Simple Function Generator Kit

MitchElectronics 2018

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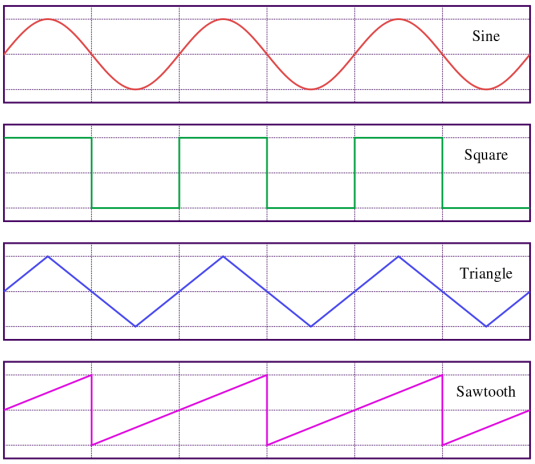
INTRODUCTION

In just about every electronic circuit there will be some signal that changes with time and in many circuits this signal may be continuous. For example the electricity from the mains supply has a sinusoidal shape (like an ocean wave). Another example would be the clock for a computer which has a square shape.

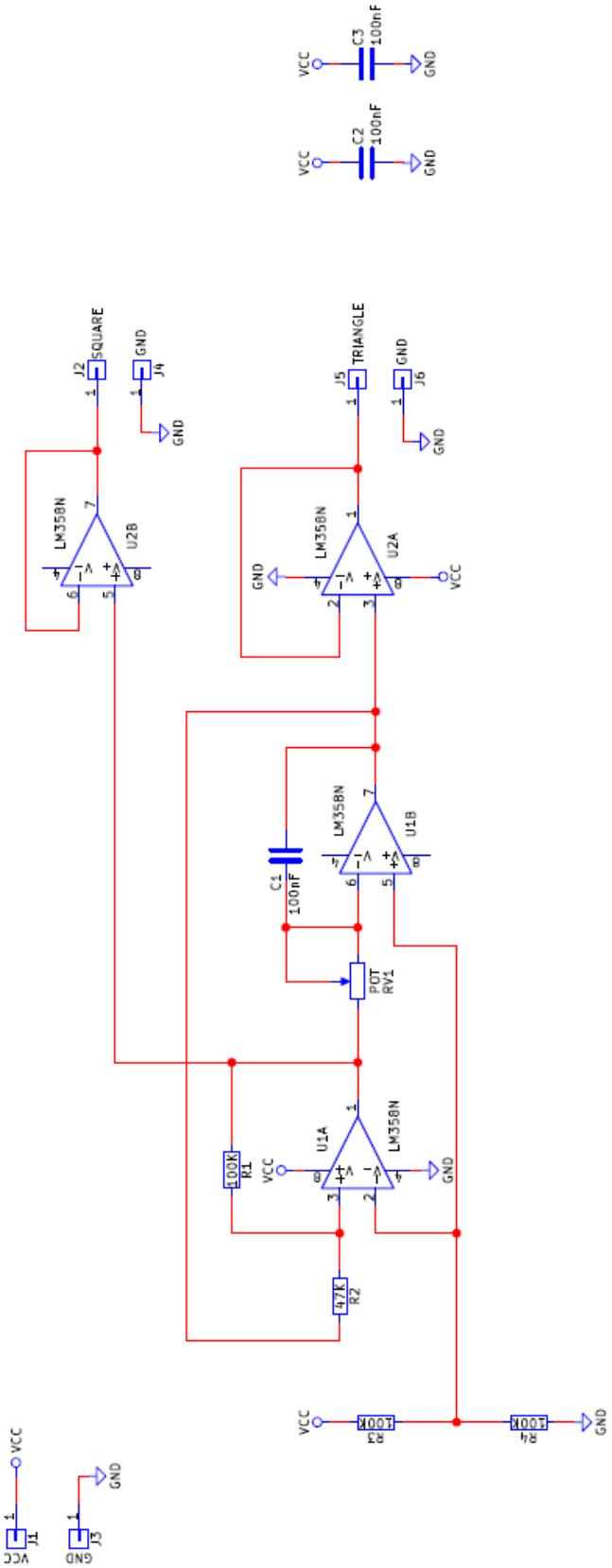


Source: http://commons.wikimedia.org/wiki/File:Waveforms.svg

Imagine a scenario where a digital circuit has been created and requires a clock from an external source. One could be built especially for the task however the clock source would most likely have a fixed frequency. Even if one was designed to have a variable frequency (which takes time), the device would only output a square wave. This is where the humble function generator steps in!

Not only does the SFG (Simple Function Generator), have both a square and triangle output but the frequency is also adjustable. The square and triangle wave are generated by the same source and thus are always in the same phase which means that the two waveforms follow each other constantly (useful if both waves are being used). But how does this circuit work? What active devices are used to create the oscillations and how is the frequency adjusted? Let's find out...

