

连接/参考器件

AD9834	75 MHz完整低功耗DDS
AD5620	12位电压输出nanoDAC®

用于AD9834波形发生器(DDS)的幅度控制电路

电路功能与优势

图1所示电路提供一种简单的方法，可控制75 MHz低功耗(20 mW)波形发生器(DDS) AD9834的输出波形幅度。

DDS(直接数字频率合成器)器件能够产生正弦波、方波和三角输出波形，因此可以用作波形发生器。

AD9834内置相位调制和频率调制功能。不过，为了调制输出信号的幅度，需要一个低功耗DAC或数字电位计来设置满量程电流。可以利用一个电压输出DAC，通过一个串联

电阻驱动AD9834的FS ADJUST引脚，从而决定满量程DAC电流的幅度。

本例所用的DAC为nanoDAC系列的12位AD5620。它内置一个5 ppm/°C片内基准电压源，配有SPI接口，采用8引脚SOT-23或MSOP封装。低功耗(3.3 V电源时为2.2 mW)和小尺寸(8引脚SOT-23)的特点，使得AD5620非常适合从AD9834产生幅度调制输出。

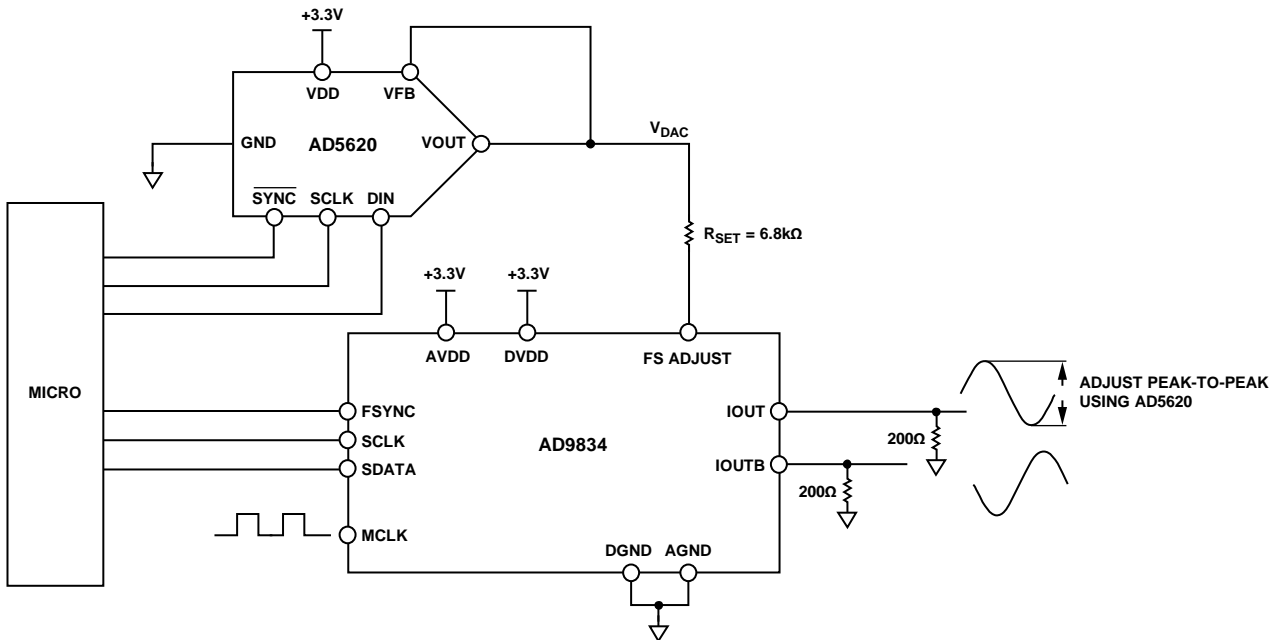


图1. 用于AD9834 DDS的低功耗幅度控制电路(原理示意图：未显示所有连接和去耦)

Rev. A

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电路描述

该电路采用3 V至5 V单电源供电。DAC和DDS均采用SPI接口工作。许多DDS器件的片内DAC都能为AD9834 DDS提供互补电流输出IOUT和IOUTB。

DAC的基准电流是内部基准电压 V_{REF} 和外部电阻 R_{SET} 的函数，该电阻一般从DAC FS ADJUST引脚接地。基准电流等于 V_{REF}/R_{SET} ，其中 V_{REF} 是AD9834的内部基准电压，典型值为1.20 V。 R_{SET} 电阻的典型值为6.8 k Ω 。

