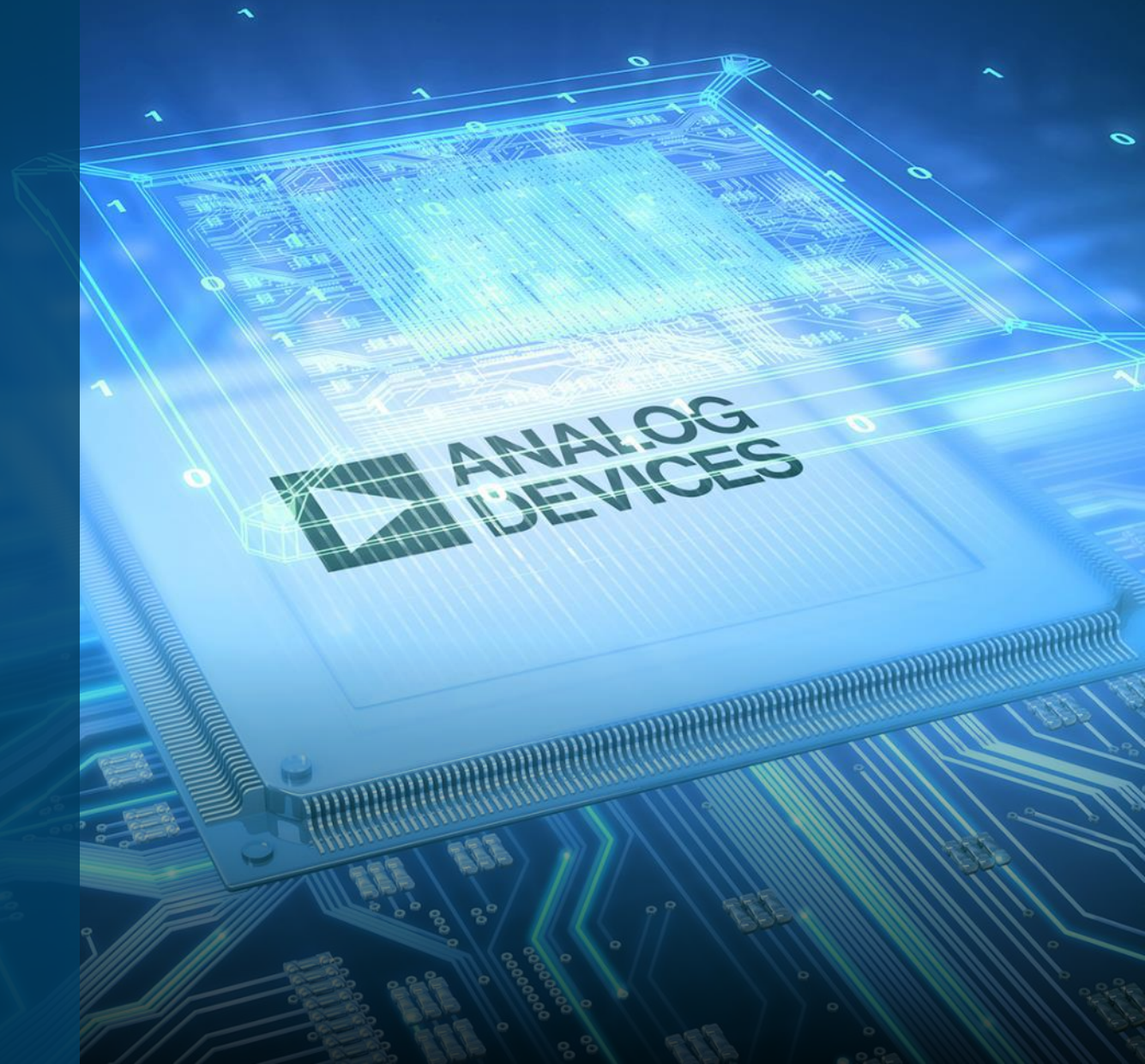
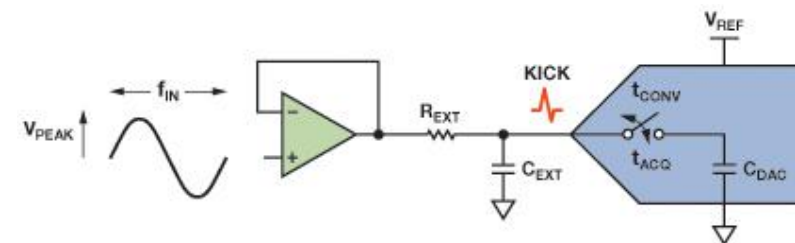


让精密信号链设计更容易



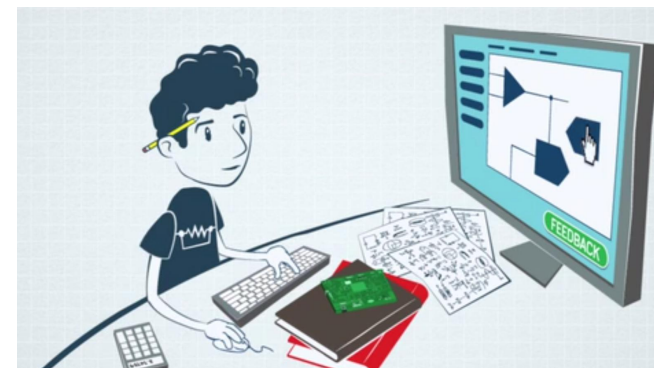
► 易使用的ADC

- 信号链架构的设计考虑
- 易驱动的ADC
- μ Module®数据采集解决方案



► 设计工具

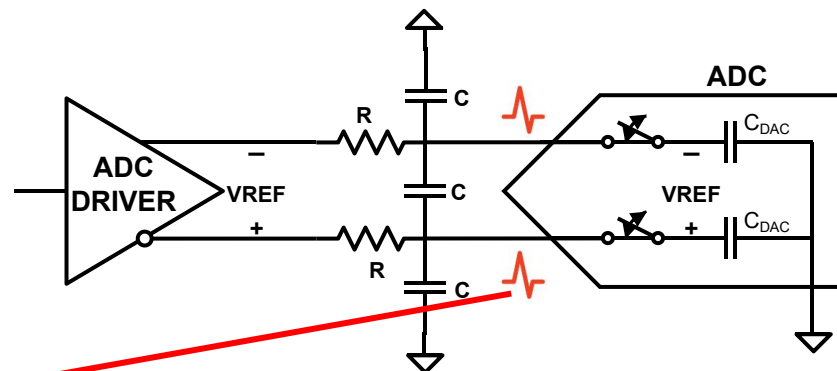
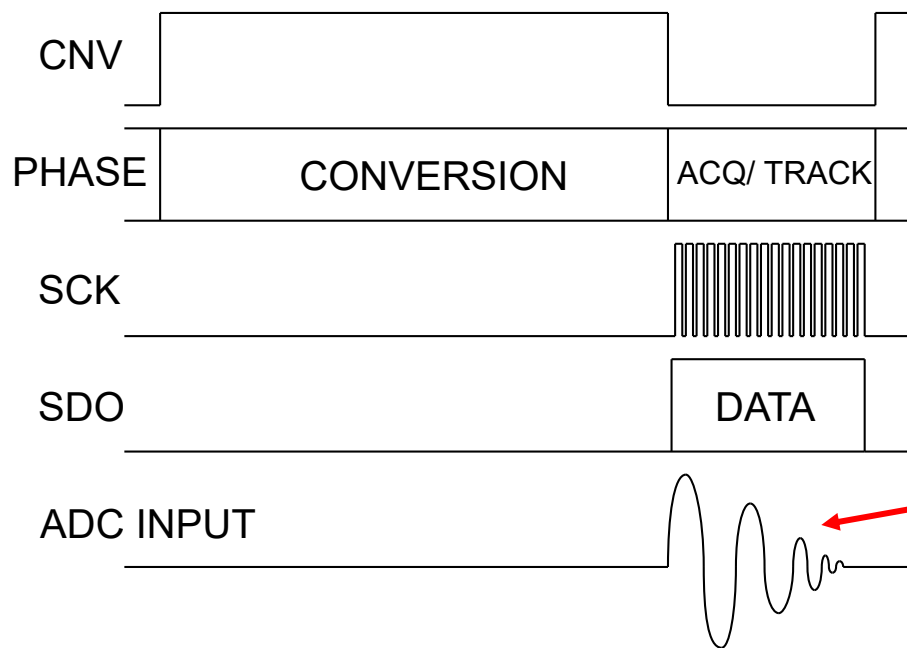
- 基于电路
- 基于产品



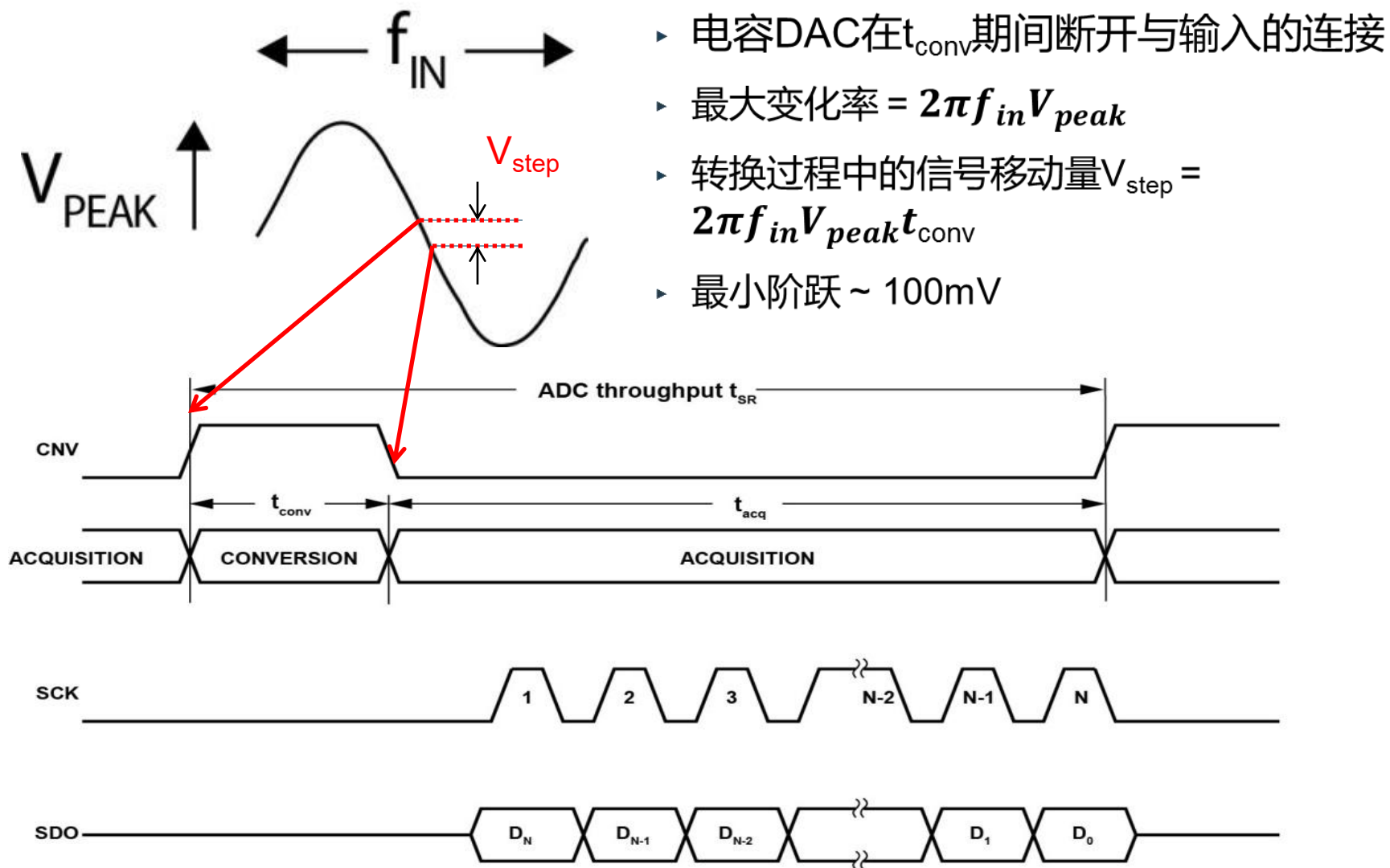
信号链架构的设计考虑

SAR ADC操作

传统SAR

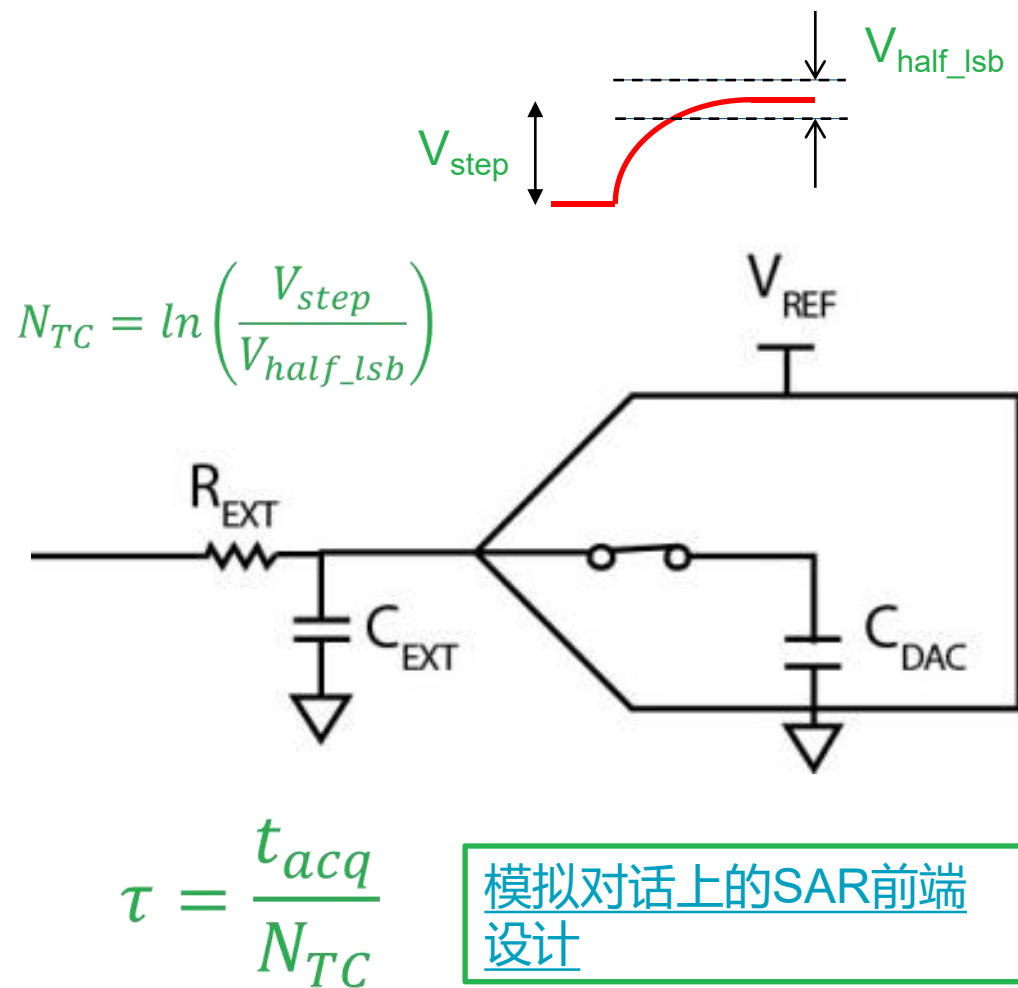


计算RC滤波器带宽

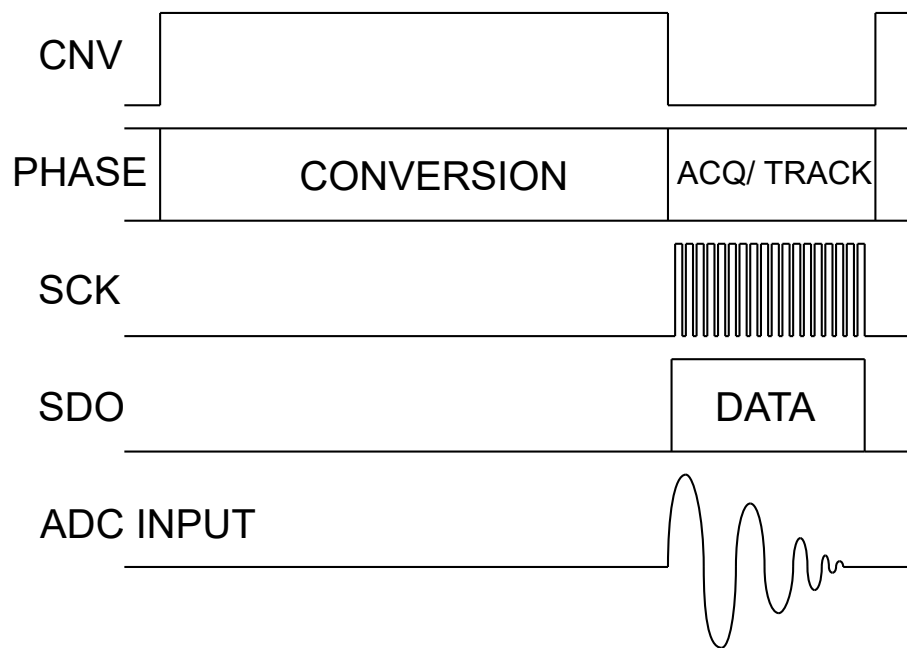


计算RC滤波器带宽

- ▶ 需要在 t_{acq} 内将其余阶跃建立为一半LSB
- ▶ N_{TC} 为针对指数式建立计算的时间常数数量
- ▶ 所需的RC时间常数(τ)是采集时间除以时间常数数量
- ▶ 或RC BW = $\frac{1}{2\pi\tau}$
- ▶ 请注意，带宽与器件采集时间直接相关

