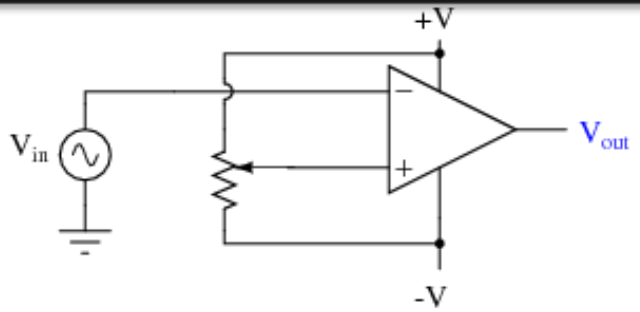
Precision Analog Product Roadmap

Sensor AFE

Energy Solutions

Precision Amplifiers Roadmaps



Low Voltage Op-Amps

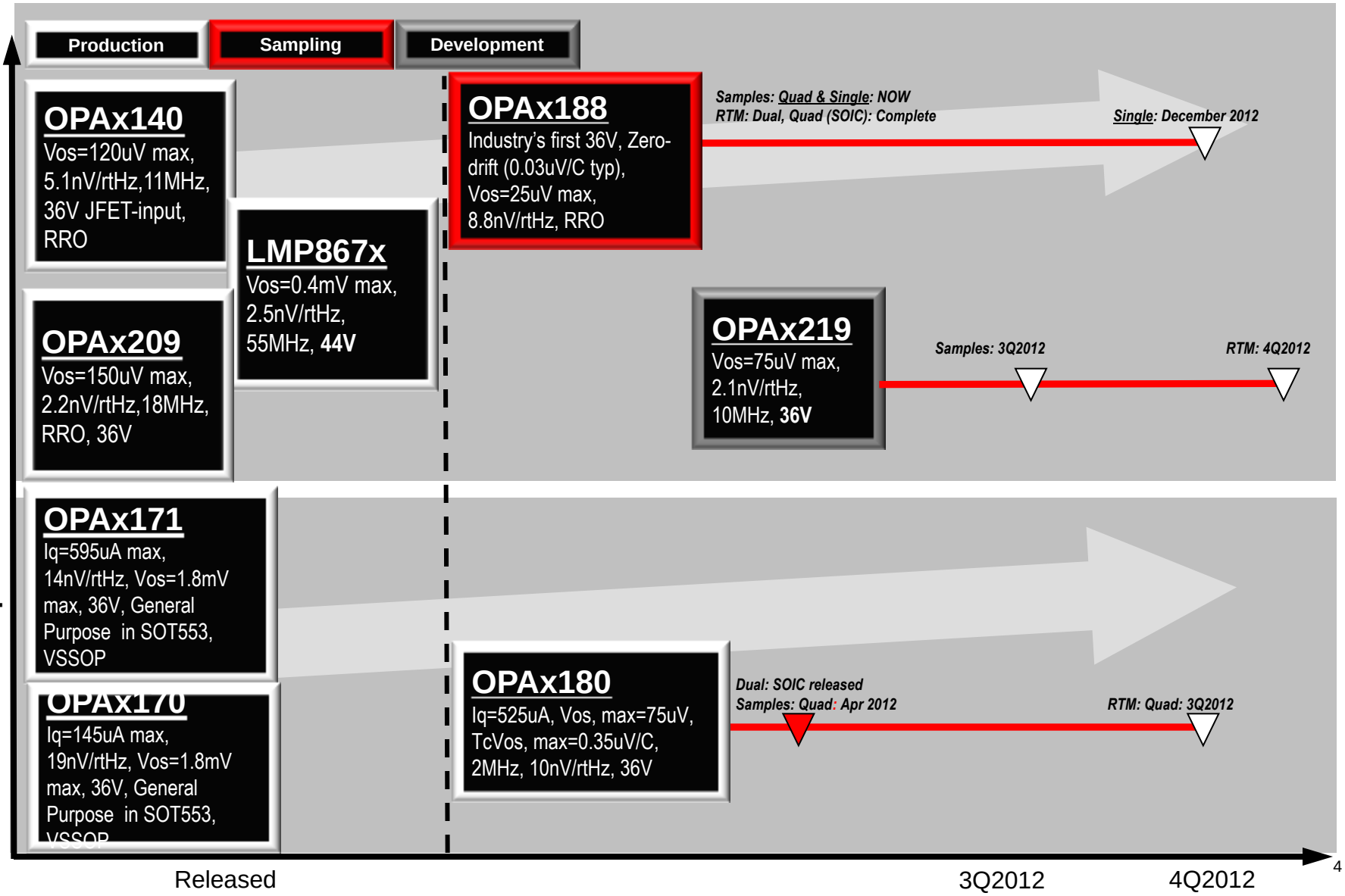
Wide Supply Op-Amps

Instrumentation Amps

Precision Audio Op-Amps

Comparators

Wide Supply Op Amp Roadmap (Vs>5.5V)



OPA219 / OPA2219

Preview

Single and Dual High Precision Low Noise Operational Amplifiers

Features

- **Wide Supply Range 5 to 36V**
- **Low Vos: 50uV**
- **Low TcVos: 0.5uV/°C max**
- Ibias = 6nA
- High Avol: 150dB
- High CMRR/PSRR: 120dB
- **Low Noise only 2.1nV/rt Hz at 2.7mA**
  - **2Hz 1/f Corner, 60nVpp 0.1 to 10Hz BW noise**
- 9MHz GBW
- **High Output Drive ±70mA**

