

Max-038 Based High Frequency Wave Generation and Wave Selection Using Microcontroller

M.Vishnu Chittan¹ Dr.Mani Kumar.C² Dr.D.Sailaja³

¹Student of Research Scholar ²Assistant Professor ³Associate Professor

^{1,2,3}Department of Electronics/Physics Engineering

^{1,2}GITAM Institute of Science, GITAM University, Visakhapatnam, Andhra Pradesh, India

³S.S.B.N.Degree College, Anantapur, Andhra Pradesh, India

Abstract— MAX-038 is an IC which is used for generating high frequency waves from 1Hz to 20MHz. The basic principle for generation of high frequency waves is ‘Relaxation oscillator principle’. An external capacitor is used for selecting the frequency of waves. At constant current the charging and discharging of capacitor generates high frequency waves. A simple microcontroller is used to switch the different wave forms (Sine, Square and Triangle). This paper experimentally explains how the waveforms (sine, square and triangle) are generated using MAX-038 and selection of waves using microcontroller.

Key words: MAX-038 high frequency wave generation, 8051 based Wave generator

wave shaper circuit is used to convert the triangular wave into sine wave.

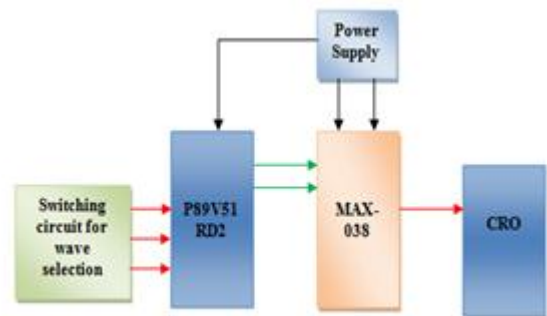


Fig. 1: Block diagram of MAX-038 based high frequency wave generation

I. INTRODUCTION

The main object of the work is to generate high frequency sine, square and triangular waves using MAX-038[1] IC. MAX-038 is a high frequency function generator IC which generates high frequency waves from 1Hz to 20MHz without noise. The operation principle of this IC is the relaxation oscillator principle. In relaxation oscillator an external capacitor is used to charge and discharge repetitively. The oscillator generates non sinusoidal waves as output.

The band width of the output wave can be determined by an external capacitor C_F . The Sine, Square and Triangular waves can be selected by two TTL/CMOS compatible logic pins of MAX-038 IC (A_0 and A_1). These two pins can be connected to microcontroller to select the respected waveform. A simple P89V51RD2 [2] Microcontroller is used to select the type of output waveform by using switch. The *Flash Program Memory* of P89V51RD2 supports both parallel programming and ISP [3] (In System Programming). This controller also allows reconfiguration of application program even when the application is running. Three switches are connected to the microcontroller for waveform selection.

MAX-038 IC operates with both +5V and -5V of power supplies. The 7805 IC and 7905 IC are used for generating +5V and -5V power supplies respectively.

The schematic diagram of the MAX-038 based high frequency wave generation and wave selection is shown in Fig . A simple microcontroller is used to select the waveforms of MAX-038 IC. The hardware configuration of the MAX-038 based high frequency wave generation is listed below.

- P89V51RD2
- MAX-038
- CRO
- Three PUSH BUTTONS
- Power Supply Circuit

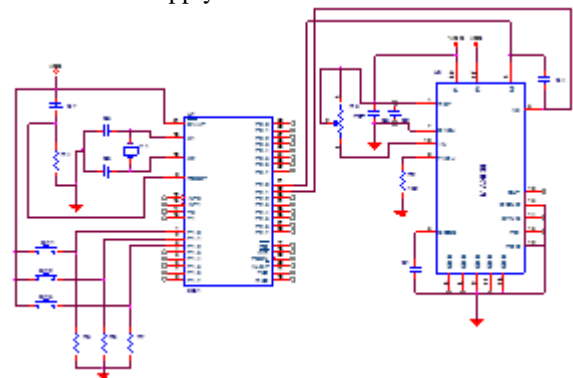


Fig. 2: Schematic Diagram

II. EXPERIMENTAL DESCRIPTION

The block diagram for MAX-038 based high frequency wave generation and wave selection is shown in Fig1.