DAC的满量程电流是基准电流的倍数。例如，AD9834的满量程电流为：

$$I_{FULLSCALE} = 18 \times (V_{REF} / R_{SET})$$

如果FS ADJUST连接到一个可变电压 V_{DAC} ，则满量程电流为：

$$I_{FULLSCALE} = 18 \times (V_{REF} - V_{DAC}) / R_{SET}$$

改变 V_{DAC} 将改变满量程电流，从而改变DDS器件的电压输出。可以利用一个电压输出DAC提供该可变电压。

AD5620是一种适用的低功耗、小尺寸、高性价比解决方案。它属于nanoDAC系列，内置一个5 ppm/ $^{\circ}$ C片内基准电压源，采用8引脚SOT-23或MSOP封装，输出电压为0 V至+2.5 V。

当 $V_{DAC} = 0$ V(零电平)时，达到最大满量程输出电流，AD9834的电流在约0.16 mA至约3.12 mA之间变化。负载电阻为200 Ω 时，AD9834的输出电压在约0.032 V至约0.624 V之间变化。AD9834 IOUT引脚上的输出电压如图2所示，其中DDS输出频率设为1 MHz。

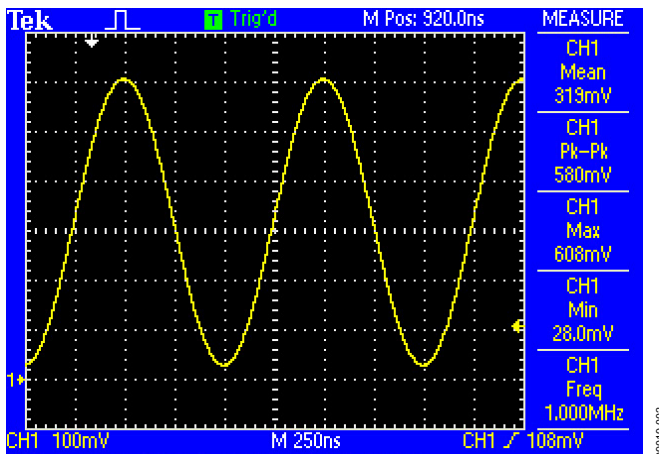


图2. 幅度控制DAC设为0 V时的DDS输出
(此时产生DDS最大满量程输出)

提高AD5620的电压输出将降低AD9834的满量程输出电流。当AD5620的输出电压等于 V_{REF} 或1.20 V时，达到最小满量程电流。

图3显示半量程输出电流对应的AD9834输出电压，其中 $V_{DAC} = 0.5 \times V_{REF}$ 或0.6 V。

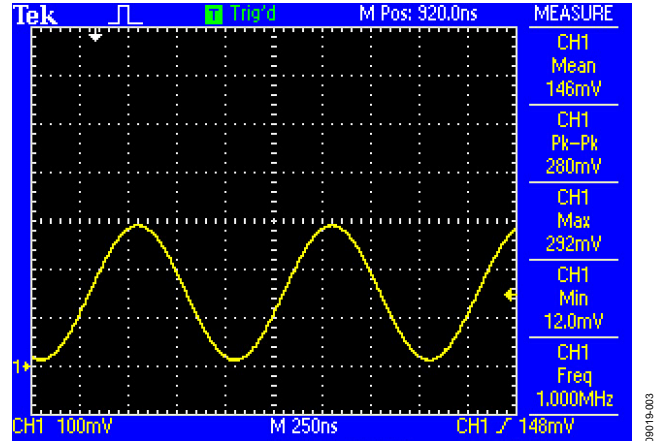


图3. 幅度控制DAC设为0.6 V时的DDS输出
(此时产生半量程DDS输出)

本电路必须构建在具有较大面积接地层的多层电路板上。为实现最佳性能，必须采用适当的布局、接地和去耦技术(请参考指南MT-031和指南MT-101)。

常见变化

AD5640和AD5660分别是AD5620的14位和16位版本，适合需要较高分辨率的应用。AD9833可提供与AD9834相同的功能，但不具有幅度调制能力。

了解详情

ADIsimDDS Design and Evaluation Tool.

Kester, Walt. *The Data Conversion Handbook*. 2005. Chapters 3, 7, and 8. Analog Devices.

MT-015 Tutorial, *Basic DAC Architectures II: Binary DACs*. Analog Devices.

MT-031 Tutorial, *Grounding Data Converters and Solving the Mystery of AGND and DGND*. Analog Devices.

MT-085 Tutorial, *Fundamentals of Direct Digital Synthesis (DDS)*. Analog Devices.

MT-101 Tutorial, *Decoupling Techniques*. Analog Devices.

Riordan, Liam. AN-1070 Application Note, *Programming the AD9833/AD9834*. Analog Devices.

数据手册和评估板[AD9834 Data Sheet](#)[AD9834 Evaluation Board](#)[AD5620 Data Sheet](#)[AD5620 Evaluation Board](#)**修订历史****2013年7月—修订版0至修订版A**

更改“电路描述”部分和图3标题2

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