Benefits

- **Flexible operation to 36V for wide dynamic range**
- **High initial precision**
- **Low temperature coefficient assures precision over temperature**
- Low bias current for med-high impedance sources
- Excellent gain linearity
- Very high CM rejection maintains accuracy
- **Very low noise density for high resolution systems**
- Wide bandwidth widens application space
- **High output current to drive capacitive loads**

Applications

- Precision Instrumentation Amps
- Precision ADC Driver
- Vibration Sensing
- Seismic Detection
- Test and Measurement
- Data Acquisition
- Low frequency applications requiring wide dynamic range

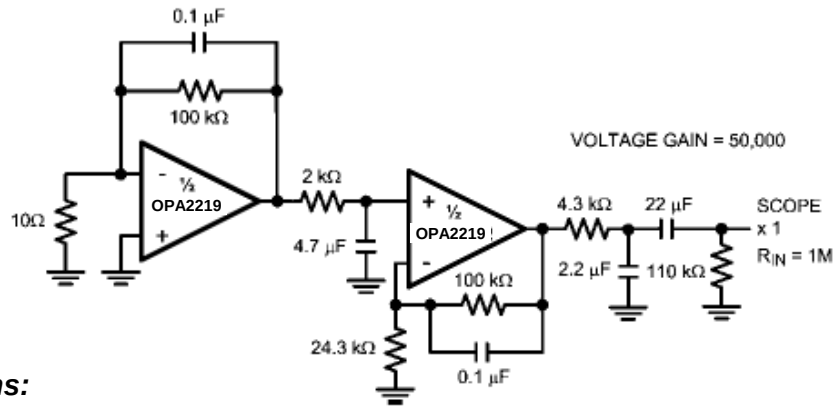


Figure 1. 0.1 to 10Hz Noise Test Circuit

Packaging options:
Single: *SOIC-8, MSOP-8*
Dual: *SOIC-8*
(Released / Sampling / Preview)

OPA188 / OPA2188 / OPA4188

0.03µV/ºC | 25µV Vos | 36V *Zerø-Drift* Operational Amplifier

Features	Benefits

• Very Low Offset and Drift
  • Offset Voltage: 25µV (max)
  • Offset Voltage Drift: 0.085µV/°C max
  • CMRR, PSRR, AoI = 130dB (min)
	• Improved high accuracy and stability
	  • Over the previous generation OPA277: 91.5% better input offset drift (max)
	  • Over nearest competition: 58% lower input offset voltage (max) and 88% lower input offset voltage drift (max)

• Noise Voltage: 8.8nV/√Hz at 1kHz • Noise voltage at 0.1Hz to 10Hz: 0.25uVpp	• Allows for high sensitivity, high resolution systems
• GBW : 2MHz • Low Quiescent Current: 475µA (max)	• Better power to speed ratio: nearest competitor has a max quiescent current of 500uA, but GBW at 1.3MHz. This ratio is about 62% higher than the OPA2188
• Low Bias Current: 160pA (typ)	• Typically, OPA2188 will have 68% less error caused by input bias current , than the nearest competition

• Supply Range: +4.0V to +36V or ±2V to ±18V
  • Rail to Rail Output
  • EMI/RFI Filtered Inputs
  • Input common mode range extending from negative rail to within 1.5V of the positive rail
	• Flexibility in design, enabling low power 5V single supply operation. Nearest competitor part's minimum input range is at 1.5V from negative rail, thus no single supply operation is possible.

Applications

- Electronic Weigh Scales
- Bridge Amplifier
- Strain Gauge
- Automated Test Equipment
- Transducer amplifier
- Medical Instrumentation
- Resistor Thermal Detector

Packaging options:
Single: SO-8, MSOP-8, SOT-23
Dual: SO-8, MSOP-8
Quad: SO-14, TSSOP-14

(Released / Sampling / Preview)

OPA140 / OPA2140 / OPA4140

11MHz Precision Low Noise RRO JFET Operational Amplifier

Features	Benefits

• Very Low Offset and Drift
  • Offset Voltage: 120µV (max)
  • Offset Drift: 1µV/°C (max)
	• Guaranteed high accuracy and stability over the full industrial temperature range

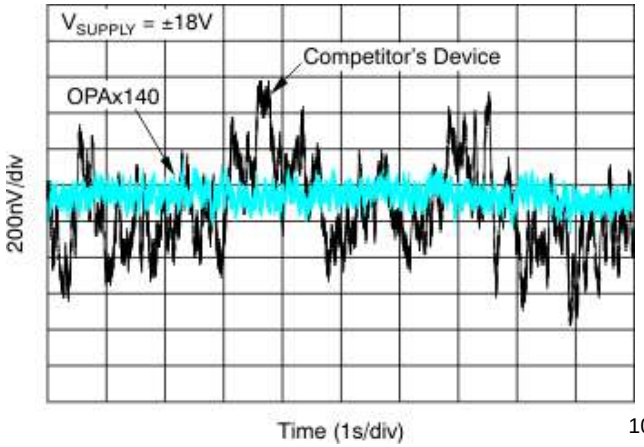
• Low Noise: 5.1nV/√Hz (1kHz) • 1/f Noise: 250nVpp (0.1-10Hz)	• Allows for high sensitivity, high resolution systems across a wide frequency range
• FET Input: Ib = 10pA (max)	• Better matching to high impedance sources such as sensor outputs • 60% lower I_B than previous generation OPA132
• GBW: 11MHz • Slew Rate: 20V/µs	• High GBW and slew rate make it ideal for driving 16-bit ADC's