A simple external circuit is connected to MAX-038 IC for generating high frequency waves as output. The external capacitor C_F is used for selecting the bandwidth of the output wave. This capacitor charges and discharges repeatedly and generates triangular wave. This triangular wave is connected to the internal comparator of MAX-038. This internal comparator generates square wave as output. A

A. P89V51RD2:

P89V51RD2 microcontroller is an 8051 core microcontroller. It has 64 kilo-Bytes of on-chip flash memory. It is a 40 pin DIP IC with four 8 bit ports. The operating frequency limit of this microcontroller is 40 MHz. A quartz crystal of frequency 11.0592 MHz is connected to XTAL1 and XTAL2 pins of microcontroller. This controller supports the In System Programming (ISP) because of having flash memory. It has in built UART controller, Programmable Watch Dog Timer (WDT) and Serial Peripheral Interface (SPI).

MAX -232 IC is used to load the application program into the microcontroller. By using Flash magic tool the application software is loaded into the microcontroller. Three switches are connected to three port pins (P1.0, P1.1 and P1.2) of 8051 microcontroller. The A₀ and A₁ TTL/CMOS based logical control pins are connected to another two port pins (P2.0 and P2.1) of microcontroller.

B. MAX- 038:

MAX – 038 is a high frequency function generator [4] and generates Triangle, Sine and Square waves from 1Hz to 20MHz without noise. It is a 20pin DIP package IC. The basic operating principle of this IC is relaxation oscillator principle. An external capacitor C_F varies the output frequency by alternately charging and discharging. The output frequency is controlled by the reference voltage (V_{REF}) and the external capacitor (C_F) and I_{IN} current. The I_{IN} current can be varied from 2uA to 750uA. This variation of current is controlled by a 20KΩ variable resistor and is connected between V_{REF} and I_{IN}. The capacitance range from 20pF to 100uF is used to generate frequencies from 1Hz to 20MHz. The formula for output frequency is $F_0 = \frac{V_{REF}}{C_F * R_{IN}}$.

The waveform selection can be done by using A₀ and A₁ pins of MAX-038 IC, which is shown in Table 1.

A0	A1	WAVE FORM
X	1	SINE WAVE
0	0	SQUARE WAVE
1	0	TRIANGLE WAVE

Table 1: Waveform selection

These two pins are connected to the P2.0 and P2.1 port pins of 8051 microcontroller. The output is taken from 19th pin of MAX-038 IC.

C. CRO:

A Cathode ray Oscilloscope is used to see the output of the waveform. CRO can be used to measure the voltage signals over a wide range of frequencies. The main blocks of CRO are Cathode tube, accelerating anode, vertical and horizontal deflection plates and fluorescent screen. An electron beam is emitted from cathode tube and accelerated through the anode terminal. The horizontal and vertical deflection plates allow the beam to reach any pixel of fluorescent screen.

D. Push Buttons:

Three Push buttons are used to select waveforms of MAX-038 IC. These three push buttons are connected to three port pins of microcontroller. The push buttons are connected in logic mode. Whenever switch is pressed a high voltage is applied to the port pin. The Fig 3 shows the schematic diagram of switching circuit.