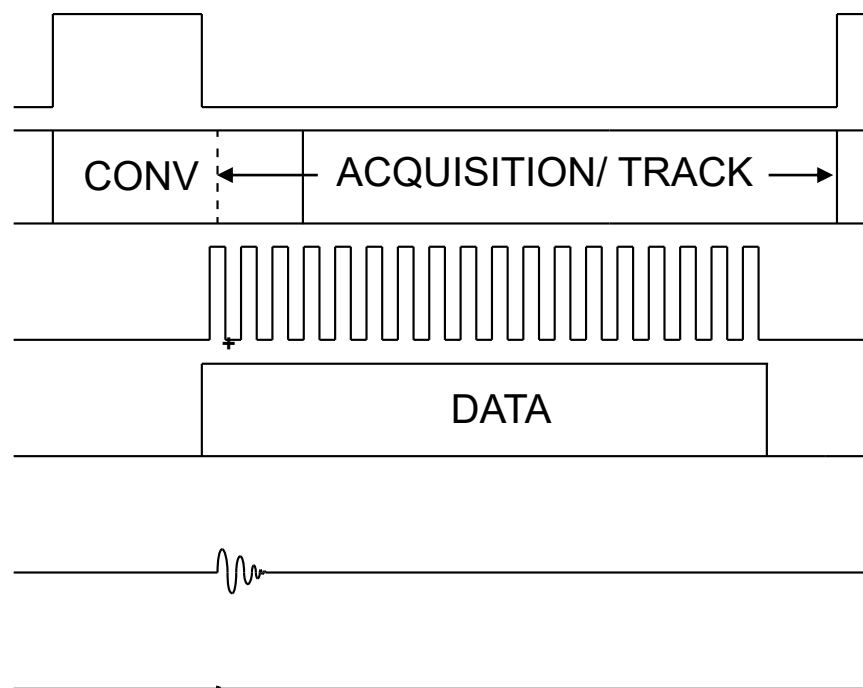


传统SAR



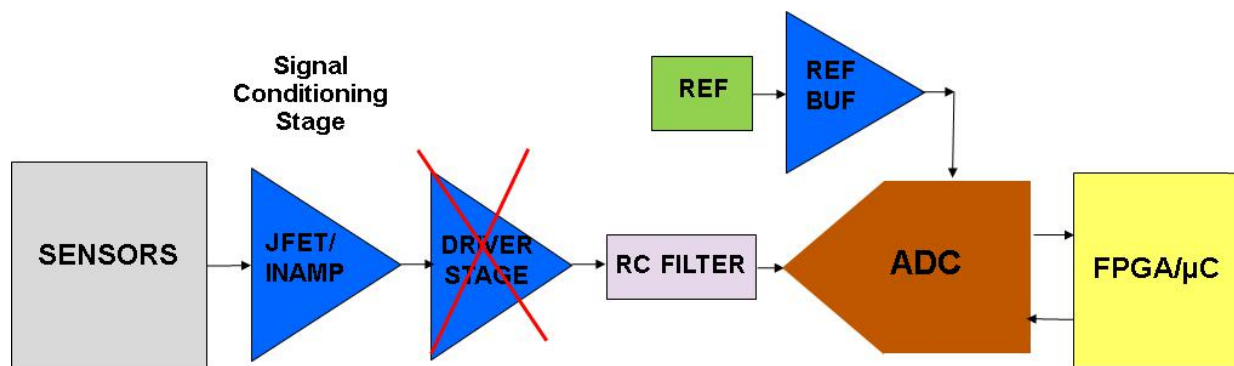
ADC输入高阻态使能

新型SAR ADC架构

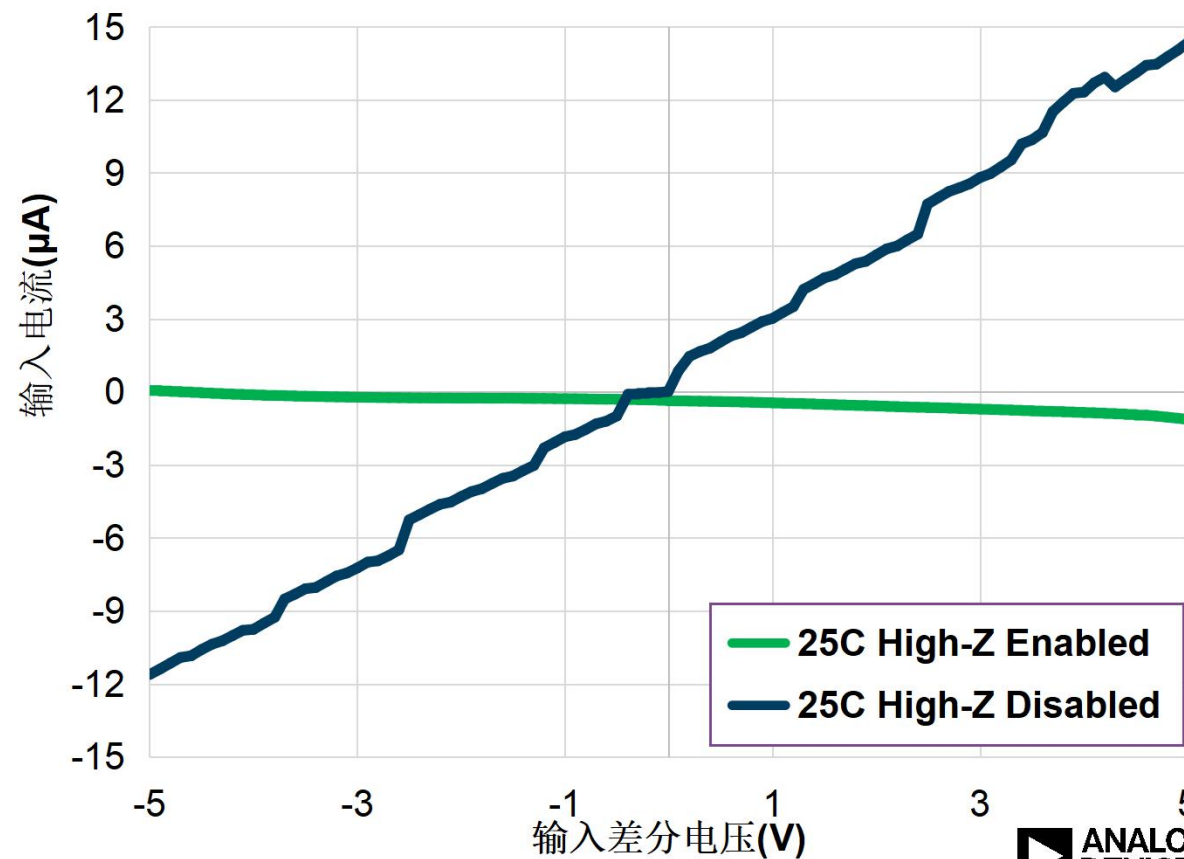


高阻态模式—优势

- ▶ 利用低功耗/带宽放大器实现低输入电流并改善THD。
- ▶ ADC可以直接由精密放大器或信号调理级驱动。
- ▶ 当目标输入频率很低($<10\text{kHz}$)时，不需要使用专用高速ADC驱动器。



典型信号链

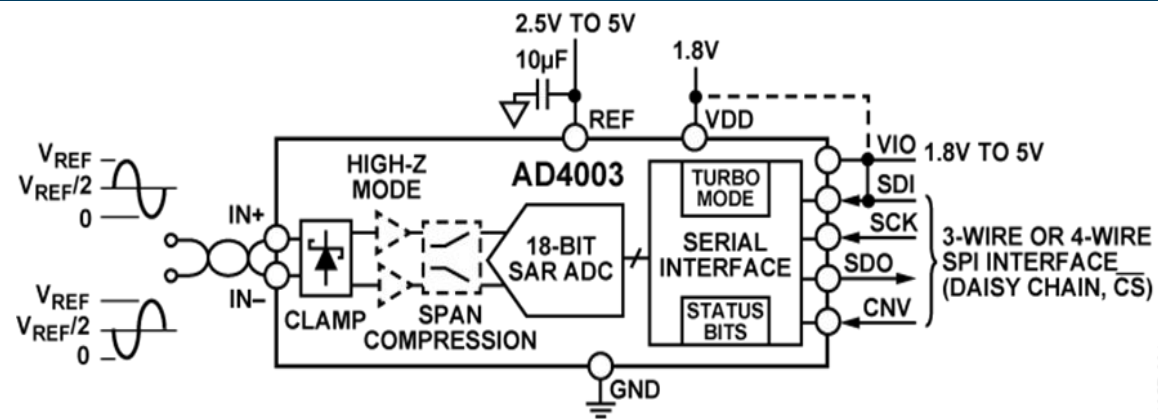


AD4003系列：20位、1.8 MSPS和18/16位、2 MSPS/1 MSPS/0.5 MSPS

易驱动的SAR ADC系列

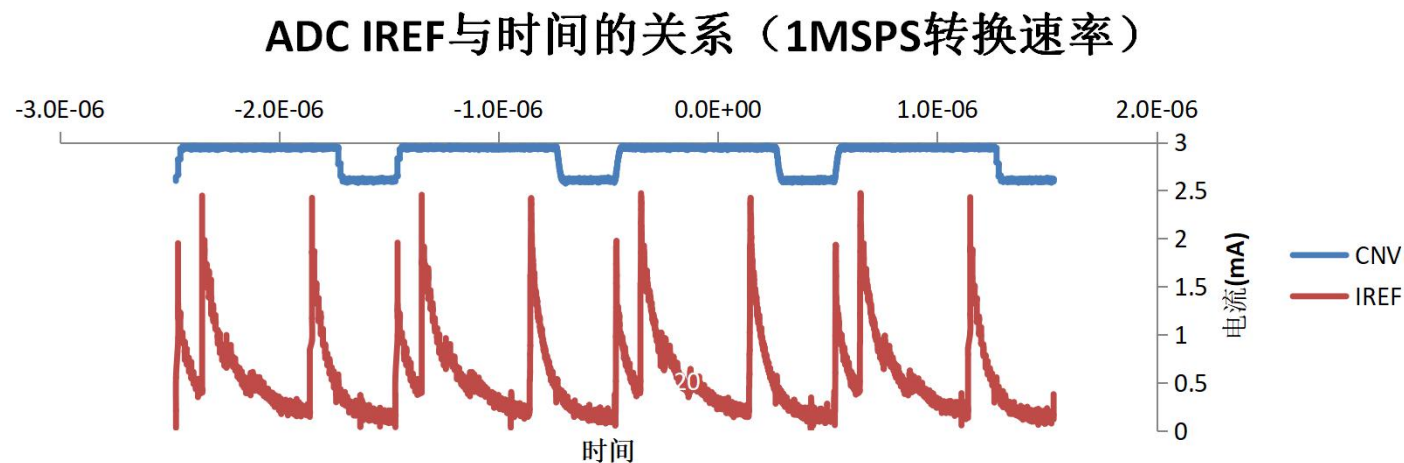
主要优势

- ▶ **易驱动**
 - 当目标带宽较低时，高阻态模式和长采集阶段支持使用低功耗、高精度ADC驱动放大器
 - 降低信号链功耗
- ▶ **易于提供数字接口**
 - 低SPI时钟速率要求降低I/O功耗并简化数字隔离要求
- ▶ **降低对外部电路的敏感度**
 - 降低对RC噪声滤波器中电阻值的性能敏感度
- ▶ **轻松实现数据手册性能**
 - 减少设计时间、调试和风险



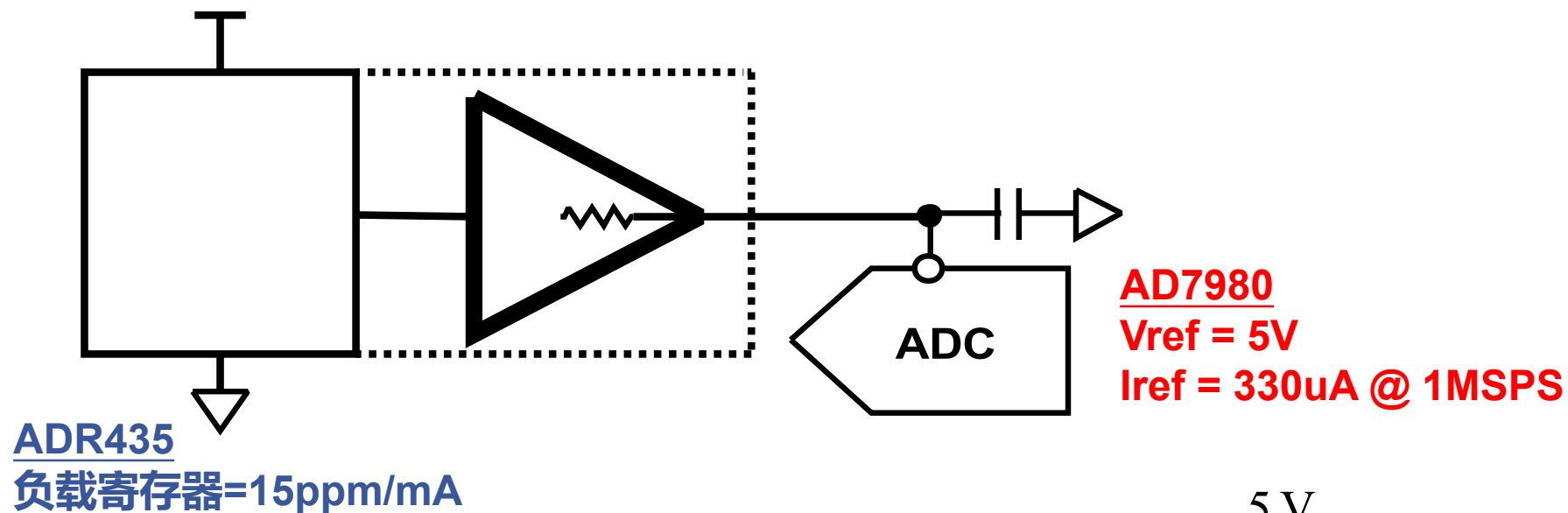
通用型号	说明 分辨率、速度、Ain输入[封装]
AD4000	16位、2 MSPS、单端[MSOP、CSP]
AD4001	16位、2 MSPS、差分[MSOP、CSP]
AD4002	18位、2 MSPS、单端[MSOP、CSP]
AD4003	18位、2 MSPS、差分[MSOP、CSP]
AD4004	16位、1 MSPS、单端[MSOP、CSP]
AD4005	16位、1 MSPS、差分[MSOP、CSP]
AD4006	18位、1 MSPS、单端[MSOP、CSP]
AD4007	18位、1 MSPS、差分[MSOP、CSP]
AD4008	16位、500 kSPS、单端[CSP]
AD4010	18位、500 kSPS、单端[CSP]
AD4011	18位、500 kSPS、差分[CSP]
AD4020	20位、1.8 MSPS、差分[MSOP、CSP]

SAR基准电压输入



- ◆ 使用**500**欧姆电阻测得的电流
 - 电流尖峰高达**2.5mA**
- ◆ 需要大储能电容，以获得稳定的基准电压
 - 通常为**10uF**或以上
 - 减少基准电压源驱动时的负担
- ◆ 基准电压源电路在转换之间为储能电容充电
 - **ADC**基准电流规定为特定吞吐速率时的平均电流
 - 平均电流与采样速率成比例

基准电压源输出驱动



$$R_o = \frac{5V * 15 ppm / mA}{1000} = 0.075 ohm \quad \checkmark \quad R_{o_max} = \frac{V_{half_lsb}}{I_{REF}} = \frac{5V}{330\mu A} = 0.115 \Omega$$

- ▶ 带隙基准电压源可以包含缓冲器(ADR43X, ADR45XX)
 - 否则, 可以使用合适的运放
- ▶ 电流负载应使基准电压下降小于0.5lsb
 - 突发模式工作是最差的情况
- ▶ 基准电压源的输出电流大于总基准输入电流的平均值

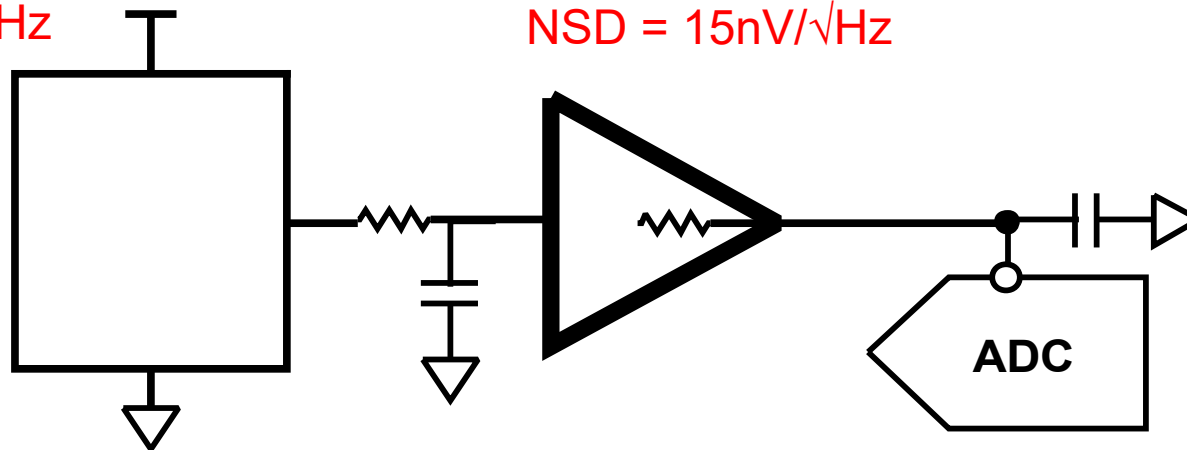
缓冲器噪声

ADR435

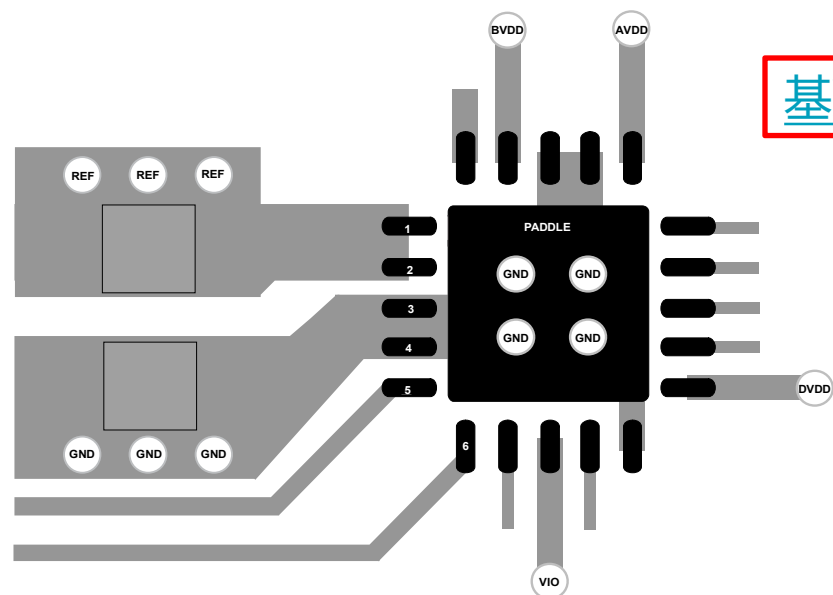
NSD = $115\text{nV}/\sqrt{\text{Hz}}$

AD8031

NSD = $15\text{nV}/\sqrt{\text{Hz}}$



- ◆ 同样地，也可以估计缓冲器的噪声
 - 需要估计在 $10\mu\text{F}$ 负载($\sim 16\text{KHz}$)情况下的带宽
 - 缓冲器噪声影响 $\sim 2.4\mu\text{V}$
- ◆ 基准电压源通常是主要噪声源
 - 假设选择噪声相对较低的缓冲器
- ◆ 如果使用缓冲器，则可通过RC对基准电压噪声进行限带处理
 - 可使用极低的截止频率（耦合 100Hz ）