• Wide Supply Range:
  • + 4.5V to +36V or ±2.25V to ±18V
  • Low power: 2.0mA/ch
	• Enabling low power 5V supply systems
	  • 13% less power consumption per channel vs. competition

Applications

- Sensor Signal Conditioning
- Security Scanner
- Photodiode Measurement
- Active Filters
- Medical Instrumentation

Packaging options:
Single: SO-8, MSOP-8, SOT-23
Dual: SO-8, MSOP-8
Quad: SO-14, TSSOP-14



OPA209 / OPA2209 / OPA4209

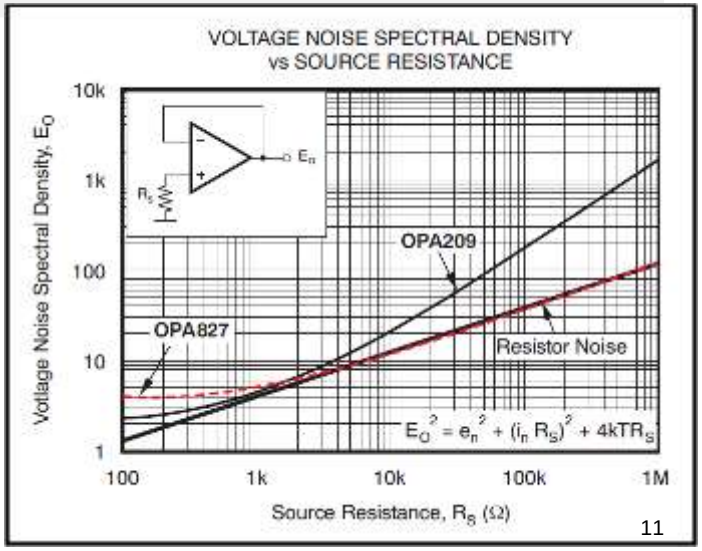
2.2nV/√Hz 18MHz Precision RRO 36V Operational Amplifier

Features	Benefits
• Low Noise : 2.2nV/√Hz at 1kHz (max) •1/f Noise: 130nVpp (0.1Hz – 10Hz)	• Provides a low noise solution across full operating frequency range
• Low Offset Voltage: 150µV (max) • Gain Bandwidth: 18MHz • Slew rate: 6.4V/ms	• Ideal for fast, high precision data acquisition applications and offering 50% wider bandwidth than the competition
• Wide Supply Range: ±2.25 to ±18V, • Single supply: 4.5 to 36V • Low Supply Current: 2.5mA/ch max	• 50% lower minimum voltage supply with rail-to-rail output maximizes dynamic range and provide greater flexibility across designs as compared to the competition

Applications

- PLL Loop Filter
- Low Noise, Low Power Signal Processing
- High Performance ADC Driver
- High Performance DAC Output Amplifier.
- Active Filters
- Low Noise Instrumentation Amplifiers

Packaging options:
Single: SO-8, MSOP-8, SOT-23
Dual: SO-8, MSOP-8
Quad: TSSOP-14



TEXAS INSTRUMENTS

LMP8671 / LMP8672 / LMP8674

Low Noise Precision Op Amps

Features

- Wide operating supply voltage
  - ±5 to ±22V or 4.5 to 44V
- Low Noise Density
  - 2.5 nV/rt Hz
- Low Vos 400uV max
- Low TcVos 2.0uV/deg C max
- 55MHz GBW
- 20V/us Slew Rate
- Supply Current 6mA/Channel

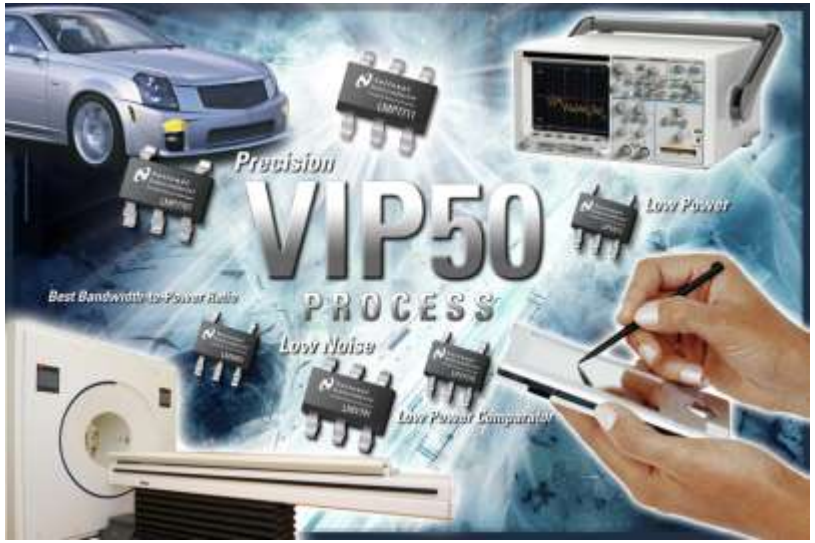
Benefits

- High Precision Performance
- Wide Bandwidth, Very Good Slew Rate
- Low Vos and TcVos for Precision performance over temperature

