

## 利用 AD5412 提供 12 位电压和 4 mA 至 20 mA 输出简化解决方案

### 电路功能与优势

本电路利用单通道、12 位、串行输入、单极性/双极性电压、4 mA 至 20 mA 电流源 DAC AD5412, 提供单极性/双极性电压和 4 mA 至 20 mA 输出。它只需用产品 AD5412, 所需外部元件只有电源引脚和参考输入上的去耦电容, 以及用于开漏故障输出的上拉电阻。当电流输出端丧失兼容电压或 AD5412 温度过高时, 开漏故障输出会予以警示。这款解决方案具有很高的集成度, 可节省成本和电路板空间。本电路非常适合工业控制应用中的可编程逻辑控制器(PLC)和分布式控制系统(DCS)。

### 电路描述

AD5412 是一款低成本、精密、高度集成的 12 位数模转换器, 提供可编程电流源和可编程电压输出, 针对工业过程控制应用的要求而设计。电压输出范围可通过编程设置为 0 V 至 +5 V、0 V 至 +10 V、-5 V 至 +5 V 或 -10 V 至 +10 V。电流输出通过一个独立的引脚访问, 可通过编程设置为 4 mA 至 20 mA、0 mA 至 20 mA 或 0 mA 至 24 mA。AD5412 内置一个 5 V、10 ppm/°C (最大值) 基准电压源, 从而可以进一步节省成本和电路板空间。额定工作电压为: AV<sub>DD</sub> 电源电压最高达 24 V, AV<sub>SS</sub> 电源电压最高达 -24 V。不过, AD5412 能够以最高 40 V 的 AV<sub>DD</sub> 电源电压工作。该器件含有 4.5 V 片内稳压输出 (DV<sub>CC</sub> 引脚), 能够提供最大 5 mA 源电流。这可以用作上拉电阻的端电极, 或者为数字电路供电, 从而无需产生逻辑电源电压。

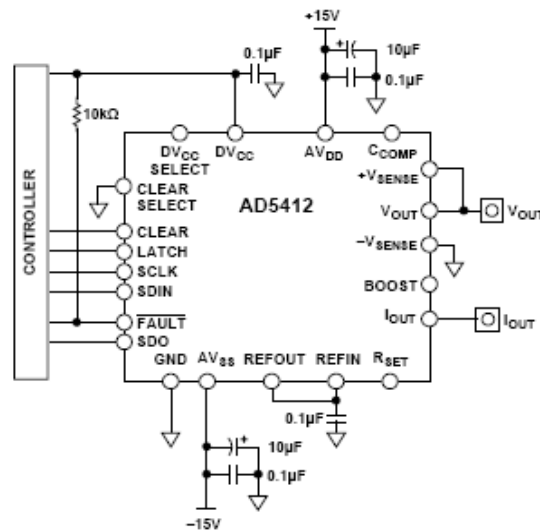


图1. AD5412 电路配置 (原理示意图)

Rev.0

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图 2和图 3显示，本电路在 25°C环境温度时的电流输出和电压输出典型精度均优于 0.011%。

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（请参考教程MT-031—“实现数据转换器的接地并解开AGND和DGND的迷团”，以及教程MT-101—“去耦技术”）。

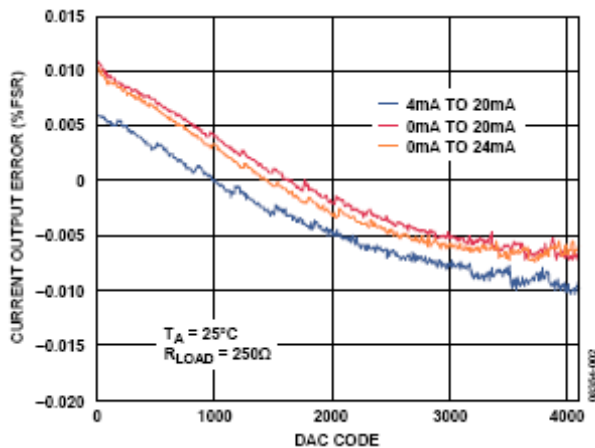


图 2. 电流输出精度

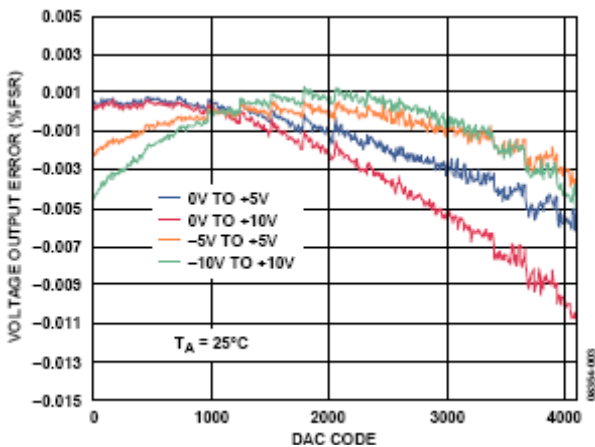


图 3. 电压输出精度

## 进一步阅读

Kester, Walt. 2005. *The Data Conversion Handbook*. Analog Devices. Chapters 3 and 7.  
 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-101 Tutorial, *Decoupling Techniques*. Analog Devices.  
 Voltage Reference Wizard Design Tool.

## 数据手册和评估板

AD5412 Data Sheet.  
 AD5422 Evaluation Board (Compatible with AD5412).

## 修订历史

7/09—Revision 0: Initial Version

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