基准电压源设计 - 模拟对话

◆ 储能电容布局至关重要

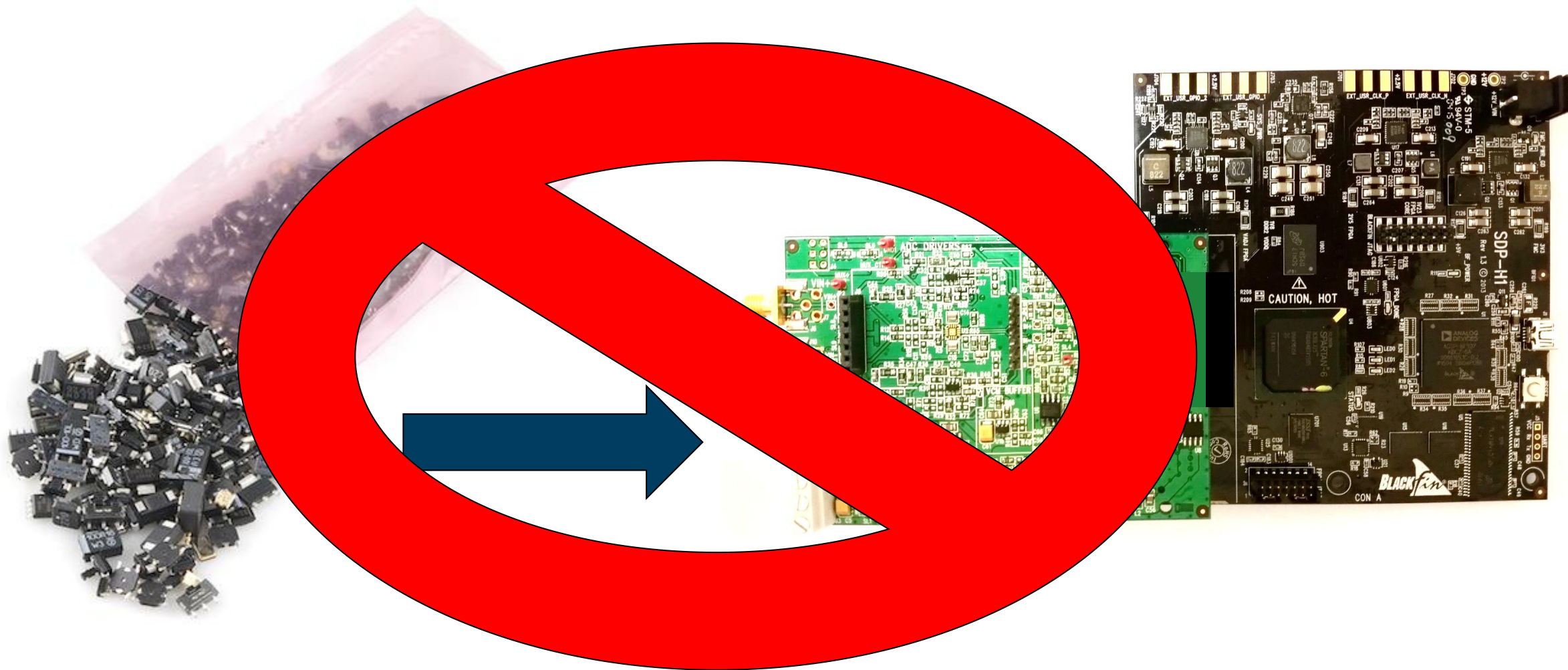
- 尽量靠近ADC基准引脚
- 使用宽走线连接
- 低阻抗接地路径或基准接地引脚（如有）

◆ 电容选择

- 低ESR
- 陶瓷X5R或X7R
- 越大越好，高达10uF，但取决于ADC电流要求。

μModule®数据采集解决方案

传统电路板设计



很多情况下，不一定必须如此！

ADI公司为何制定DAQ和DRIVE μ Module战略?

客户情况变化

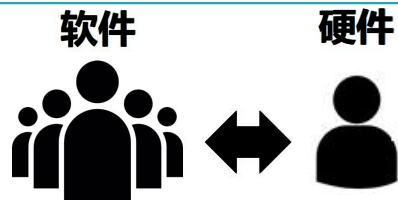
专业知识
在别处



传感器专家

算法/数据科学
专家

硬件专业技能
在减少



区分其产品
通过软件应用程序
和服务

软硬件之比++++

客户需求

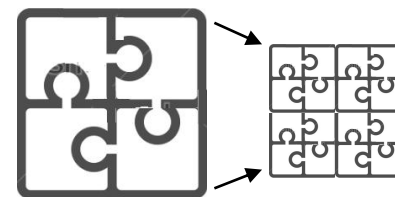
上市时间
缩短



需要控制
研发预算, 设计
复杂性提高

需要更完整的
解决方案

更多功能
更小尺寸

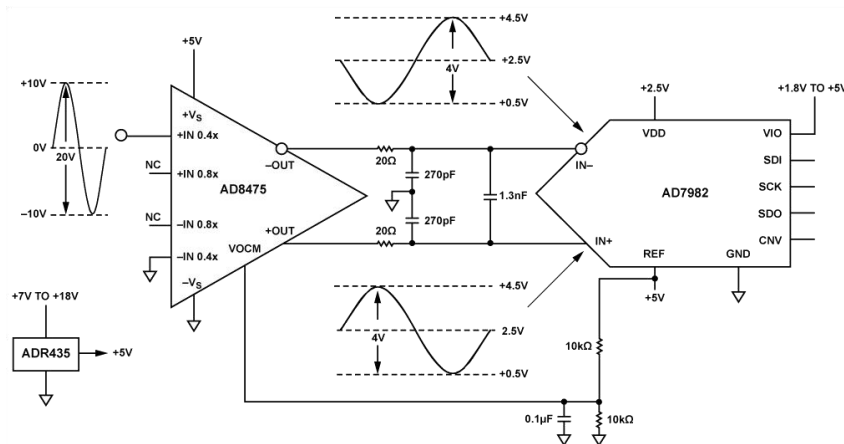


热密度
限制

突破PCB密度限制
良率和性能损失
增加

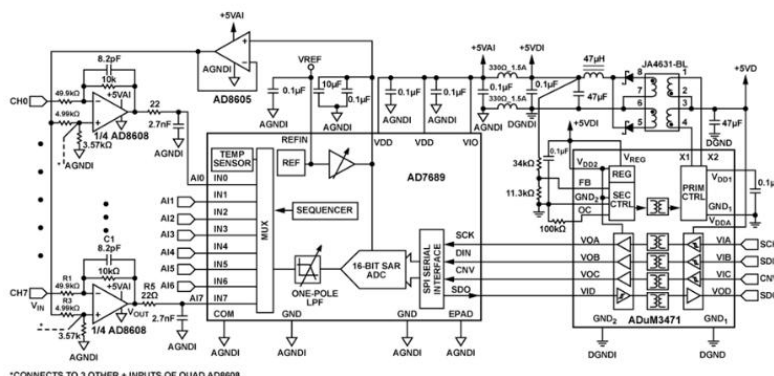
实现精密DAQ解决方案的障碍有哪些 - 快速?

很困难



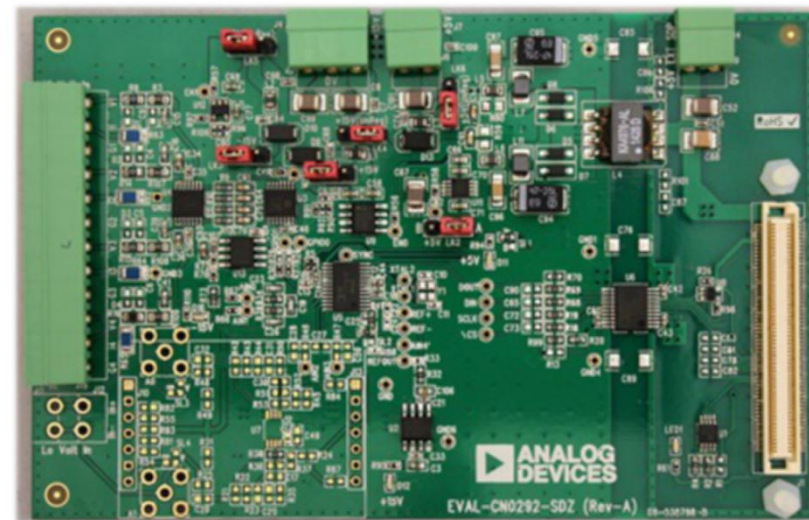
- ▶ ADC驱动、滤波和信号链偏置
- ▶ 很难实现数据手册性能

需要许多器件



- ▶ 每个测量通道的信号调理
- ▶ 多个电源轨

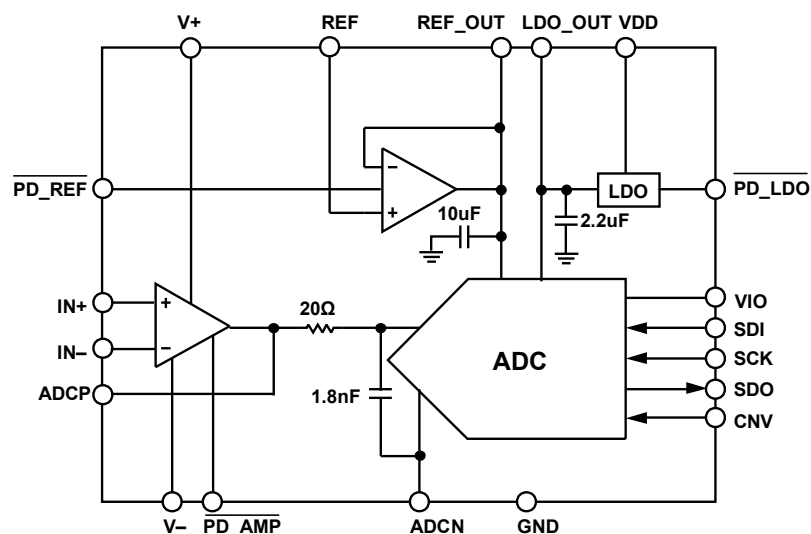
占用大量PCB空间



- ▶ 带有许多外部元件的多个IC

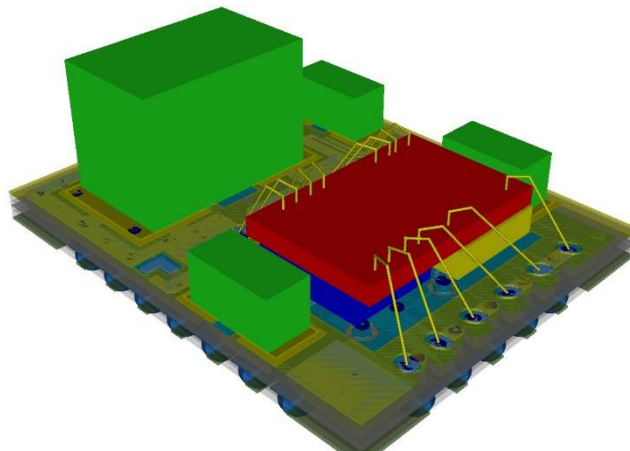
AD AQ μ Module如何解决此问题?

鲁棒的构建模块



- ▶ 信号路径的清晰实施
- ▶ 保证精度性能

集成主要器件



- ▶ 只需极少的外部器件
- ▶ 仍然足够灵活，适应各种各样的应用

高密度封装



- ▶ 在单个封装中集成信号链
- ▶ 卓越的质量和可靠性额定值

为什么是 μ Module解决方案?

优势.....

► 数据手册规格涵盖了更多信号链内容

- 提高制造产量。降低制造成本
- 提高PCB性能可重复性和良率
- 删除/减少制造中的硬件校准

► 缩短精密DAQ和DRIVE系统的开发周期

- 将器件选择、优化和布局等设计负担从设计人员转移到器件
- 加速产品上市

► 改进某些系统级性能规格

► 提高解决方案密度而不影响性能

► 简化BOM和供应链管理

- 减少与库存和管理大量不同器件相关的间接成本

ADI供应链管理

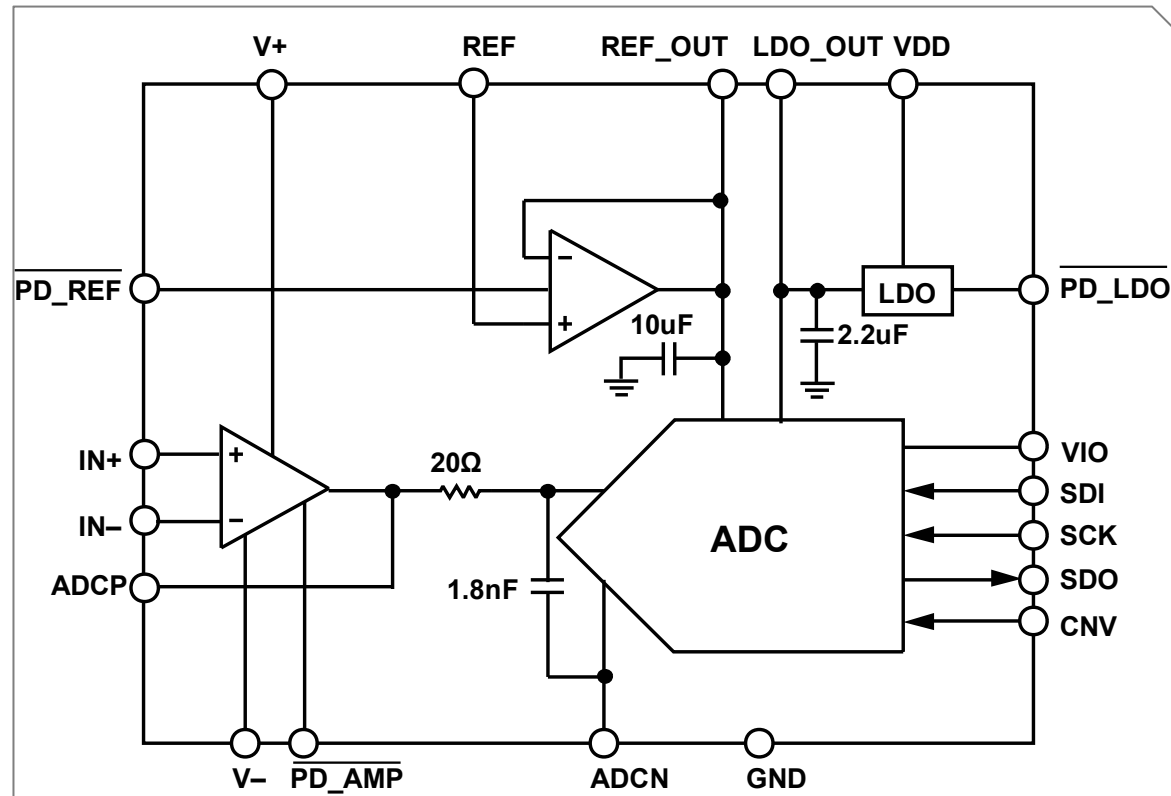
- ▶ **外部采购的任何无源器件都有两家供应商**
 - 所有来源提供的无源器件组合都适合 μ Module
 - 采用与传统产品相同的工艺和 workflows，器件完全符合认证要求
- ▶ **目前， μ Module DAQ解决方案中包含的全部有源器件均由ADI公司设计**
 - ADI公司对产能需求进行控制和监管，以制造用于构建 μ Module解决方案的IC
 - ADI公司有避免产品过时的悠久历史
 - 根据决策因素，第三方有源器件可以集成到 μ Module中
- ▶ **ADI公司开发并维护对完整 μ Module的最终出厂测试解决方案**
 - 整个信号链以与传统器件相同的方式进行测试

ADAQ7980: 16位、1 MSPS μ Module数据采集系统

- ▶ 数据采集解决方案采用 5 mm $\times$ 4 mm封装
- ▶ 集成SAR ADC、ADC驱动器、基准电压源缓冲器、LDO和关键无源器件
- ▶ 灵活的电源和输入范围以及灵活的ADC驱动放大器配置

主要优势

- ▶ 集成度与灵活性之间达成平衡，提供小尺寸解决方案而不影响性能
- ▶ 数据手册涵盖了更多信号链内容，缩短产品上市时间和开发成本
- ▶ 集成水平仍然允许器件适应各种各样的应用和系统参数



ADI信号链总结

- ▶ 驱动ADC可能很复杂
- ▶ 易驱动的ADC：[AD4003系列](#)
- ▶ μ Module数据采集系统：[ADAQ7980系列](#)

Part Number	Channels	Bits bits	Sample Rate max SPS	ADC SNR in dBFS typ dBFS	INL in LSB typ LSBs	Device Architecture	Input Type	Output Data Format	Power typ W
ad40	12 Values Selected ▼	14 Values Selected ▼	6.8 10M	60 148	0.04 2147	9 Values Selected ▼	12 Values Selected ▼	14 Values Selected ▼	21u
12 parts									
AD4004 NEW	1	16	1M	93	0.2	SAR	Pseudo Differential	Serial, SPI	7m
AD4005 NEW	1	16	1M	96.2	0.2	SAR	Differential	Serial, SPI	8m
AD4007 NEW	1	18	1M	100.5	0.4	SAR	Differential	Serial, SPI	8m
AD4011 NEW	1	18	500k	100.5	0.4	SAR	Differential	Serial, SPI	4m
AD4020 NEW	1	20	1.8M	100.5	1	SAR	Differential	Serial, SPI	15m
AD4008 NEW	1	16	500k	93	0.2	SAR	Pseudo Differential	Serial, SPI	2m
AD4002 NEW	1	18	2M	95	0.8	SAR	Pseudo Differential	Serial, SPI	14m
AD4000	1	16	2M	93	0.2	SAR	Pseudo Differential	Serial, SPI	14m
AD4003	1	18	2M	100.5	0.4	SAR	Differential	Serial, SPI	16m
AD4001	1	16	2M						
AD4006	1	18	1M						
AD4010	1	18	500k						