Applications

- Low Noise Industrial Applications
- ATE
- Ultrasound
- Precision Active Filters
- PLL Filters
- 4-10mA Current Loops
- Motor Control

Packaging options:
Single: SOIC-8
Dual: SOIC-8
Quad: SOIC-14



OPA171 / OPA2171 / OPA4171

Industry's smallest 36V Low Power RRO General Purpose Op Amp

Features	Benefits
• Industry's smallest 36V Packages: • Single in SOT553, Dual in VSSOP-8	• Micropackages use >50% less board space than the larger SOT23 and MSOP packages

• Rail to Rail Output
  • +2.7V to +36V or ±1.35V to ±18V
  • High CMRR: 104dB
  • Low Noise: 14nV/√Hz at 1kHz
	• Maximizes input voltage range for use with low voltage sensor outputs
	  • Versatility in design for ease of use with different supply rail systems

• Low Quiescent Current: 475µA/ch	• Enables battery powered operation

• DC Precision
  • Offset Voltage: 1.8mV (max)
  • Offset Voltage Drift: 0.3µV/°C
  • Low Bias Current: 8pA
	• Accuracy and stability over the entire industrial temperature range

• EMI/RFI Filtered Inputs	• Improved noise immunity from wireless interference
• GBW: 3 MHz • Slew Rate: 1.5V/µs	• Wide Signal sources and fast response suitable to drive high performance ADCs

Applications

- Tracking Amplifiers in Power Modules
- Merchant Power Supplies
- Transducer Amplifiers
- Strain Gage Amplifier
- Precision Integrator
- Battery Powered Instruments

Packaging options:
Single: SO-8, SOT23-5, SOT553
Dual: SO-8, MSOP-8, VSSOP-8
Quad: SO-14, TSSOP-14

SOT23-5
3 x 3 x 1.45

VSSOP
3.1 x 2 x 0.9

SOT553
1.6 x 1.6 x 0.6

OPA170 / OPA2170 / OPA4170

Industry's smallest 36V microPower RRO General Purpose Op Amp

Features	Benefits
• Industry's smallest 36V Packages: • Single in SOT553, Dual in VSSOP-8	• Micropackages use >50% less board space than the larger SOT23 and MSOP packages
• Very Low Quiescent Current: 110µA/ch	• Enables battery powered operation

• Rail to Rail Output
  • +2.7V to +36V or ±1.35V to ±18V
  • High CMRR: 104dB
	• Maximizes input voltage range for use with low voltage sensor outputs
	  • Versatility in design for ease of use with different supply rail systems

• DC Precision
  • Offset Voltage: 1.8mV (max)
  • Offset Voltage Drift: 0.3µV/C
  • Low Bias Current: 8pA
	• Accuracy and stability over the entire industrial temperature range

• Low Noise: 19nV/√Hz at 1kHz	• Clean signal conditioning
• RFI Filtered Inputs	• Improved noise immunity from wireless interference

Applications

- Tracking Amplifiers in Power Modules
- Merchant Power Supplies
- Transducer Amplifiers
- Strain Gage Amplifier
- Precision Integrator
- Battery Powered Instruments

Packaging options:
Single: SO-8, SOT23-5, SOT553
Dual: SO-8, MSOP-8, VSSOP-8
Quad: SO-14, TSSOP-14