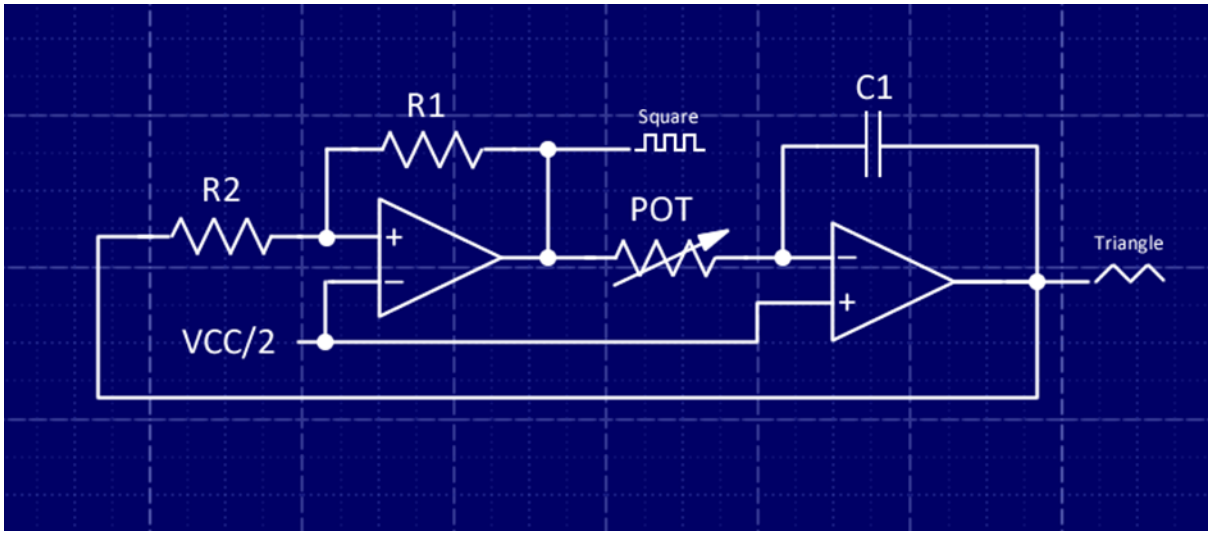
SCHEMATIC


C3
100nF
VCC
GND
C2
100nF
VCC
GND
J2
SQUARE
GND
J4
GND
J5
TRIANGLE
GND
J6
GND
LM358N
U2B
LM358N
U2A
GND
VCC
LM358N
U1B
C1
100nF
POT
RV1
U1A
LM358N
100K
R1
VCC
GND
47K
R2
VCC
100K
R3
100K
R4
GND
VCC
J1
GND
J3

SCHEMATIC EXPLANATION

The Simple Function Generator circuit uses special component arrangements such as Schmitt triggers and integrators. To properly understand how this circuit operates it is important that the following is pre-studied:

- Op-Amps
- Schmitt triggers
- Integrators



The first op-amp with R1 and R2 is configured as an inverting Schmitt trigger. The second op-amp with C1 and the potentiometer (POT), form an integrator. Assuming the Schmitt trigger output is 0V the integrator will begin to discharge C1. This forms the downward slope of the triangle wave.

The Schmitt triggers output will rise to VCC once the output voltage on the second op-amp falls below the Schmitt triggers lower threshold voltage. As a result of this the integrators output will begin to rise because C1 will begin to charge. This forms the upward slope on the triangle wave.

Eventually the output of the integrator will become larger that the Schmitt triggers upper threshold voltage. When this happens the Schmitt trigger will output a voltage of 0V which will result in the integrators output to fall. This process results in the constant production of both a square wave and a triangular wave, in other words it oscillates.

The rate at which the oscillation occurs (i.e. the frequency), depends on the resistance of the POT and the capacitance of C1. Since a variable capacitor would not be ideal in this situation (as they are only available with small ranges), a potentiometer is used instead. By adjusting the resistance of the POT the frequency of the produced wave will change.

MATERIALS

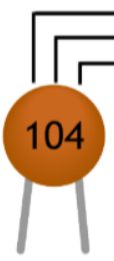
Check that you have the following components

Component	Component Name	Quantity	Looks like
8 DIP Socket	U1, U2	2	
LM358	U1, U2	2	
100nF Capacitor	C1, C2, C3	3	
47kΩ Resistor	R2	1	
100kΩ Resistor	R1, R3, R4	3	
Potentiometer	RV1	1	
Wire	Red, Green and Blue	1 Each	
Wire	Black	2	
PCB	-	1	

RESISTOR AND CAPACITOR IDENTIFICATION

Colour	1ST Band	2ND Band	3RD Band	Multiplier	Tolerance
BLACK	0	0	0	1Ω	
BROWN	1	1	1	10Ω	±1%
RED	2	2	2	100Ω	±2%
ORANGE	3	3	3	1kΩ	
YELLOW	4	4	4	10kΩ	
GREEN	5	5	5	100kΩ	±0.50%
BLUE	6	6	6	1MΩ	±0.25%
VIOLET	7	7	7	10MΩ	±0.10%
GREY	8	8	8		±0.05%
WHITE	7	7	7		
GOLD					±5%
SILVER					±10%

4 Band Resistor
5.6k ±5%



1st Significant Digit
2nd Significant Digit
Multiplier

1 - First Digit
0 - Second Digit
4 - 10000 Multiplier
100nF Capacitor

CONSTRUCTION

Download the electronics construction manual

To learn how to construct circuits on PCBs download the Electronics Construction Manual from Mitch-Electronics using the link below. This document shows you how to install all electronic components used in MitchElectronics kits. The list below shows the sections relevant to this kit so do not worry if you see component sections in the document that don't come with this kit!

www.mitchelectronics.co.uk/electronicsConstructionManual.pdf

Relevant sections in the electronics construction manual

Resistors

Capacitors

Potentiometers

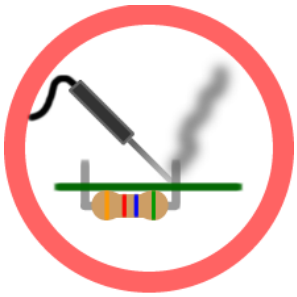
Integrated Circuits

Wires

IMPORTANT INFORMATION

RoHS Compliant Kit (Lead free)

Low Voltage Kit



Caution! Soldering Required