Part Number	Channels	Bits bits	Sample Rate max SPS	ADC SNR in dBFS typ dBFS	INL in LSB typ LSBs	Device Architecture	Input Type	Output Data Format	Power typ W
adaq	12 Values Selected ▼	14 Values Selected ▼	6.8 10M	60 148	0.04 2147	9 Values Selected ▼	12 Values Selected ▼	14 Values Selected ▼	21u
2 parts									
ADAQ7980	1	16	1000k	91.5	0.5	SAR	Pseudo Differential, SE-Bip, SE-Uni, Single-Ended	QSPI, Serial, SPI	21m
ADAQ7988	1	16	500k	91.5	0.5	SAR	Pseudo Differential, SE-Bip, SE-Uni, Single-Ended	QSPI, Serial, SPI	21m

精密信号链设计工具

MATT DUFF

设计工具集成: LTC + ADI

► LTspice

- LTspice将是合并后公司的首选spice仿真器。已经测试了100个ADI型号并将其导入LTspice库（即将导入更多型号）
- ADIsimPE将被逐步淘汰

现在包括
ADI
放大器

LTspice®



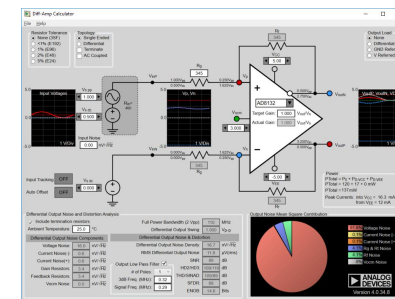
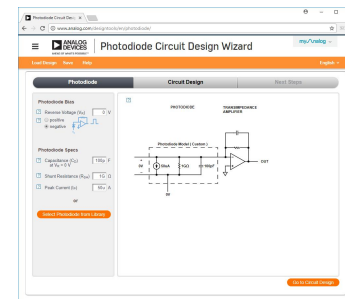
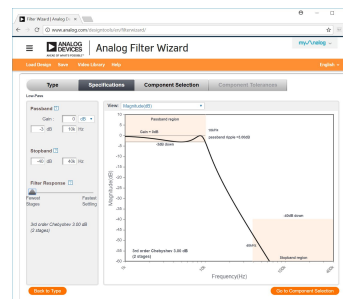
► 设计工具

- 包含LTC器件
 - 滤波器向导
 - 光电二极管向导
 - 差分放大器计算器
 - ADC驱动器工具

现在包括
LTC
放大器

■ 生成LTspice原理图

- 滤波器向导
- 光电二极管向导



设计工具：议题

► 电路模块设计工具

- 滤波器向导
- 光电二极管向导
- 新品：ADC驱动器计算器

► 基于产品

- 仪表放大器：钻石图计算器
- 差分放大器：DiffAmpCalc
- ADC：Virtual Eval

www.analog.com/designtools

The screenshot displays the Analog Devices Design Center website. The top navigation bar includes links for MY HISTORY, PARAMETRIC SEARCH, PRODUCTS, APPLICATIONS, DESIGN CENTER (highlighted), COMMUNITY, EDUCATION, and SUPPORT. Below this, a breadcrumb trail shows the path: ADuCM3029 > Counting... > CN0396 > Circuit Design Tools & Calculators. The main content area is titled "Circuit Design Tools & Calculators" and features a description of the design tools, a list of benefits, and a cartoon illustration of a person using a computer. To the right, there are thumbnails for the "In-Amp Diamond Plot Tool" and "Virtual Eval - BETA". A sidebar on the left lists various design tools and calculators, including "Amplifier & Linear", "Clock & Timing", "Data Converter", "Power Management", and "RF & Synthesis". At the bottom, a section titled "Amplifier and Linear Tools" lists specific tools like "ADI DiffAmpCalc", "ADIsimPE Linear and Mixed-Signal Circuit Simulator - Personal Edition", and "Analog Filter Wizard".

MY HISTORY | PARAMETRIC SEARCH | PRODUCTS | APPLICATIONS | **DESIGN CENTER** | COMMUNITY | EDUCATION | SUPPORT

ADuCM3029 > Counting... > CN0396 > Circuit Design Tools & Calculators

Print My Analog

Circuit Design Tools & Calculators

Analog Devices' Design Tools simplify your design and product selection process through ease of use and by simulating results that are optimized and tested for accuracy. Analog Devices Circuit Design tools are web based or downloadable but always free to use.

- Reduce your testing time and get to the finished product faster
- Overcome engineering challenges and simplify calculations
- Use industry leading products to create the best design
- Be confident in the results and your solution

ADI Design Tools: Helping you through your design challenges.

In-Amp Diamond Plot Tool

Virtual Eval - BETA

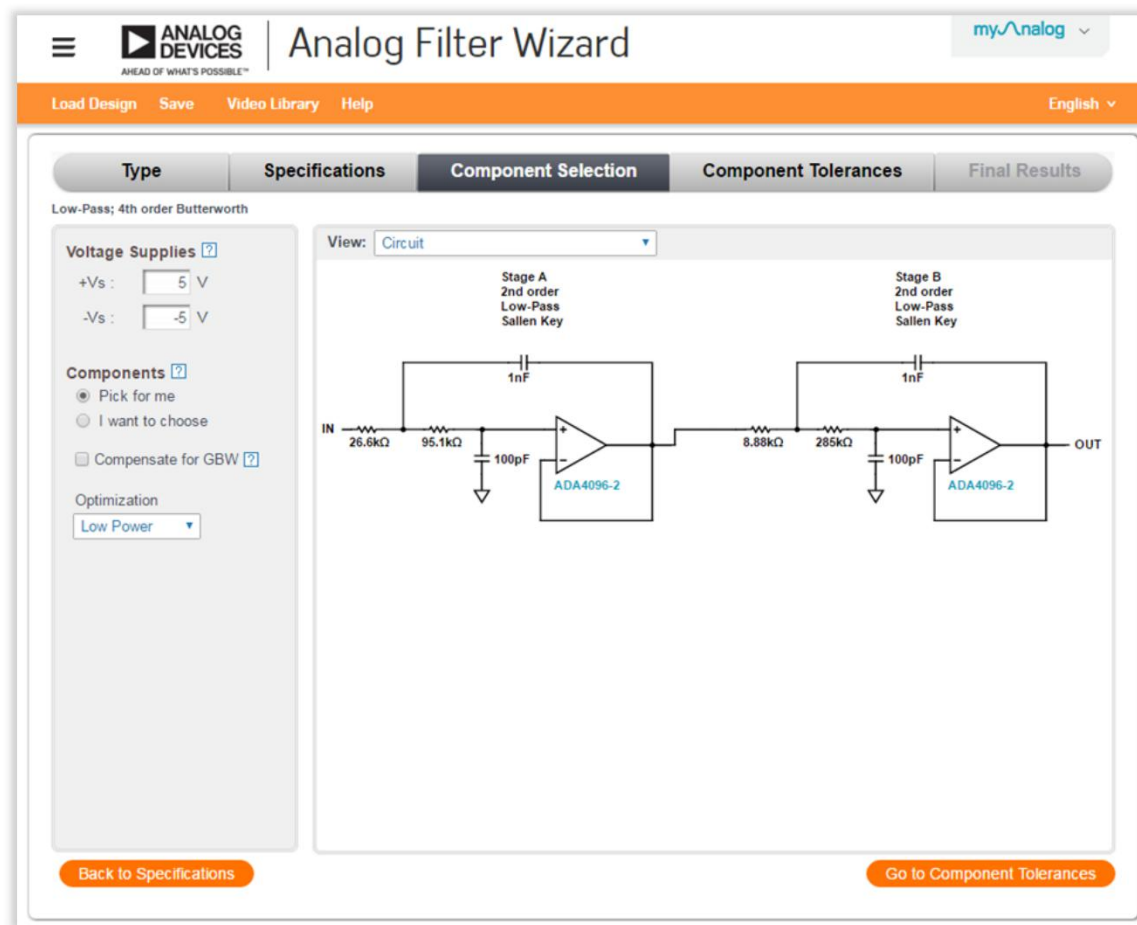
Amplifier and Linear Tools

- ADI DiffAmpCalc
- ADIsimPE Linear and Mixed-Signal Circuit Simulator - Personal Edition
- Analog Filter Wizard

电路模块设计工具

模拟滤波器向导—为何需要模拟滤波器？

- ▶ 降低ADC要求
- ▶ 降低数字后端需求
- ▶ 但设计模拟滤波器很困难
 - 特别是如果使用实际器件



analog.com/filterwizard

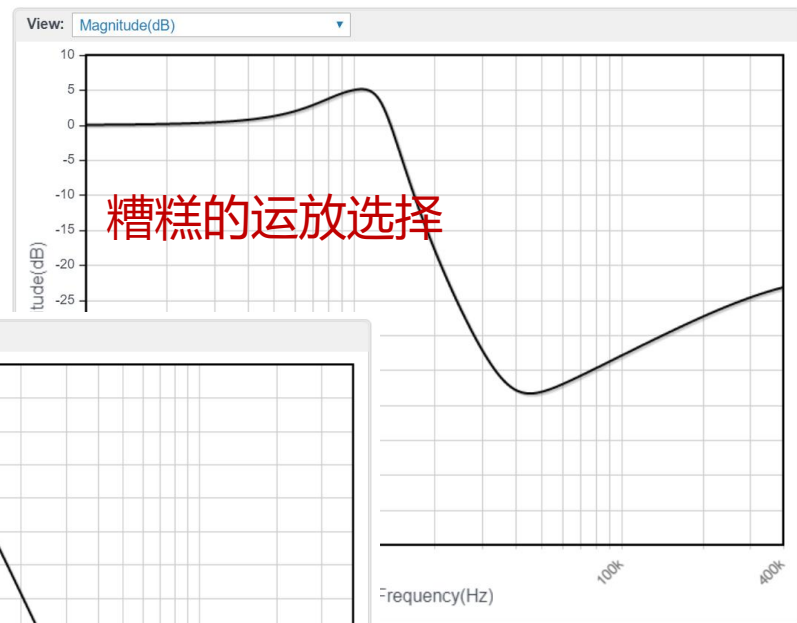
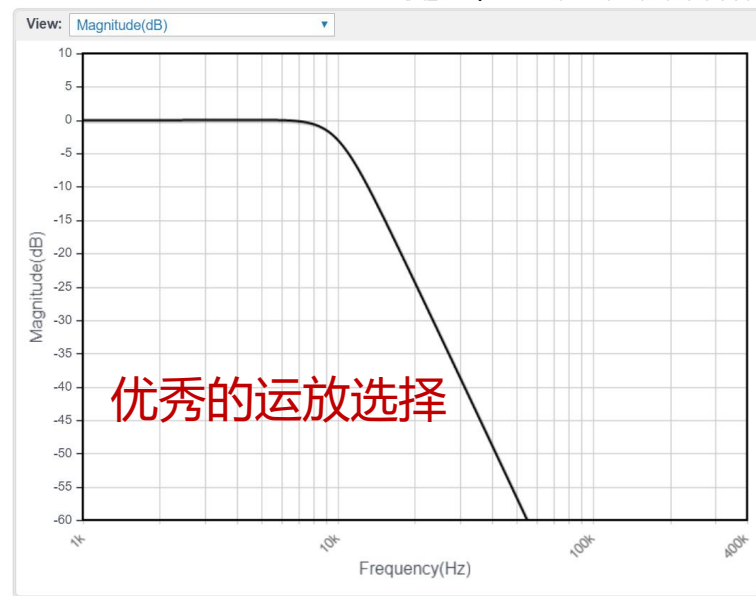
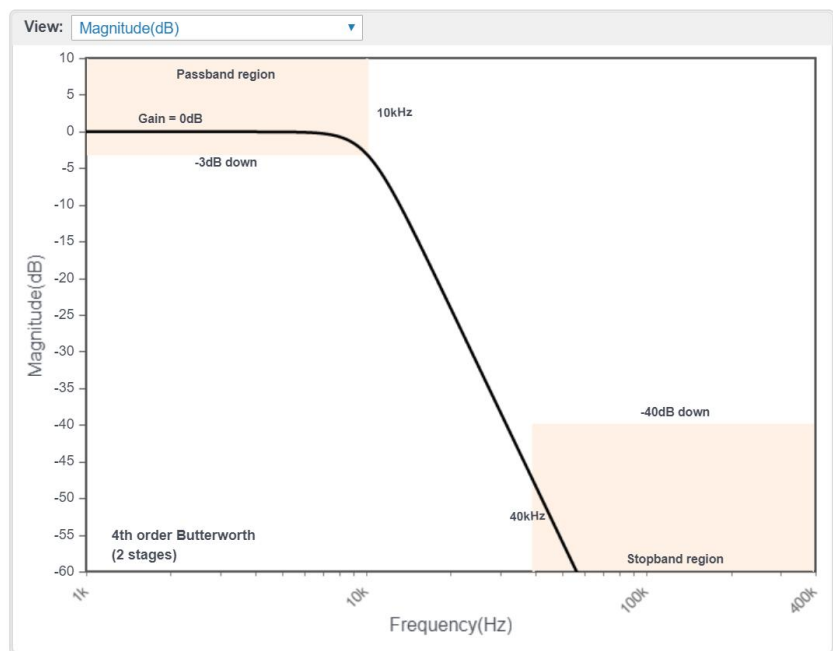
模拟滤波器向导

缩小理想与实际性能之间的差距

- ▶ 设计理想滤波器
- ▶ 然后用实际器件检查
 - 为我选择：让工具针对最佳器件进行优化
 - 我要选择：使用您中意的值

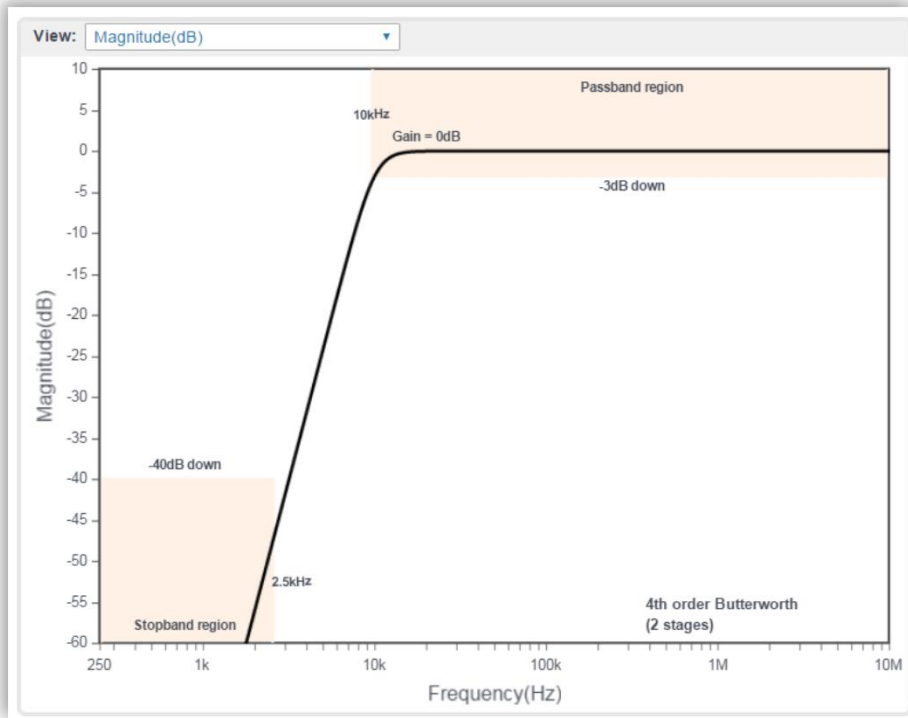
analog.com/filterwizard

理想频率响应

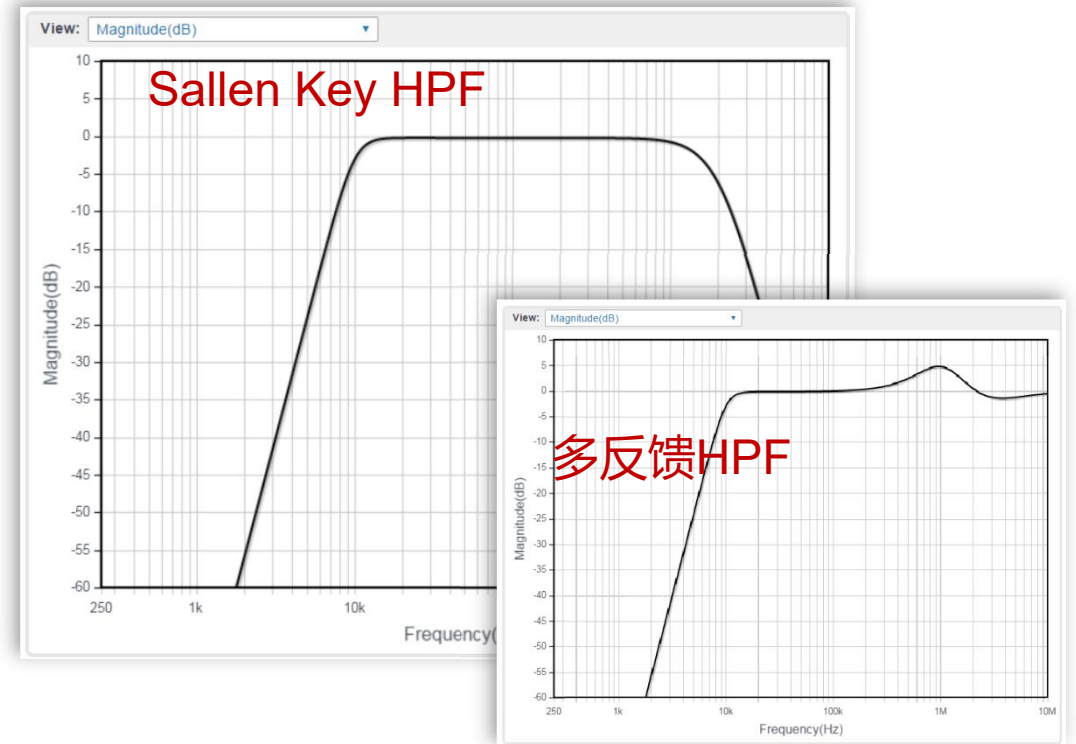


理想性能与实际性能 续...