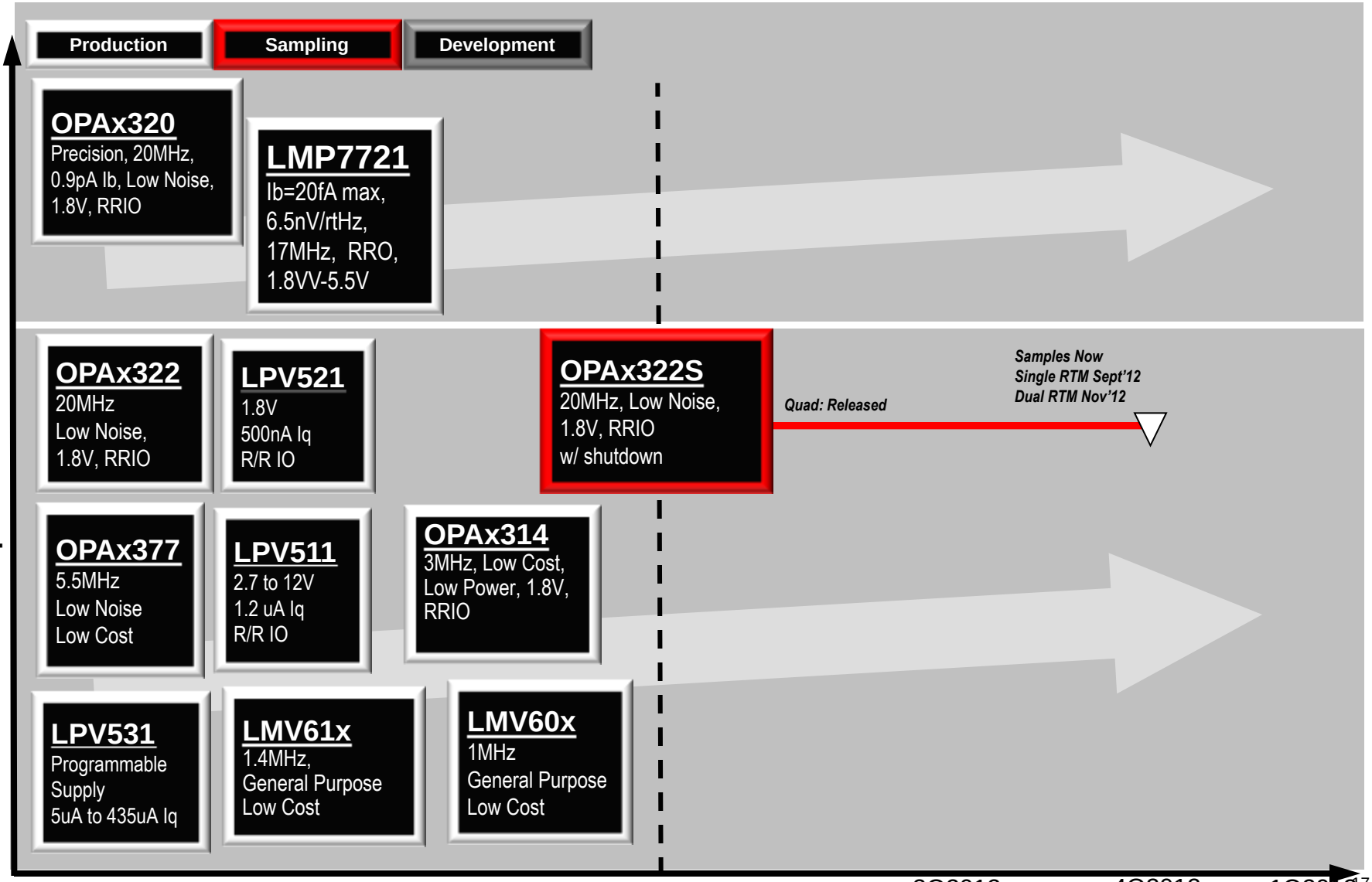
SOT23-5
3 x 3 x 1.45

VSSOP
3.1 x 2 x 0.9

SOT553
1.6 x 1.6 x 0.6

*(Preview / **Already released** / Sampling)*

Low Voltage Op Amp (Vs≤5.5V) Roadmap



OPA377 / OPA2377 / OPA4377

5.5MHz | Low Cost | Low Noise CMOS Amplifier

Features	Benefits

• Low Noise Performance:
  • 7.5nV/rtHz @1kHz
  • 2fA/rtHz @1kHz
  • 0.0027% THD +N @1kHz
	• Accurately measures AC signals without introducing additional error

• Ultra-Low Input Bias Current: 200fA (typ)	• High impedance input does not load sensor inputs enabling accurate signal for trans-impedance designs

• EMI Filtering & Single Supply Operation
  • Offset Voltage: 1mV (max)
  • Iq: 0.76mA/ch
  • Rail-to-Rail Output
  • Supply Voltage: 2.2V to 5.5
	• Provides additional immunity to RF Interference in broad range of applications.

Applications

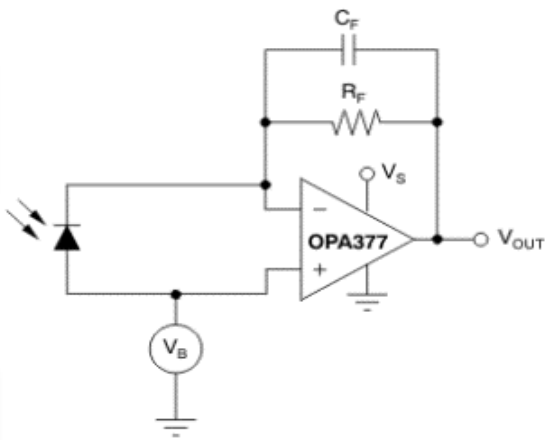
- Photodiode Preamp
- Piezoelectric Sensor Preamp
- Sensor Signal Conditioning
- Consumer Audio

Packaging options:
Single: SC70, SOT23, SO-8
Dual: MSOP-8, SO-8
Quad: TSSOP-14

OPA377
1ku: $0.40

OPA2377
1ku: $0.60

OPA4377
1ku: $0.90



Photodiode Preamplifier

OPA320 / OPA2320

Precision 20MHz | Ib=0.9pA | RRIO CMOS Op Amp

Features	Benefits

• Precision with Zero Crossover Distortion
  • Low Offset Voltage: 150µV (max)
  • High CMRR: 114dB
  • Rail-to-Rail I/O
	• Assures high precision and excellent signal linearity over the entire input common mode range making it ideal for driving sampling ADCs

• Wide Gain-Bandwidth: 20MHz
  • High Slew-rate: 10V/us
  • Low Noise: 7nV/√Hz at 10kHz
	• Wide GBW and slew rate for frequency and time domain applications and 16-bit resolution systems
	  • 35% lower noise than the OPA365

• Input bias: 0.9pA (max)	• Lowest input bias current of 5V CMOS op amps for supporting high source impedance applications
• Supply Voltage: 1.8V to 5.5V • Quiescent Current: 1.6mA/ch, max	• Excellent power/bandwidth ratio (80uA/MHz) resulting in 50% higher efficiency operation than the OPA376

