

04. Building an analog function generator

Description

Function generators are commonly used to generate analog waveforms (like sine waves, square waves, sawtooth waves etc.) in a variety of applications, such as sweep generation, AM/FM generation and Phase Locked Loops (PLLs). Some of the popular analog ICs used in the past were MAX038, XR2206 and NTE864. Now they have been mostly replaced with chips using Direct Digital Synthesis (AD9850 DDS signal generator module).

Function generators can usually change their waveform frequency precisely among a wide range of values (0.1 Hz to 1 MHz). Furthermore, they can even change their amplitudes and average DC values. In some sensitive applications, capability of a function generator to create a clean, noise-free waveform becomes extremely important.

Your project here is to build an analog circuit using transistors and op-amps which can generate sine waves, square waves (with variable duty cycle), sawtooth waves and triangular waves.

Outcomes

1. Design an analog function generator which generates sine, square, sawtooth and triangular waves.
2. The output amplitude should be variable from 0V to 10V, and the output frequency should be variable from 20 Hz to 20000 Hz.
3. It should be able to drive at least a 50 Ohm load without significant waveform distortion or amplitude reduction.
4. Function generator should output a clean, noise-free waveform. (Marks will be deducted for noticeable distortions)
5. Square pulse waveform should have a variable pulse width (1% to 99%).
6. Along with the demonstration, the group must provide a datasheet for the circuit, following the formats of already available function generator ICs. During the demonstration they have to prove that their circuits closely follow the characteristics given in their datasheet.
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Additional Rules

1. Any change of the above specifications is negotiable only before the mid review.
2. All the circuits should be simulated using software before the implementation.
3. It is allowed to use an external PCB manufacturer for producing the circuits, and no marks will be reduced or added.
4. Using any other pre-built ICs (other than transistors and op-amps) are prohibited.
5. Regardless of the method of PCB manufacture, the full set of output files required to mass produce the PCBs, to assemble the circuit and to package it is required.
6. Follow provided “General guidelines”.