理想频率响应



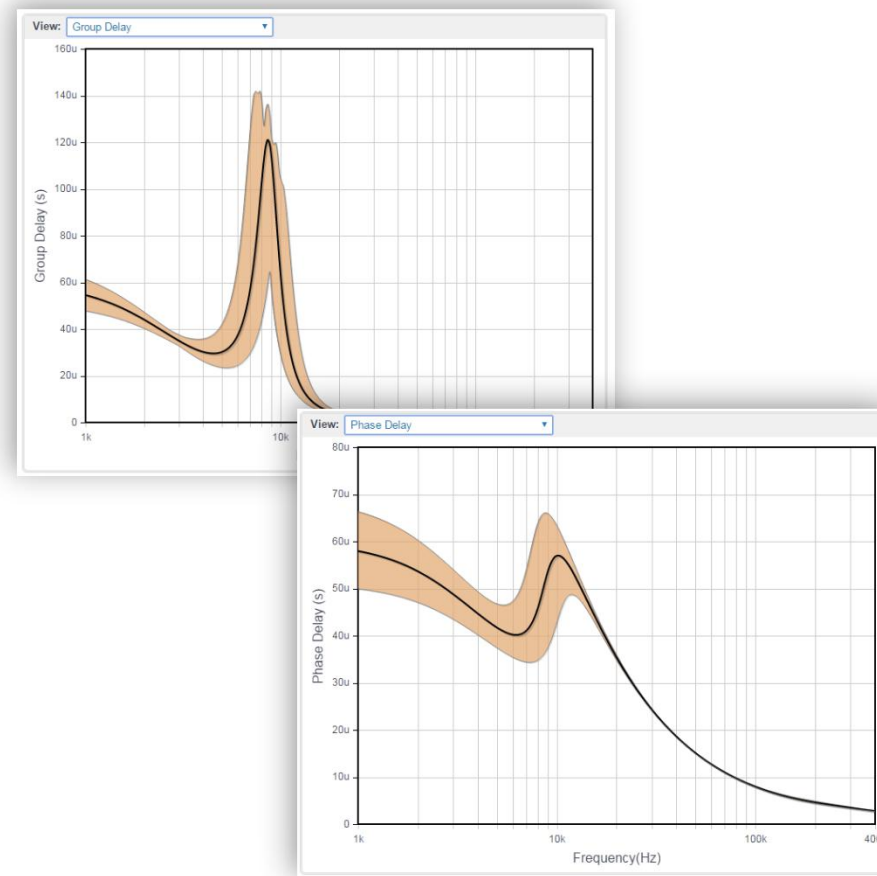
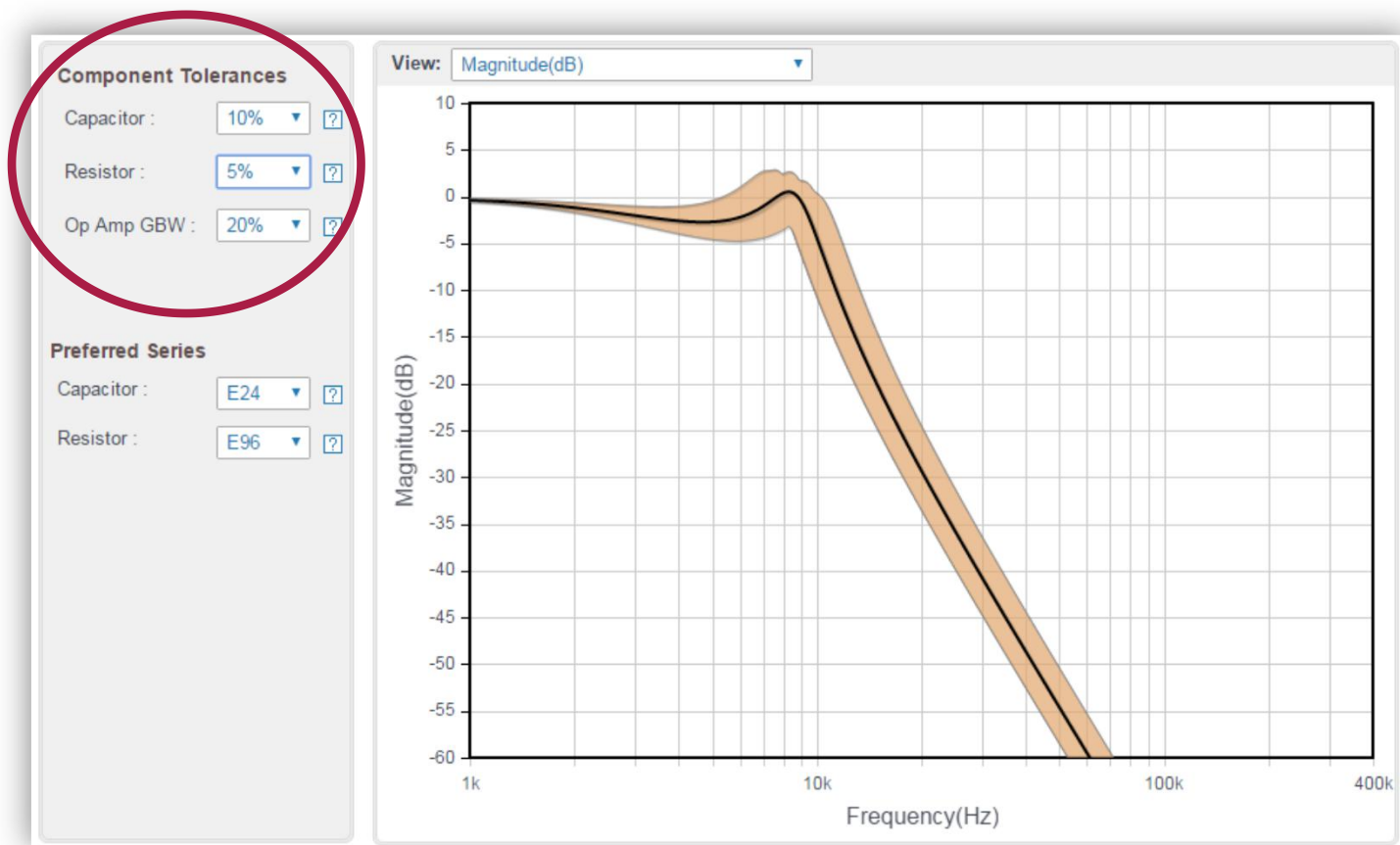
实际频率响应 - 器件选择步骤中显示



analog.com/filterwizard

滤波器向导演示

器件容差影响可视化



analog.com/filterwizard

滤波器向导演示 仿真和原型开发

订购样片和评估板

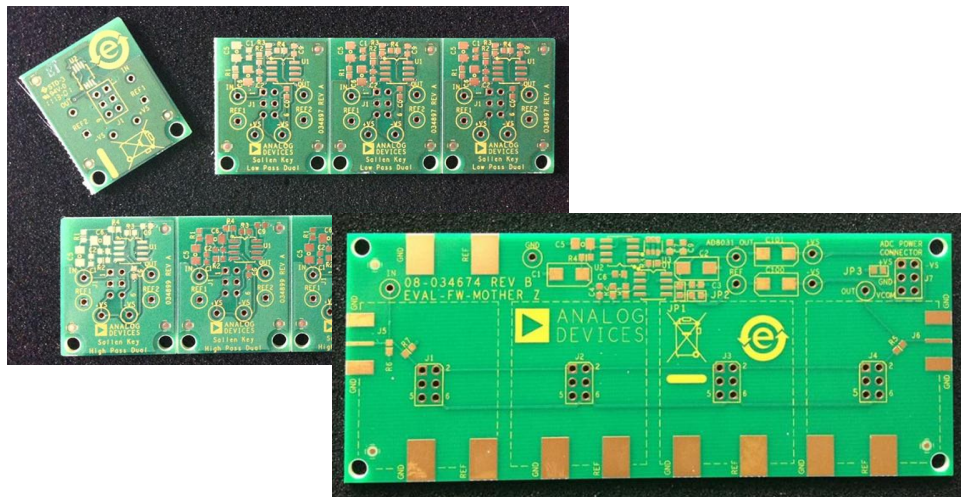
Order Eval Board

Evaluation Boards Needed [?]

Stage	Stage Information	Eval Boards Needed	Solder These Parts (Order Parts Separately)
A	Low Pass First Order Stage -- Dual Op Amp	EVAL-FW-LPSK2	C101M, C100M, C9M, J1M, J2M, J3M, J4M, J3M, J4M, R5M, JP2, J5M, J6M, +VS, -VS, GND
B	Low Pass Sallen Key Stage -- Dual Op Amp	EVAL-FW-LPSK2	R1A, R4A, C2A, U1A, C9A, C0A, J1A

*Each daughterboard box we ship contains 4 individual stages, so this board will not show in your order

Cancel Order

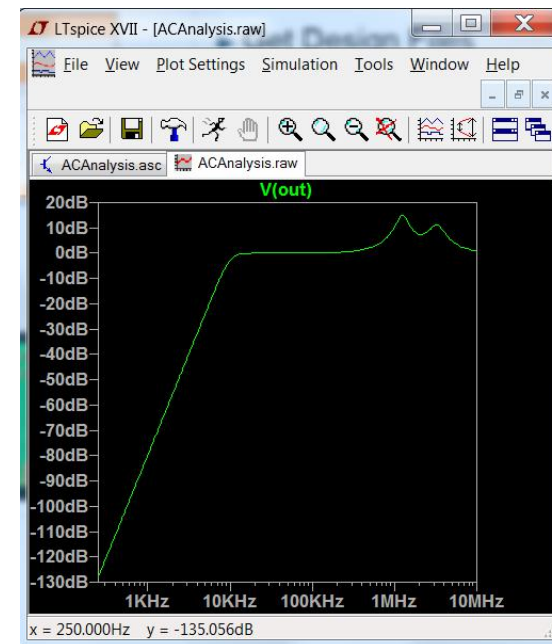


获取设计文件

获取设计文件包括:

- 设计的PDF文件, 包含原理图、BOM和图表
- LTspice仿真原理图 - 交流、瞬态和噪声
- 用于在其他仿真程序中进行仿真的SPICE网表

下载LTspice



analog.com/filterwizard

滤波器向导资源

► 工具

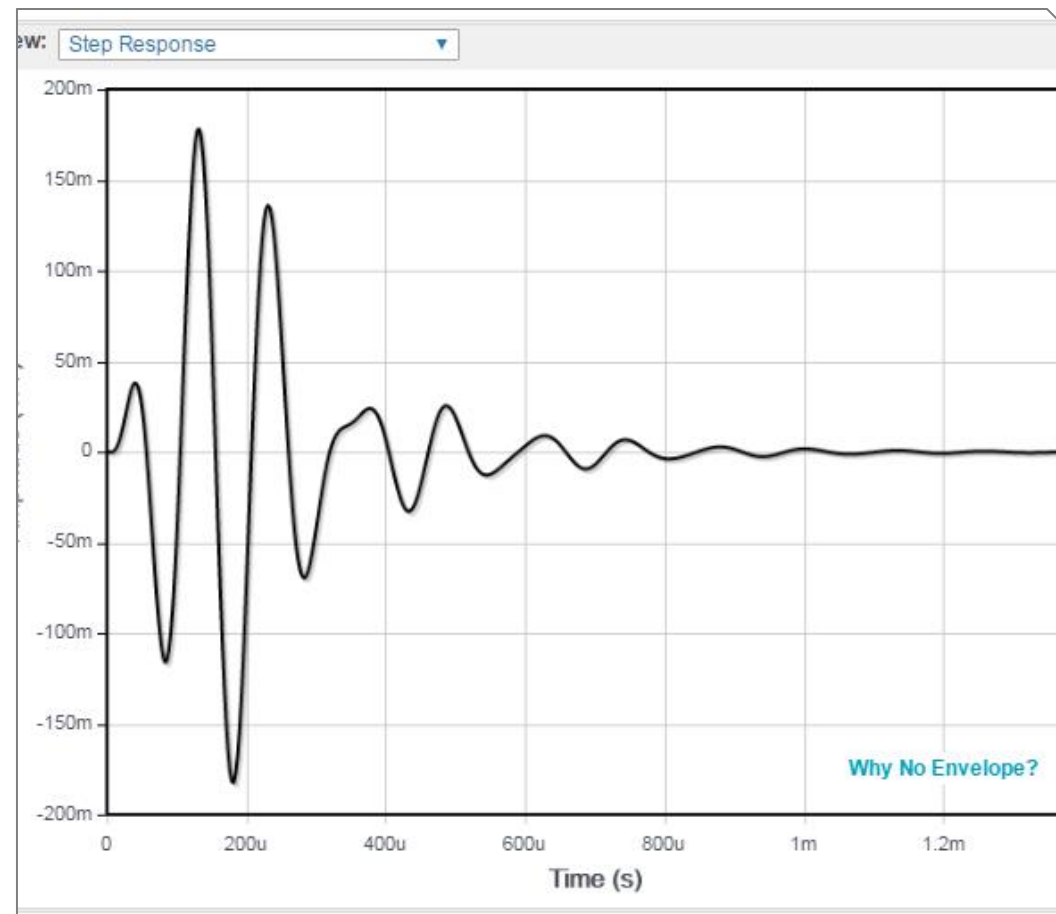
- analog.com/filterwizard

► 视频

- [演示](#)
- [滤波器101—系列](#)
- [Sallen Key 101—系列](#)
- [简化有源滤波器设计，缩短设计时间](#)

► EngineerZone®

- [滤波器向导 - 新电路和特性](#)—博客文章(2014)
- [快速设计有源滤波器](#)—博客文章(2016)
- [支持社区](#)

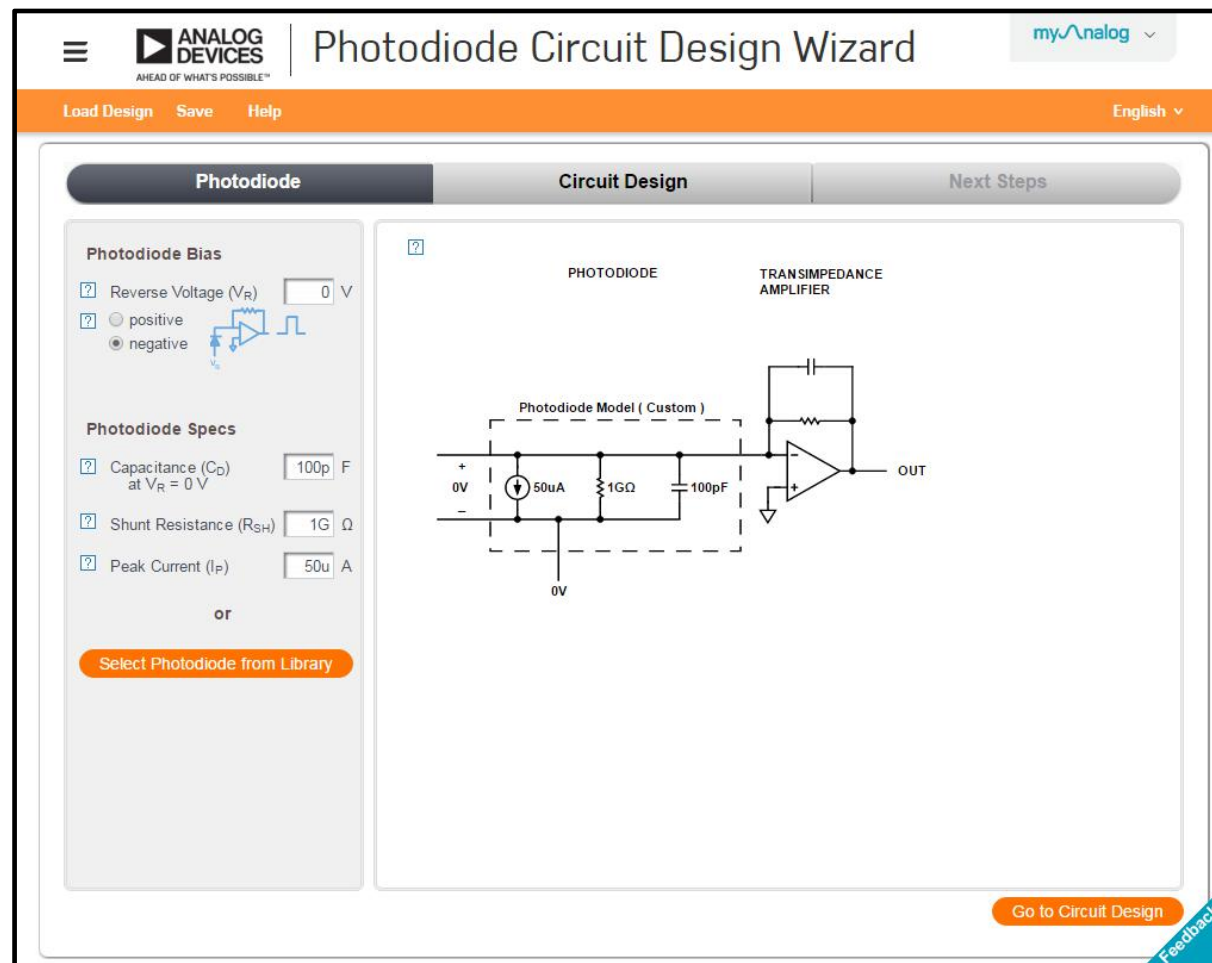
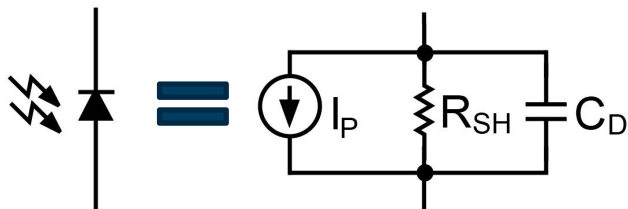


analog.com/filterwizard

光电二极管电路设计向导。

- ▶ 光电二极管：
 - 生成一个小电流输出
 - 并有高电容
- ▶ 古怪的放大组合
- ▶ 跨阻放大器

光电二极管等效电路



analog.com/photodiode

光电二极管向导演示

第1步：输入光电二极管传感器规格

工具右侧的输入面板

Photodiode Bias

Reverse Voltage (V_R)