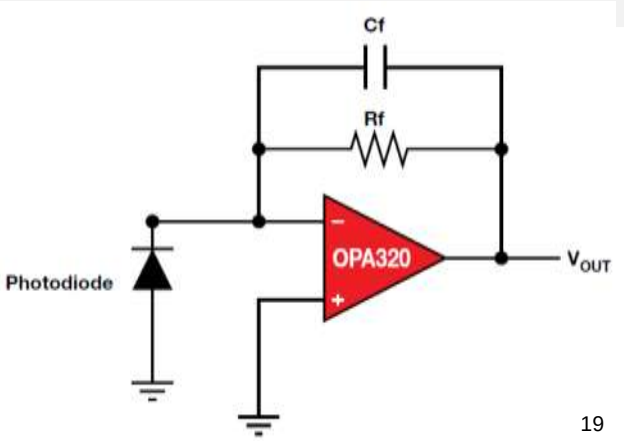
Applications

- Transimpedance Amplifier
- Precision Data Acquisition Systems
- High-Z Sensors and Signal Conditioning
- Programmable Logic Controllers (PLCs)
- Motor Control Loops
- Active Filters

Packaging options:
Single: SOT23-5
Dual: MSOP-8, SON-8

OPA320
1ku: $0.80

OPA2320
1ku: $1.25



OPA314 / OPA2314 / OPA4314

1.8V | 3MHz | 190uA | RRIO General Purpose CMOS Amplifier

Features	Benefits
• Best combination of Power and Performance • Iq: 190µA/ch (max) • Low Noise: 14nV/√Hz at 1kHz • Offset Voltage: 2.5mV (max)	• Up to 30% lower noise than the nearest competitors – maintains high signal-to-noise ratios which is critical for low-level signal amplifications
• Rail-to-Rail Input / Output • Supply Voltage: 1.8V to 5.5V • EMI/RFI Filtered Inputs	• RRIO maximizes input dynamic range with full use of single supply range, enabling use in a very wide variety of applications
• GBW: 3MHz	• High gain bandwidth for fast pulse response - 47.5% better power to speed ratio than the nearest competitor
• Low Ib: 0.2pA (typ)	• ~50% lower than nearest competitors – designed for high source impedance applications

Applications

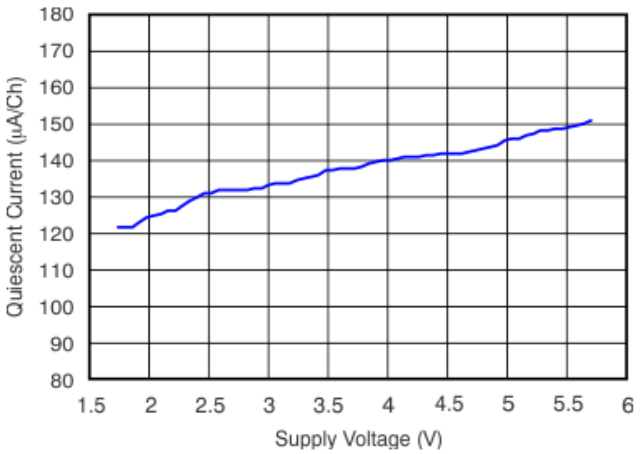
- Photodiode Amplifier
- Sensor Signal Conditioning
- Low-Side Current Sense
- CO/Smoke detectors
- Portable Medical and Instrumentation

Package Options:
Single: SC70-5, SOT23-5
Dual: MSOP-8, SO-8, DFN-8
Quad: TSSOP-14

OPA314
1ku: $0.25

OPA2314
1ku: $0.45

OPA4314
1ku: $0.75



LMP7721

3 Femptoampere Input Bias Current Precision Op Amp

Features

- Ultra ultra Low Input Bias Current
  - 3 fA typical, 20fA @ 25°C max guaranteed
- Wide operating supply voltage
  - 1.8 to 5.5V
- Low Supply Current
  - 1.5mA max
- Low Vos only 180uV @ 25°C max
- Low Noise Density
  - 6.5nV/rt Hz

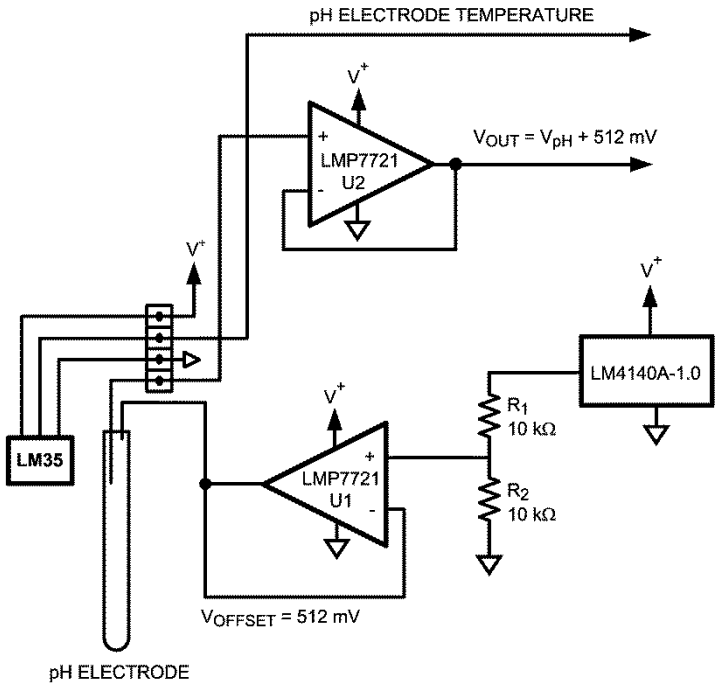
Benefits

- Offers precision performance at very low power
- Guaranteed tempco means precision over temperature
- CMOS inputs great for high impedance sources

