

# Sine Wave Generation Techniques

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Sine Wave Generation Techniques

Producing and manipulating the sine wave function is a common problem encountered by circuit designers. Sine wave circuits pose a significant design challenge because they represent a constantly controlled linear oscillator. Sine wave circuitry is required in a number of diverse areas, including audio testing, calibration equipment, transducer drives, power conditioning and automatic test equipment (ATE). Control of frequency, amplitude or distortion level is often required and all three parameters must be simultaneously controlled in many applications.

A number of techniques utilizing both analog and digital approaches are available for a variety of applications. Each individual circuit approach has inherent strengths and weaknesses which must be matched against any given application (see table).

## PHASE SHIFT OSCILLATION

A simple inexpensive amplitude stabilized phase shift sine wave oscillator which requires one IC package, three transistors and runs off a single supply appears in Figure 1. Q2, in combination with the RC network comprises a phase

shift configuration and oscillates at about 12 kHz. The remaining circuitry provides amplitude stability. The high impedance output at Q2's collector is fed to the input of the LM386 via the 10  $\mu$ F-1M series network. The 1M resistor in combination with the internal 50 k $\Omega$  unit in the LM386 divides Q2's output by 20. This is necessary because the LM386 has a fixed gain of 20. In this manner the amplifier functions as a unity gain current buffer which will drive an 8 $\Omega$  load. The positive peaks at the amplifier output are rectified and stored in the 5  $\mu$ F capacitor. This potential is fed to the base of Q3. Q3's collector current will vary with the difference between its base and emitter voltages. Since the emitter voltage is fixed by the LM313 1.2V reference, Q3 performs a comparison function and its collector current modulates Q1's base voltage. Q1, an emitter follower, provides servo controlled drive to the Q2 oscillator. If the emitter of Q2 is opened up and driven by a control voltage, the amplitude of the circuit output may be varied. The LM386 output will drive 5V (1.75 Vrms) peak-to-peak into 8 $\Omega$  with about 2% distortion. A  $\pm$ 3V power supply variation causes less than  $\pm$ 0.1 dB amplitude shift at the output.

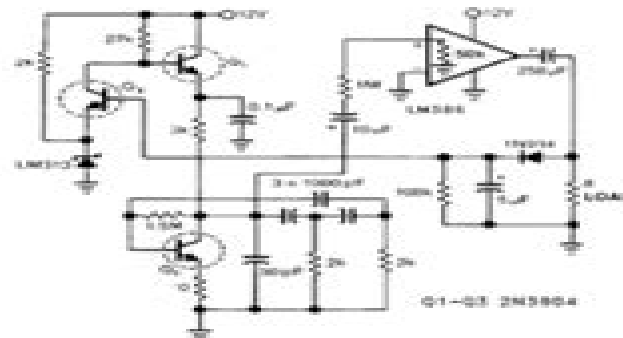


FIGURE 1. Phase-shift sine wave oscillators combine simplicity with versatility. This 12 kHz design can deliver 5 Vp-p to the 8 $\Omega$  load with about 2% distortion.

AN-263

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## **Table of Contents Sine Wave Generation Techniques**

1. Understanding the eBook Sine Wave Generation Techniques
  - The Rise of Digital Reading Sine Wave Generation Techniques
  - Advantages of eBooks Over Traditional Books
2. Identifying Sine Wave Generation Techniques
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Sine Wave Generation Techniques
  - User-Friendly Interface

4. Exploring eBook Recommendations from Sine Wave Generation Techniques
  - Personalized Recommendations
  - Sine Wave Generation Techniques User Reviews and Ratings
  - Sine Wave Generation Techniques and Bestseller Lists
5. Accessing Sine Wave Generation Techniques Free and Paid eBooks
  - Sine Wave Generation Techniques Public Domain eBooks
  - Sine Wave Generation Techniques eBook Subscription Services
  - Sine Wave Generation Techniques Budget-Friendly Options
6. Navigating Sine Wave Generation Techniques eBook Formats
  - ePub, PDF, MOBI, and More
  - Sine Wave Generation Techniques Compatibility with Devices
  - Sine Wave Generation Techniques Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Sine Wave Generation Techniques
  - Highlighting and Note-Taking Sine Wave Generation Techniques
  - Interactive Elements Sine Wave Generation Techniques
8. Staying Engaged with Sine Wave Generation Techniques
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Sine Wave Generation Techniques
9. Balancing eBooks and Physical Books Sine Wave Generation Techniques
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Sine Wave Generation Techniques
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Sine Wave Generation Techniques
  - Setting Reading Goals Sine Wave Generation Techniques
  - Carving Out Dedicated Reading Time

12. Sourcing Reliable Information of Sine Wave Generation Techniques
  - Fact-Checking eBook Content of Sine Wave Generation Techniques
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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