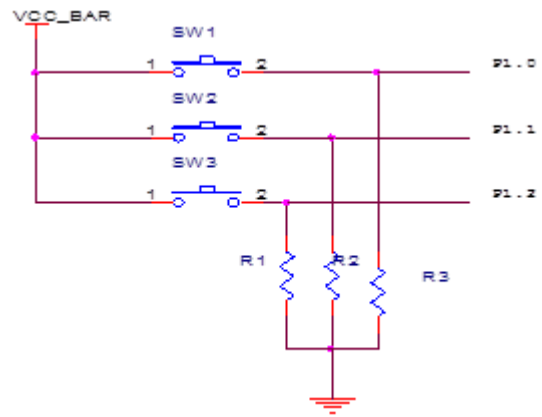


Fig. 3: Switching circuit

E. Power Supply:

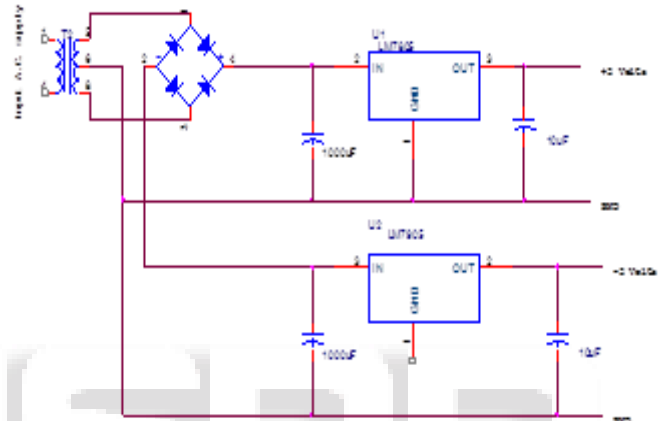


Fig. 4: Power Supply ORCAD Schematic Diagram

The schematic diagram of power supply is shown in Fig 4. The 7805 Voltage regulator is used to design +5 Volts power supply and the 7905 Voltage regulator [5] is used to design -5Volts of power supply.

III. RESULTS

The Fig 5 shows the output as triangular wave and is selected when A0=1 and A1=0. The SW3 (switch 3) has been used to make this selection.

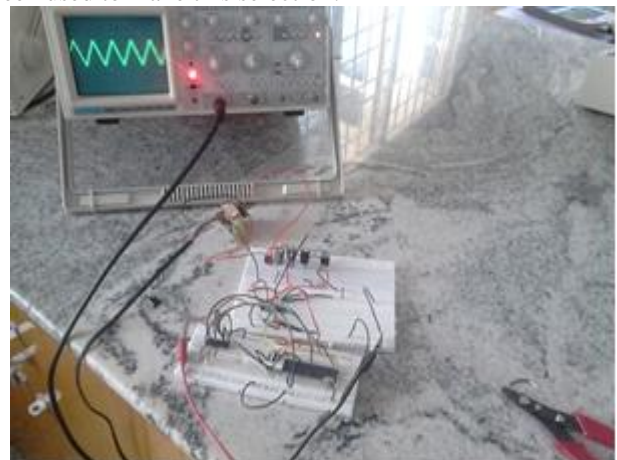


Fig. 5: A Triangular wave output

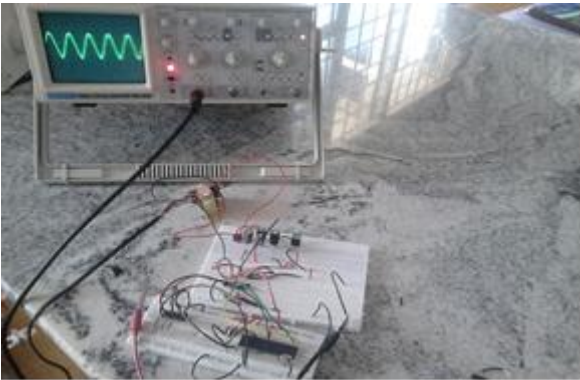


Fig. 6: A sine wave as output

The Fig 6 shows the output as sinewave wave and is selected when $A_0=0$ or 1 and $A_1=1$. The SW1 (switch 1) has been used to make this selection.



Fig. 7: A square wave as output

The Fig 6 shows the output as square wave and is selected when $A_0=0$ and $A_1=0$. The SW2 (switch 2) has been used to make this selection.

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