Applications

- Precision Instrumentation Amplifiers
- Battery Powered Medical Instruments
- High Impedance Sensors
- Electrometers
- Photodiode Amplifier
- Ion Chamber Amplifier
- pH electrode Amplifier
- Transimpedance Amplifier

LMP7721
1ku: $4.70



EVM PART # LMP7721MAEVALMF/NOPB

LPV511 / LPV521 / LPV531

Micro/Nano-power Operational Amplifiers in Small Packages

Features

- **LPV511**
  - Iq = 1.2uA
  - Supply voltage range: 2.7V to 12V
  - Rail to Rail Input and Output
  - Micro-package: SC70-5
- **LPV521 World's Lowest supply current**
  - Iq = 400nA max (704 uW @ 1.6V)
  - Supply voltage: 1.6V to 5.5V
  - Rail to Rail Input and Output
  - Micro-package: SC70-5
- **LPV531** Programmable Power and Bandwidth
  - Iq = 5uA to 435uA (programmable)
  - TSOT23-6 package

Benefits

- Microwatt Power Consumption
- Long Battery Life in Portable Applications
- Programmable supply current (LPV531)
- Minimum board area

Applications

- Battery powered systems
- Security systems
- Micropower thermostats
- Solar powered systems
- Portable instrumentation
- Micropower filter
- Remote sensor amplifier