0 V

positive

negative

Photodiode Specs

Capacitance (C_D)
at V_R = 0 V

100p F

Shunt Resistance (R_{SH})

1G Ω

Peak Current (I_P)

50u A

or

Select Photodiode from Library

Electrical and optical characteristics (Typ. Ta=25 °C, unless otherwise noted)

Type no.	Spectral response range λ (nm)	Peak sensitivity wavelength λ _p (nm)	Photosensitivity S (A/W)		Short circuit current I _{sc} 100 lx	Dark current I _D V _R =10 mV max.	Temp. coefficient of I _D T _{CD}	Rise time t _r V _R =0 V R _L =1 kΩ	Terminal capacitance C _t V _R =0 V f=10 kHz	Shunt resistance R _{sh} V _R =10 mV		Noise equivalent power NEP	
			200 nm							Min. (GΩ)	Typ. (GΩ)		
			λ _p	Min. Typ.	He-Ne laser 633 nm	Min. (μA) Typ. (μA)	(pA)	(times/°C)	(μs)	(pF)		(W/Hz ^{1/2})	
S1336-18BQ	190 to 1100	960	0.5	0.10	0.12	1	1.2	1.15	0.1	20	0.5	2	5.7 × 10 ⁻¹⁵
S1336-18BK	320 to 1100			-	-	0.9	1.0						
S1336-5BQ	190 to 1100			0.10	0.12	4	5						
S1336-5BK	320 to 1100			-	-	-	-						
S1336-44BQ	190 to 1100			0.10	0.12	8	10						
S1336-44BK	320 to 1100			-	-	-	-						
S1336-8BQ	190 to 1100	320 to 1100	0.10	0.12	22	28	100	1	380	0.1	0.4	1.3 × 10 ⁻¹⁴	1.0 × 10 ⁻¹⁴
S1336-8BK	320 to 1100												

根据光电二极管数据手册输入Cd和Rsh规格

或

Please Select A Sensor

Part Number	Manufacturer	Package	Spectral Range	Spectral Peak	Sensitivity	Dark Current
PDB-C134	Advanced Photo...	Radial	400nm ~ 1100nm	900nm	540mA/W	2nA
PDB-C134F	Advanced Photo...	Radial	700nm ~ 1100nm	970nm	580mA/W	2nA
PDB-C139	Advanced Photo...	Radial	400nm ~ 1100nm	900nm	530mA/W	5nA
PDB-C152SM	Advanced Photo...	Radial	400nm ~ 1100nm	950nm	550mA/W	10nA
PDB-C156	Advanced Photo...	Radial	400nm ~ 1100nm	900nm	540mA/W	2nA
PD15-22B-TR8	Everlight	Radial	730nm ~ 1100nm	940nm	340mA/W	10nA
PD93-21C-TR8	Everlight	Radial	400nm ~ 1100nm	940nm	340mA/W	10nA
PD95-21B-TR10	Everlight	Radial	730nm ~ 1100nm	940nm	340mA/W	10nA
S1227-1010BQ	Hamamatsu	Radial	190nm ~ 1000nm	720nm	360mA/W	50pA
S1227-1010BR	Hamamatsu	Radial	340nm ~ 1000nm	720nm	430mA/W	50pA
S1227-16BQ	Hamamatsu	Radial	190nm ~ 1000nm	720nm	360mA/W	5pA

Cancel Select

从库中选择一款光电二极管

光电二极管向导演示

第2步：调整TIA设计

工具右侧的输入面板

Output Signal

☒ Peak Voltage (V_p) V

☒ Target Speed

☒ Bandwidth ☐ Pulse Width Hz

☒ Peaking

low high

Stages

☒ One ☐ Two

Op Amp

☒ AD8622 [Change](#)

Quick Results

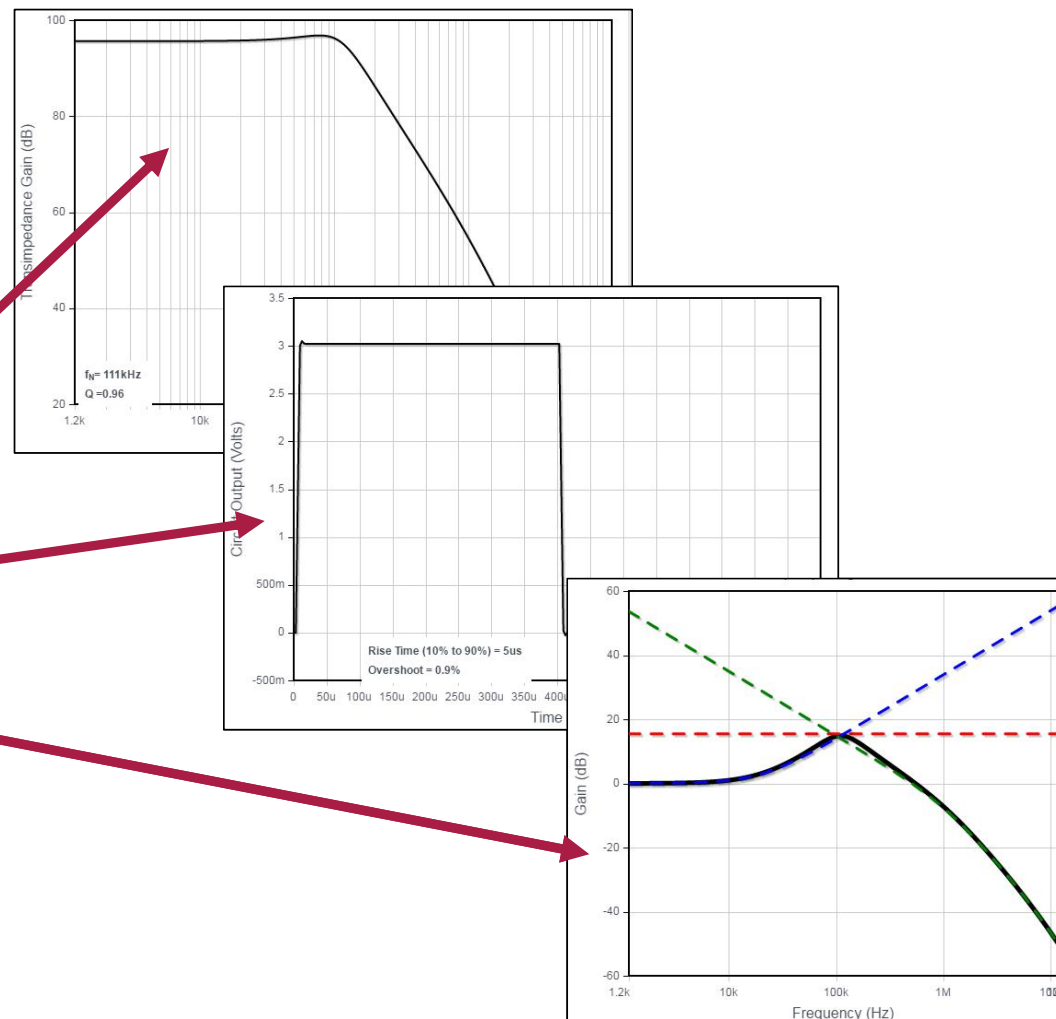
☒ ENOB: 15.2 bits

SNR: 93.5 dB

Output Offset: 137uV

修改输出要求、峰值和选定运算放大器，并观察其影响：

- ▶ ENOB/SNR
- ▶ 输出失调
- ▶ 频率响应
- ▶ 脉冲响应
- ▶ 噪声增益



第3步：获取设计文件、仿真、订购

Order Samples

Get Design Files

Mail to Colleague

Was this tool helpful?

Give Feedback

- ▶ 设计的PDF文件，包含原理图、BOM和图表
- ▶ LTspice原理图，以及SPICE仿真网表 — 交流、瞬态和噪声

可以使用LTspice来仿真设计包中包含的原理图

下载LTspice

设计包中包含的.cir网表可以在其他SPICE仿真器中使用



光电二极管向导设计资源

► 工具

- analog.com/photodiode

► 视频

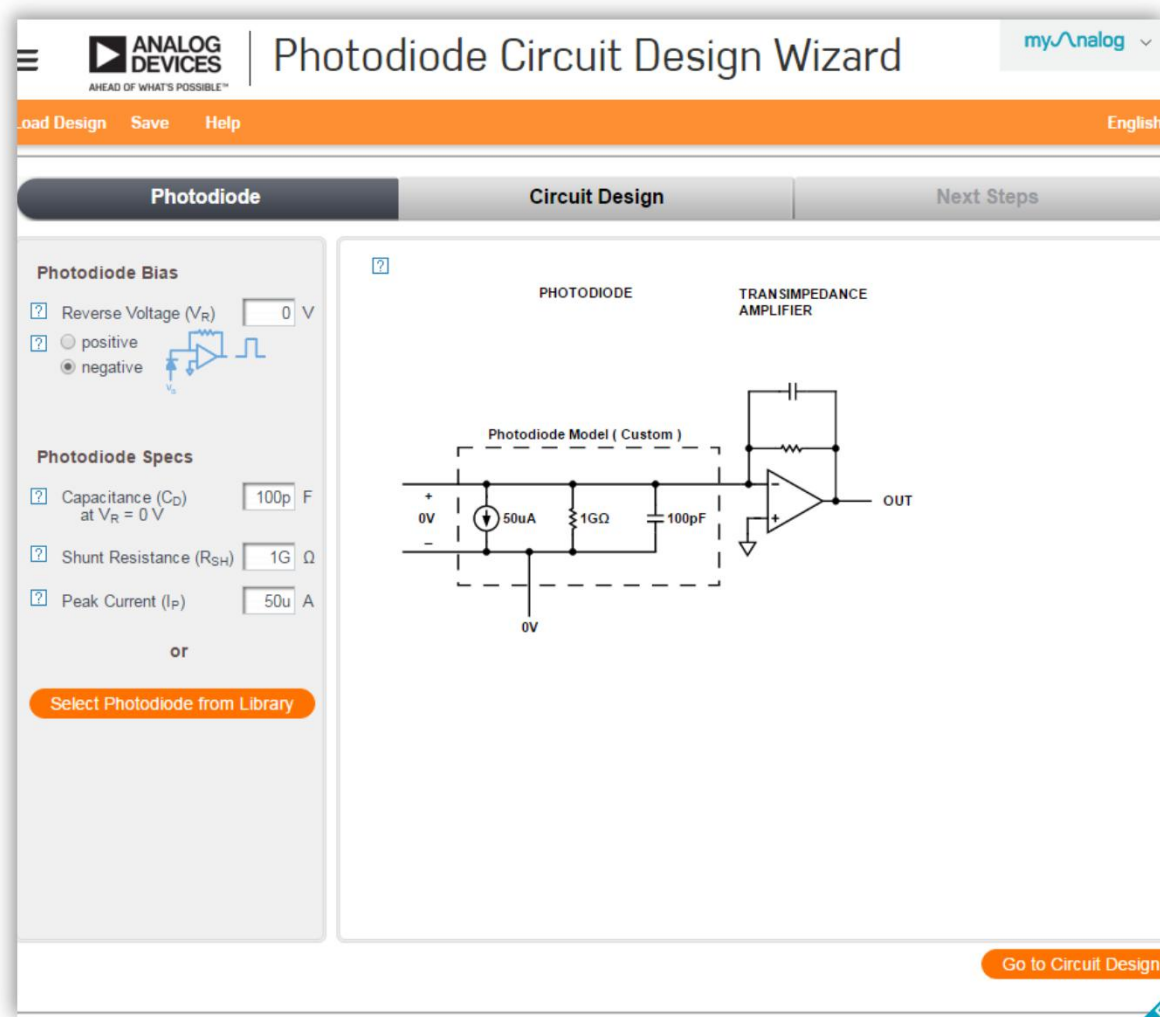
- [演示](#)

► EngineerZone®在线技术支持论坛博客文章

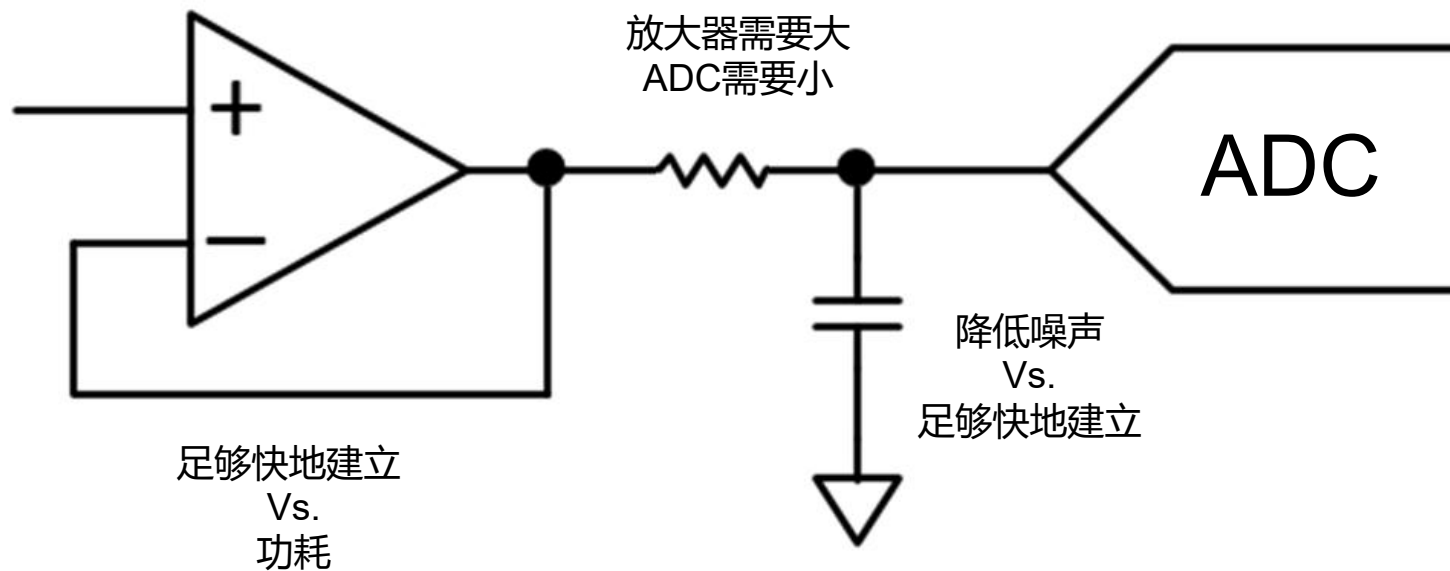
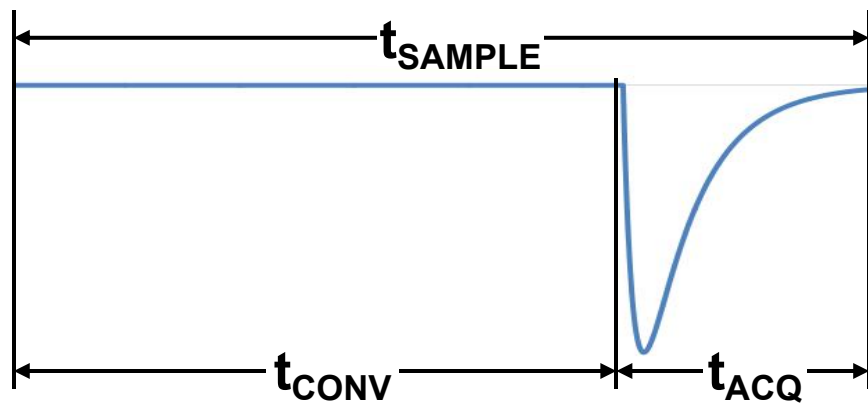
- [使用光电二极管向导进行光电二极管放大器设计\(2014\)](#)
- [使用SPICE仿真验证光电二极管向导设计\(2014\)](#)

► 进一步阅读

- [高阻抗传感器](#)——“传感器信号调理实用设计技术”第5章



ADC驱动器工具



ADC驱动器工具

ADC Driver Tool - ALPHA

About This Tool ⓘ Give feedback 🗨

ADC [LTC2378-20](#)

Sampling Rate: SPS

Vref: V

For LTC2378-20, maximum sample rate is 1MSPS and maximum voltage for Vref is 6V

Driver [ADA4899-1](#)

Vout: Vp-p

Gain: V/V

Rf: Ω

Input

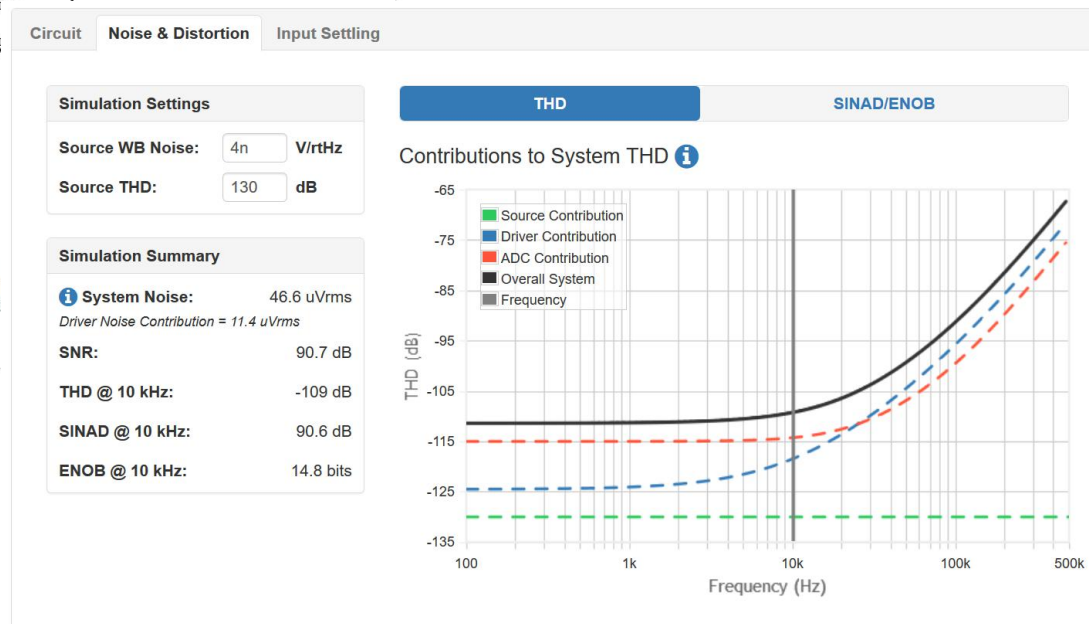
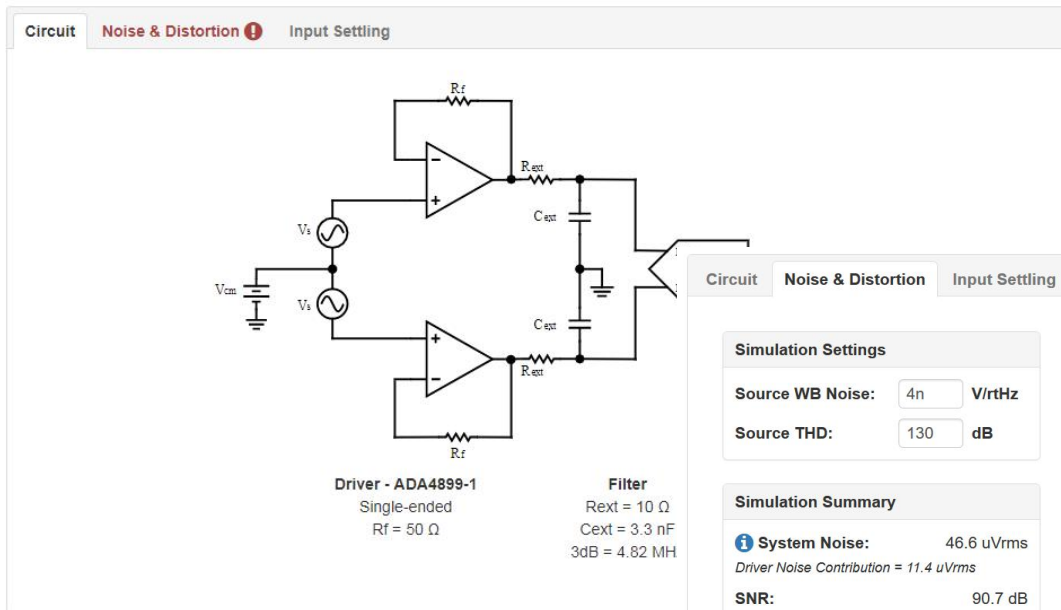
Frequency: Hz

☐ Input will be multiplexed ⓘ

Filter

Rext: Ω

Cext: F



AD4003系列与旧款ADC进行比较!

