mu\text{F}, R_{B1} = R_{B2} = 100\,\text{k}\Omega, R_{C1} = R_{C2} \approx 0.5\,\text{k}\Omega$

3. Oscilloscope $\triangleright$Press the `CH1` and `CH2` Menu $\triangleright$`Coupling` $\triangleright$`DC`.

4. Adjust R_{B1} and R_{B2} to make the lamp be able to sparkle and make the oscillatory frequency of the lamp as ideally as you wish.

5. Record the value of oscillatory frequency f_0.

6. Use the `Cursors` menu button to measure and record the value of T_H, T_L, Duty cycle , $R_{C1}, R_{C2}, R_{B1}, R_{B2}$.

2.3 An astable multivibrator using the LM555 IC

1. supply voltage $V_{CC} = 5\,\text{V}$. Apply the values $R_A = R_B = 10\,\text{k}\Omega$ and $C = 1$.

2. Adjust R_A, R_B to fulfill the condition of $f_0 = 100\,\text{kHz}$, Duty cycle $= 90\%$ and $T_L = 1\,\text{μs}$.

3. Attach `CH1` and `CH2` probes of oscilloscope to pin 3 and pin 6, respectively, and observe the measured waveform in `CH1` and `CH2`.

4. Use the `Cursors` menu button to measure and record the value of T_L, `Duty cycle` .

5. Record f_0, R_A, R_B.

6. Change the supply voltage $V_{CC} = 10\,\text{V}, 15\,\text{V}$ and repeat the process.

2.4 The series of 555 Circuits.

2.4.1 Circuit implementation

1. Supply voltage $V_{CC} = 5\,\text{V}, I_{SET} = 0.5\,\text{A}$.

2. Do not connect $8\,\Omega$ speaker in the following steps.

3. Use $10\,\text{k}\Omega$ for R_A, R_B, R_C, R_D.

4. Attach `CH1` and `CH2` probes of oscilloscope to pin 3 of A_1 and $A - 2$ respecively.

5. Observe the measured wveform in `CH1` and `CH2`.

2.4.2 Frequency Adjustment

1. Adjust R_A to have $f_1 = 300\,\text{Hz} \sim 700\,\text{Hz}$ and R_B to have Duty cycle $= 50\%$.

2. Adjust R_C to have $f_2 = 0.1\,\text{Hz} \sim 10\,\text{Hz}$ and R_D to have Duty cycle $= 50\%$.

2.4.3 Alarm Bell Adjustment

1. Connect $8\,\Omega$ speaker.

2. Adjust R_A, R_C to have an appropriate sound.

2.4.4 Measurement

1. Record $f_1, f_2, R_A, R_B, R_C, R_D$.

2.4.5 Speaker Replacement

1. Replace the $8\,\Omega$ speaker with LED, observe whether the LED twinkles.