<http://playground.analog.com/adcdriver>

ADC驱动资源

► 工具

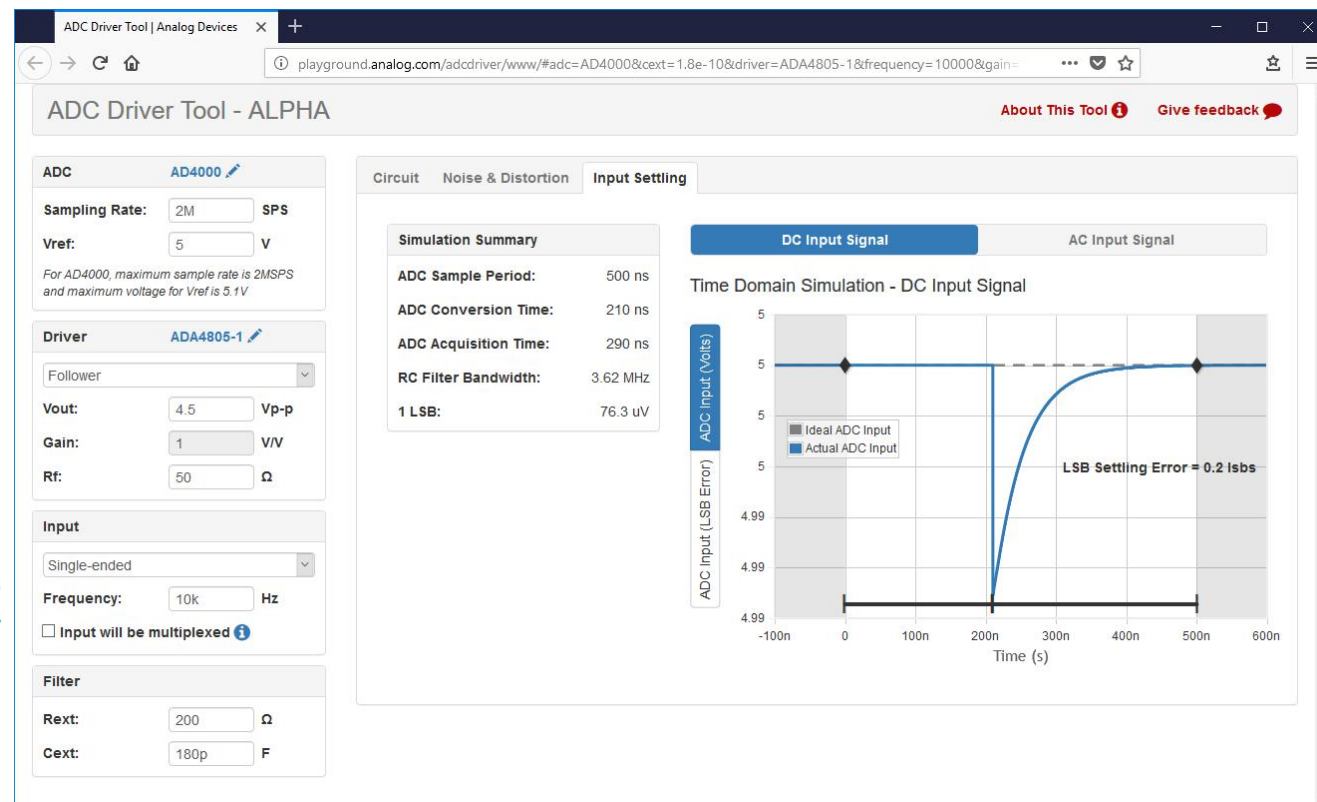
- <http://playground.analog.com/adcdriver>

► 视频

- [LTspice: SAR ADC驱动器接口](#)

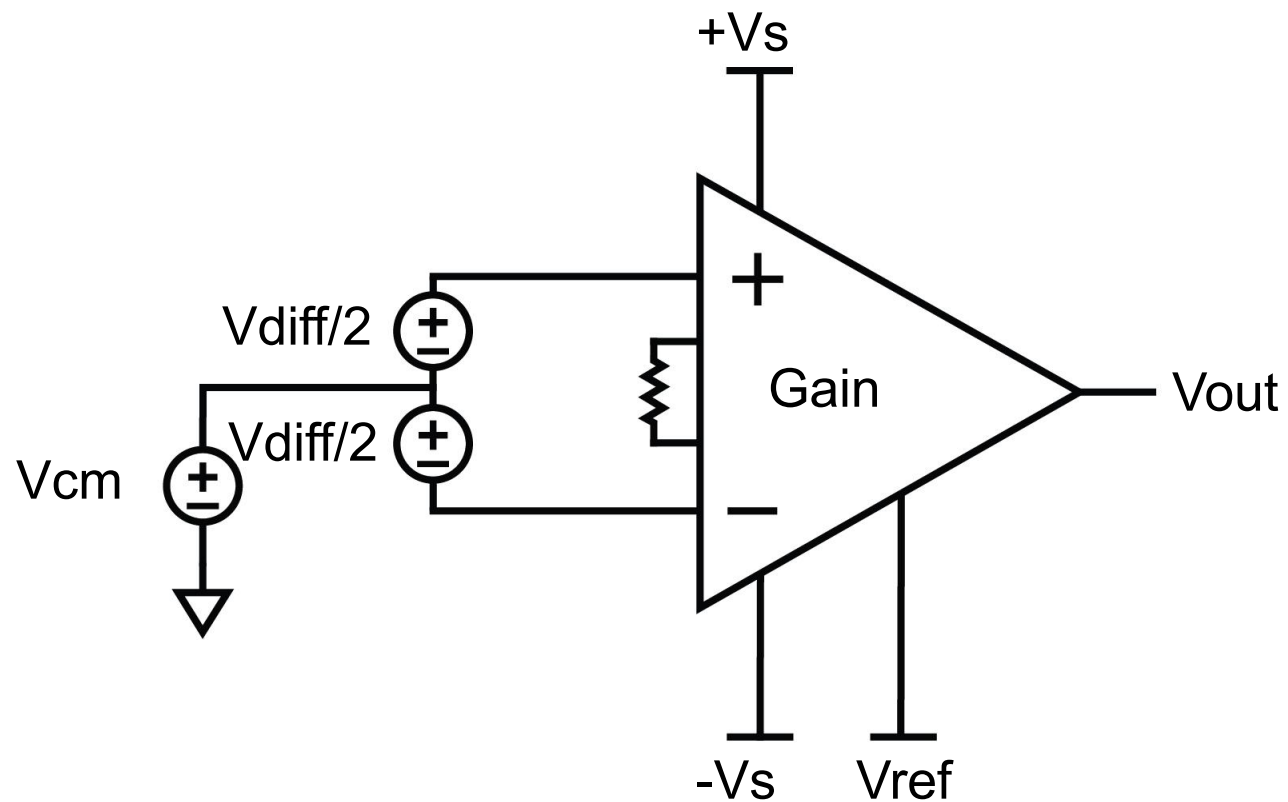
► 文章

- [精密SAR模数转换器的前端放大器和RC滤波器设计](#)
- [LTspice: 仿真SAR ADC模拟输入](#)



基于器件的工具

$$V_{out} = (V_{diff} * Gain) + V_{ref}$$



Data Sheet

AD8422

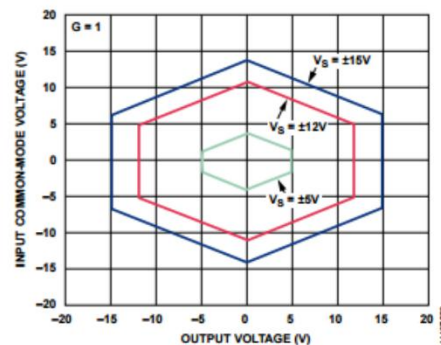


Figure 10. Input Common-Mode Voltage vs. Output Voltage ($G = 1$), $V_S = \pm 15\text{ V}$, $V_S = \pm 12\text{ V}$, $V_S = \pm 5\text{ V}$

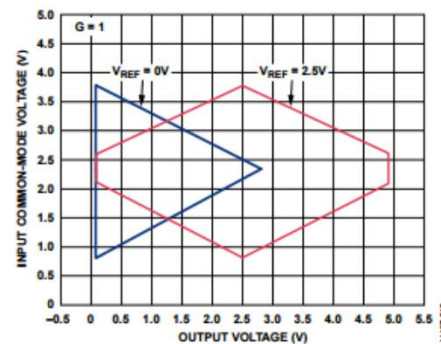


Figure 11. Input Common-Mode Voltage vs. Output Voltage ($G = 1$), Single-Supply, $V_S = 5\text{ V}$

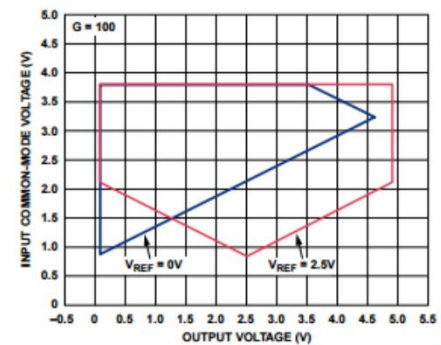


Figure 13. Input Common-Mode Voltage vs. Output Voltage ($G = 100$), Single-Supply, $V_S = 5\text{ V}$

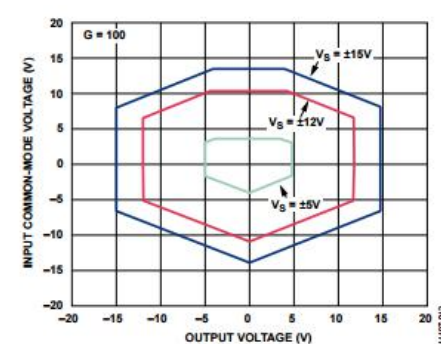
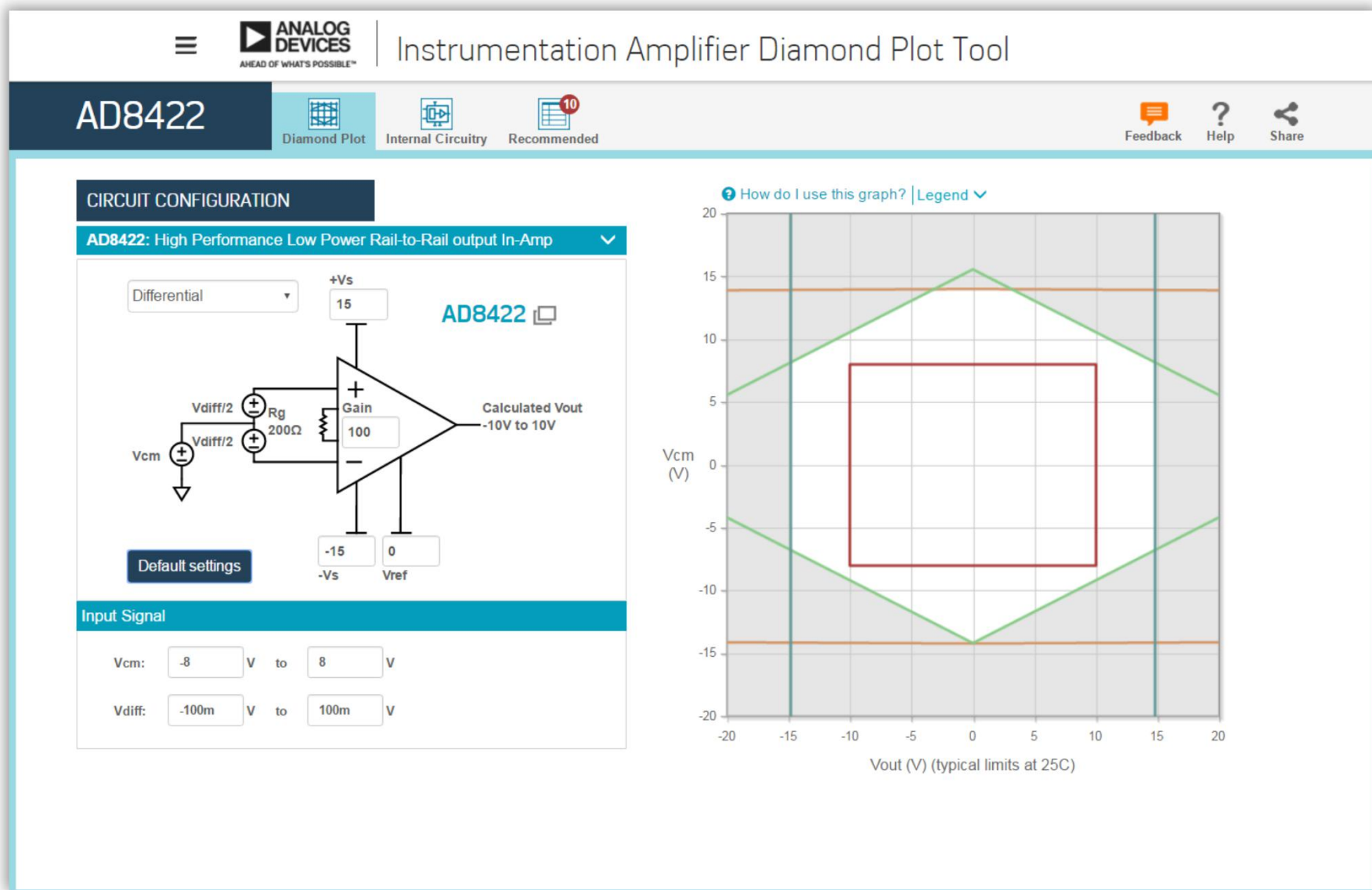


Figure 12. Input Common-Mode Voltage vs. Output Voltage ($G = 100$), $V_S = \pm 15\text{ V}$, $V_S = \pm 12\text{ V}$, $V_S = \pm 5\text{ V}$

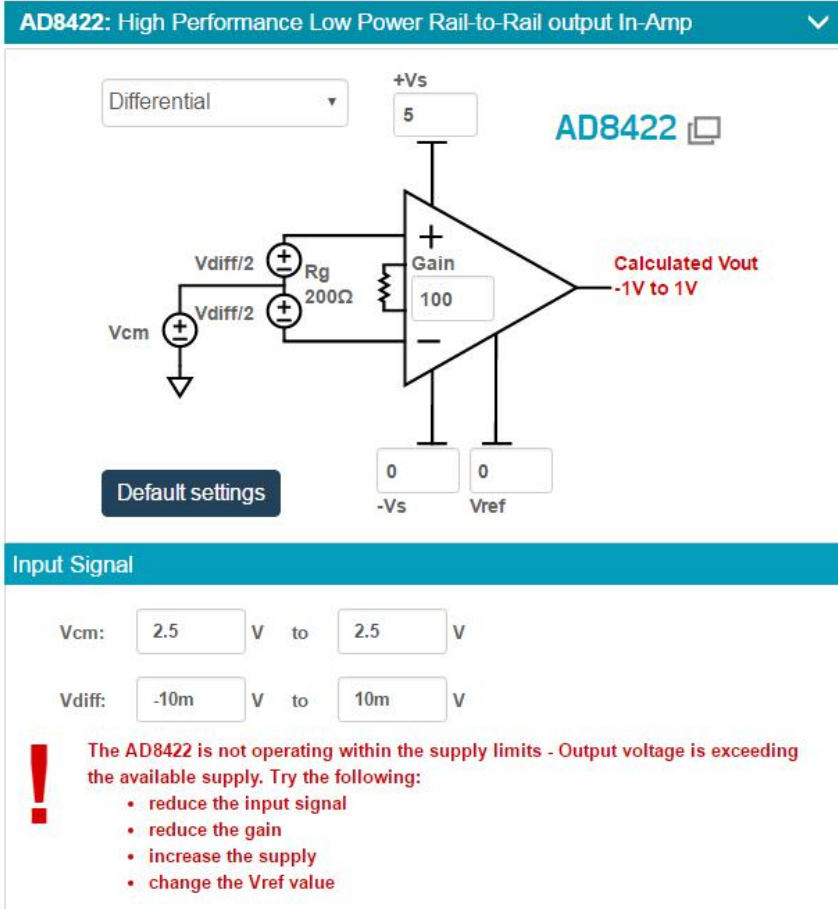
仪表放大器钻石图工具



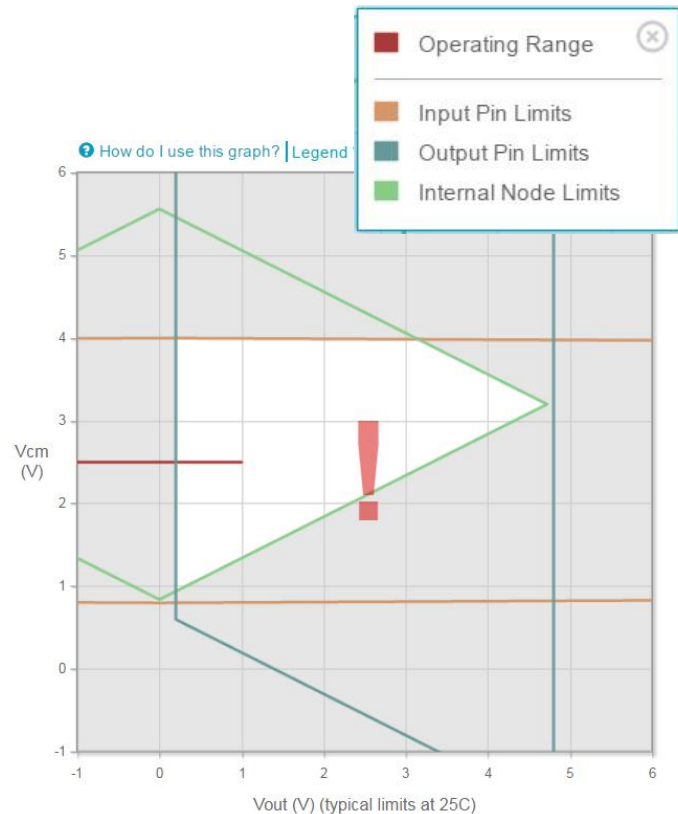
analog.com/diamond

仪表放大器钻石图工具

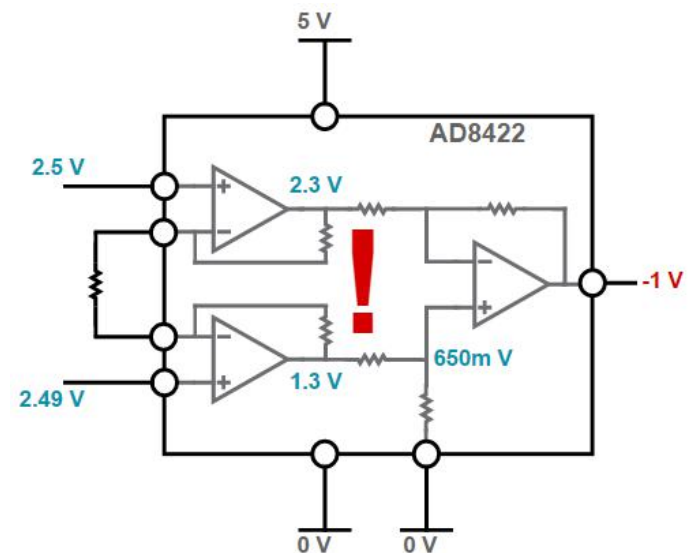
输入信号和电路要求



钻石图



内部电路



仪表放大器钻石图工具

其他有效仪表放大器...

10 Recommended

Recommended in amps, based on settings specified in left panel

Filter this list by specifications

Part	Description
AD8422	High Performance Low Power Rail-to-Rail output In-Amp
AD8237	Zero-drift, micropower, true rail-to-rail, ICF In-Amp
AD8420	Wide supply range, micropower, ICF In-Amp
AD8226	Wide Supply Rail-to-Rail output In-Amp
AD8227	Wide Supply Rail-to-Rail output In-Amp
AD8426	Dual Wide Supply Rail-to-Rail output In-Amp
AD8235	Single supply, micropower, 2 op amp In-Amp in WLCSP
AD8236	Single supply, micropower, 2 op amp In-Amp
AD623	Single Supply Rail-to-Rail output In-Amp
AD627	Wide supply range, micropower, 2 op amp In-Amp

View parameters for recommended in-amps

View parameters for all in-amps

现在可以根据其他规格（CMRR、噪声密度、功耗等）来检查“有效”器件的列表，以找到“最佳”器件

Expanded Parametric View

Specifications estimated based on gain of 200V/V

Part	Valid Gains	CMRR (dB)	Vos RTI (V)	Ios Max (A)	Noise Density (V/√Hz)	BW (Hz)	ISupply per Amp (A)	Description
AD8235	5 to 200	100	2.5m	25p	70n	400	40u	Single supply, micropower, 2 op amp In-Amp in WLCSP
AD8236	5 to 200	100	3.5m	5p	70n	400	40u	Single supply, micropower, 2 op amp In-Amp
AD627	5 to 1000	100	152u	1n	38n	1.56k	85u	Wide supply range, micropower, 2 op amp In-Amp
AD8420	1 to 1000	100	125u	1n	55n	1.25k	90u	Wide supply range, micropower, ICF In-Amp
AD8237	1 to 1000	114	75u	650p	68n	5k	115u	Zero-drift, micropower, true rail-to-rail, ICF In-Amp
AD8422	1 to 1000	140	25.7u	150p	8.01n	60k	330u	High Performance Low Power Rail-to-Rail output In-Amp
AD8226	1 to 1000	120	52u	500p	22n	10k	425u	Wide Supply Rail-to-Rail output In-Amp
AD8227	5 to 1000	110	103u	1.5n	24n	25k	425u	Wide Supply Rail-to-Rail output In-Amp
AD8426	1 to 1000	110	103u	500p	24n	10k	425u	Dual Wide Supply Rail-to-Rail output In-Amp
AD623	1 to 1000	105	103u	2n	35n	5.56k	550u	Single Supply Rail-to-Rail output In-Amp

View parameters for recommended in-amps

View parameters for all in-amps

Reset

Close

analog.com/diamond

仪表放大器钻石图资源

► 工具

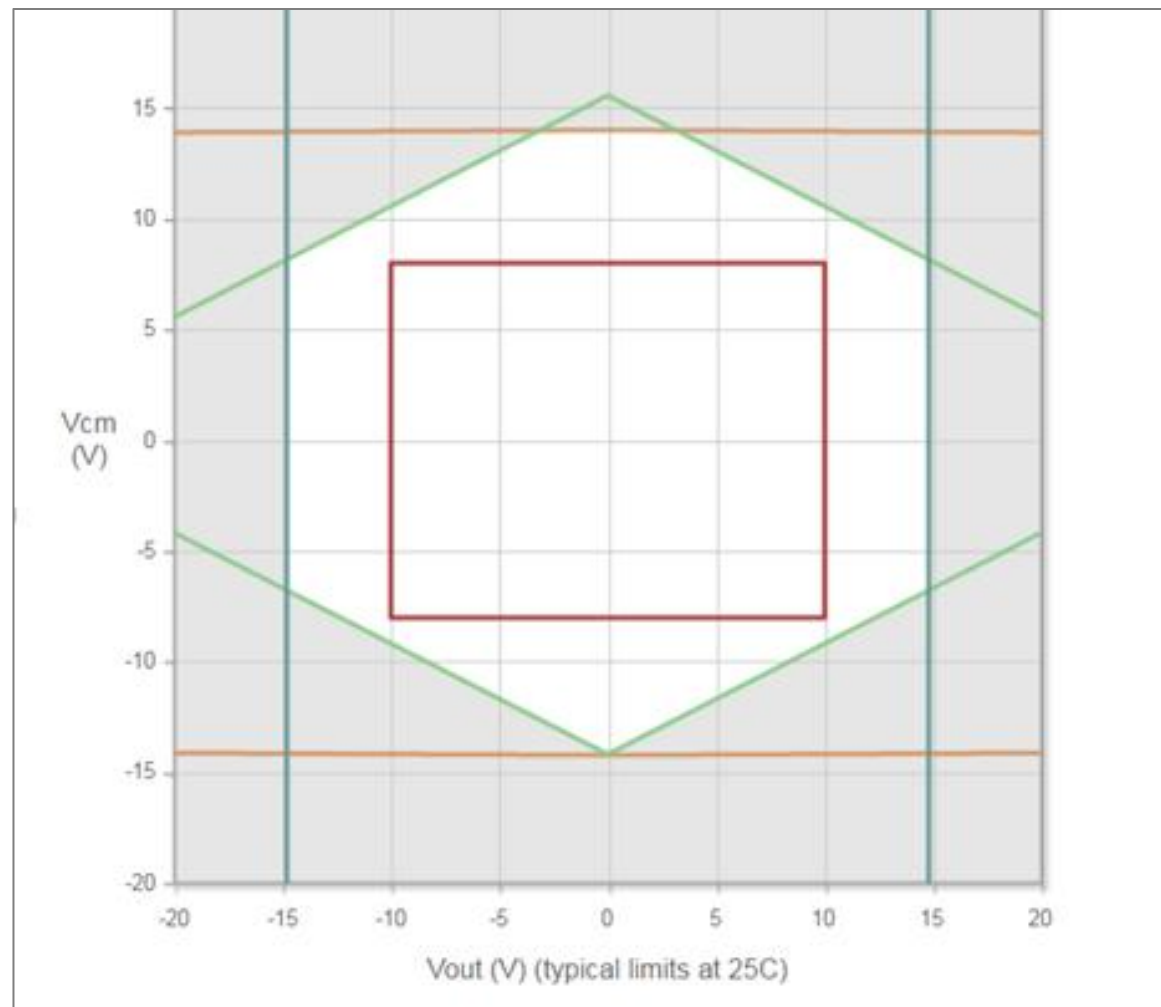
- analog.com/diamond

► 视频

- [演示视频](#)
- [仪表放大器输入范围](#)
- 微型教程: [三运放仪表放大器基本配置](#)
- 微型教程: [双运放仪表放大器基本配置](#)

► 文章

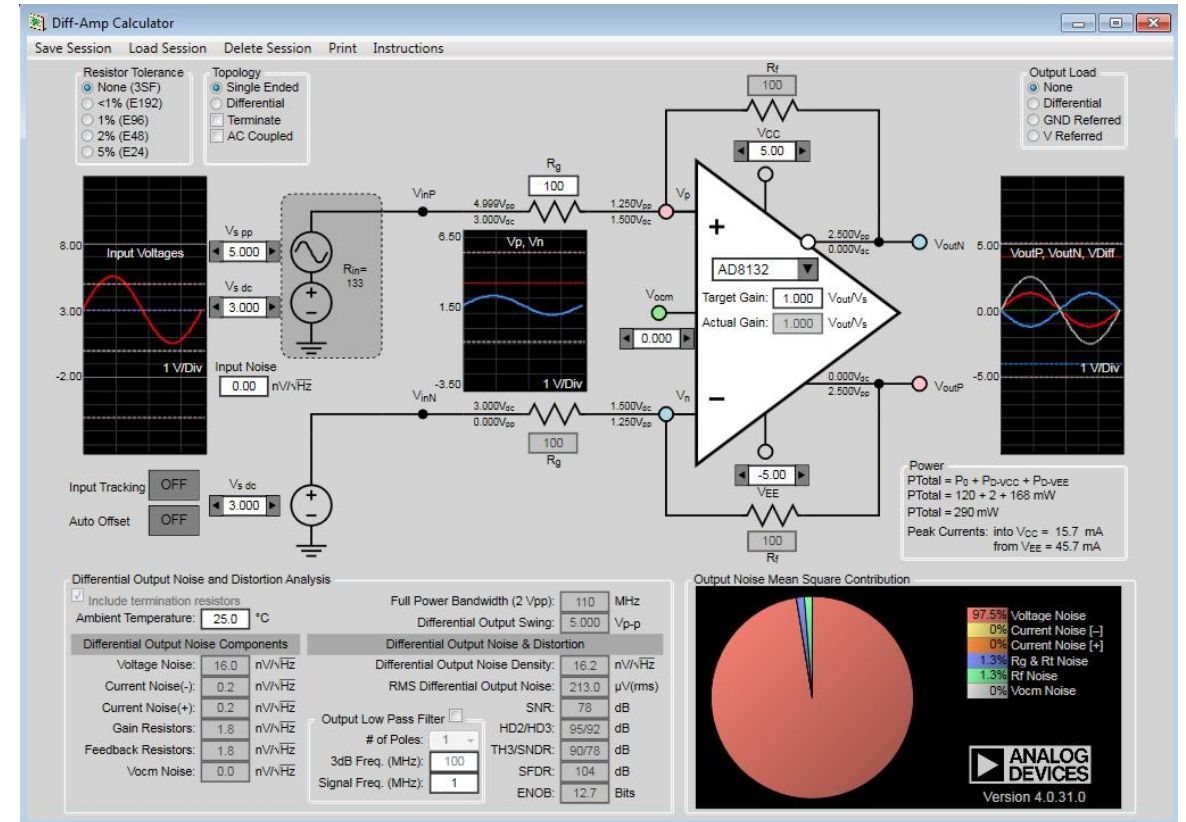
- [钻石图](#): 《模拟对话》文章 (2014年7月)
- [简介](#): 博客文章 (2014年8月)
- [工具发布](#): 博客文章 (2016年3月)



DiffAmpCalc™

- ▶ 全差分放大器自动计算
- ▶ 第4版新内容
 - LTC差分放大器
 - Windows 10兼容性
 - 修正窗口缩放错误

www.analog.com/diffampcalc



AD7172-4 Change Product



SETTINGS

▶ Run X Clear

Analog Input (DC)

AIN+ 2.501V

AIN- 2.5V

▶ MUX

▶ AIN Buffers

▶ ADC / Filter

▶ Reference Voltages

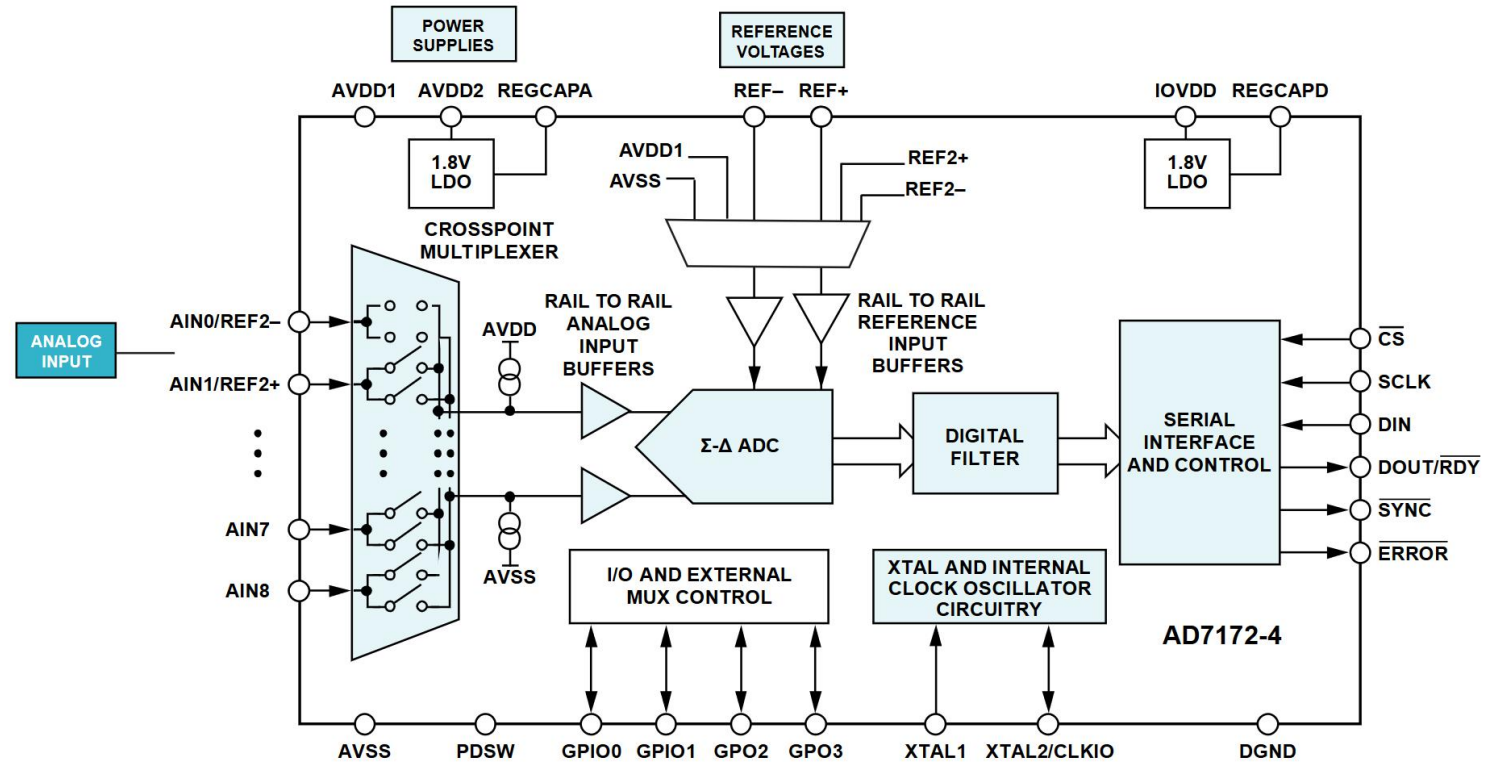
▶ Clock Circuitry

▶ Serial Interface

▶ Power Supplies

▶ Frequency Response

▶ Step Response



设计工具汇总

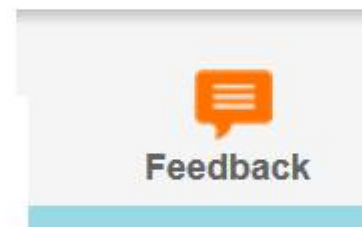
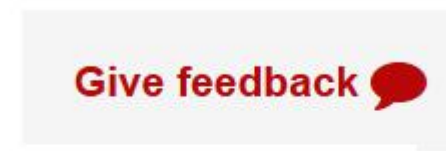
► 电路模块设计工具

- 滤波器向导
- 光电二极管向导
- 新品：ADC驱动器计算器(ALPHA)

► 基于产品

- 仪表放大器：钻石图计算器
- 差分放大器：DiffAmpCalc
- ADC：Virtual Eval

www.analog.com/designtools



谢谢观看！

- ▶ ADI中国地区技术支持热线：4006 100 006
- ▶ ADI中国地区技术支持信箱：
china.support@analog.com
- ▶ ADI样片申请网址：
<http://www.analog.com/zh/sample>