Package Options:
LPV511: SC70-5
LPV521: SC70-5
LPV531: TSOT23-6

LPV511
1ku: $0.45

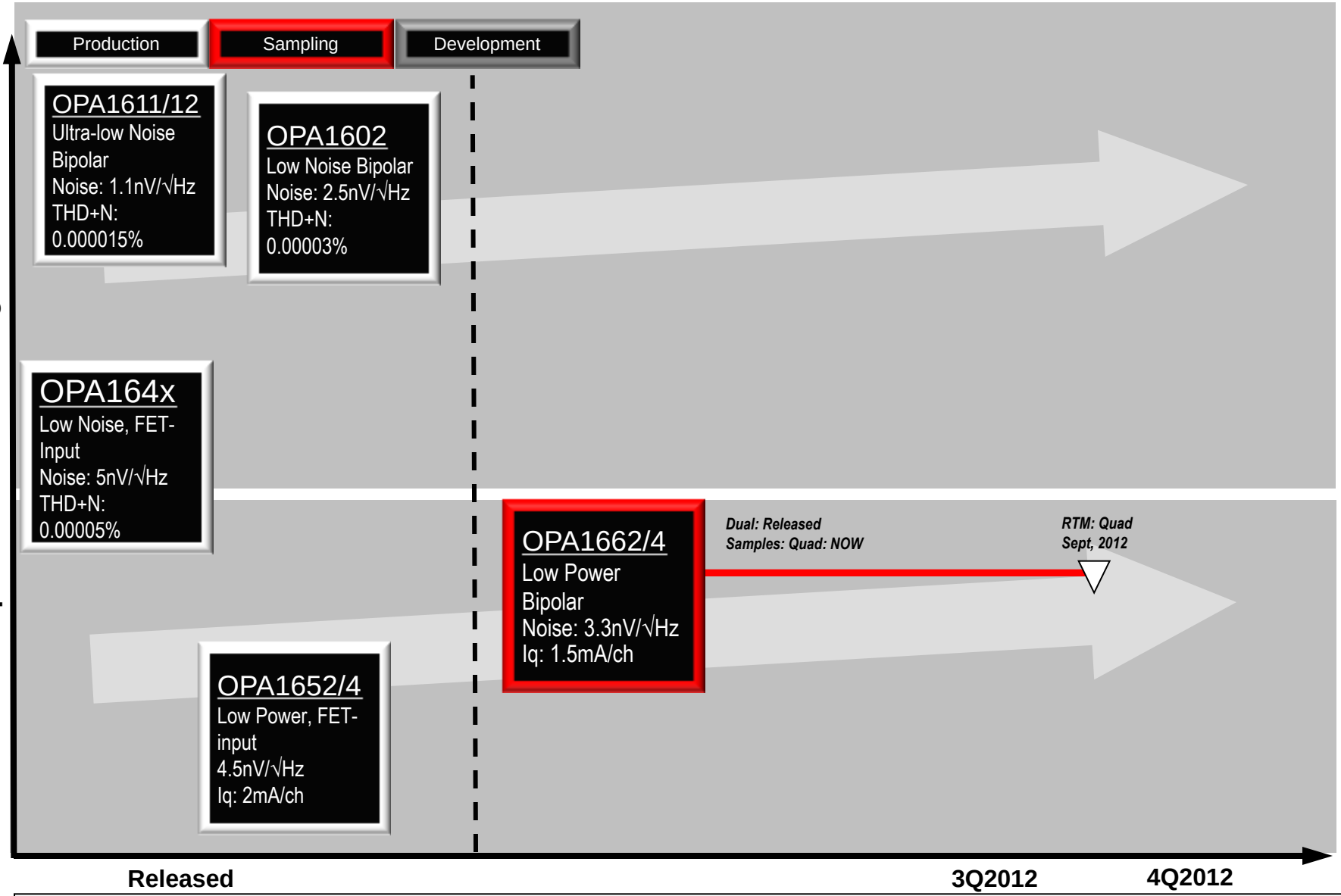
LMV521
1ku: $0.65

LPV531
1ku: $0.45

EVM PART 551012922-001/NOPB

Texas Instruments

Precision Audio Op Amp Roadmap



OPA1641 / OPA1642 / OPA1644

High Performance Family of JFET-Input Audio Op-amps

Features

- Low noise:
  - 5nV/√Hz @ 1kHz
  - Low THD+N: 0.00005% @ 1kHz
- Slew Rate: 20V/us
- Industry's lowest power high performance
  - Low Quiescent Current: 1.8mA / channel
- FET input Audio op-amp
- Wide supply range: +/- 2.25V to +/- 18V

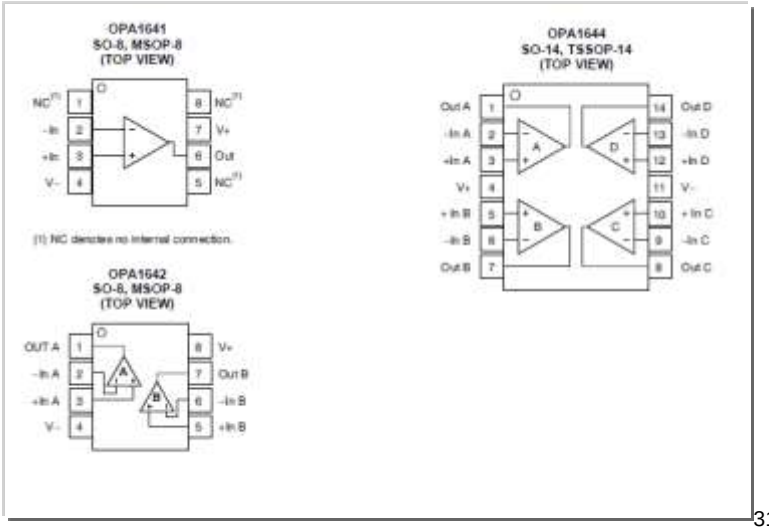
Benefits

- Excellent Op Amp for Discerning Audio Applications
- Minimizes signal errors due to load impedance
- Maintains excellent SNR, even with high gain levels
- Maintains low noise and good dynamic range
- Rail to Rail output swing, enables higher signal level using less power.

Applications

- Professional Audio Equipment
- Blu-ray Players
- High-end AV Receivers
- Digital and Analog Mixing Consoles
- Broadcast Studio Equipment

Packaging options:
Single: SO-8, MSOP-8
Dual: SO-8, MSOP-8
Quad: SO-14, TSSOP-14



OPA1662 / OPA1664

Low-Power/Low Noise | Dual and Quad Bipolar Audio Op-amps

Features

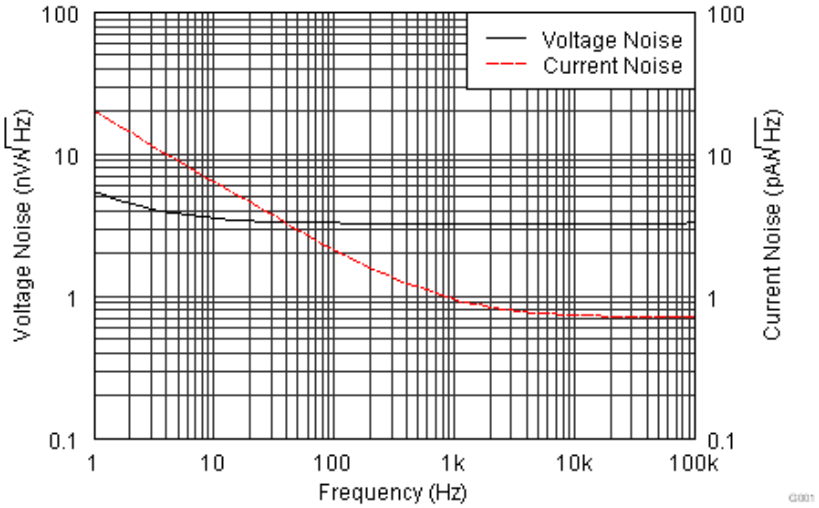
- Low Quiescent Current:1.5mA per Channel
- Low noise: 3.3nV/√Hz @ 1kHz
- Low THD+N: 0.00004% @ 1kHz
- Slew Rate: 17V/us
- Gain Bandwidth: 22MHz
- Rail to Rail Output
- Wide supply range: +/- 1.5V to +/- 18V

Benefits

- Low power consumption
- Great for use in applications where there is a strict system power budget
- Low noise and distortion, an excellent Op Amp for Audio Applications
- Rail to Rail output swing, enables higher signal level using less power.
- Great Op-amp for use in +5V and other single supply applications

Applications

- USB and FireWire Audio Systems
- Analog and Digital Mixers
- Portable Recording Systems
- Audio Effects Processors
- High-End A/V Receivers
- High-End DVD and Blue Ray Players
- High-End Car Audio



Packaging options:
Dual: SO-8, MSOP-8
Quad: SO-14, TSSOP-14

(Released / Sampling / Preview)

OPA1652 / OPA1654

Low-Power/Low Noise | Dual and Quad Audio Op-amps

Features

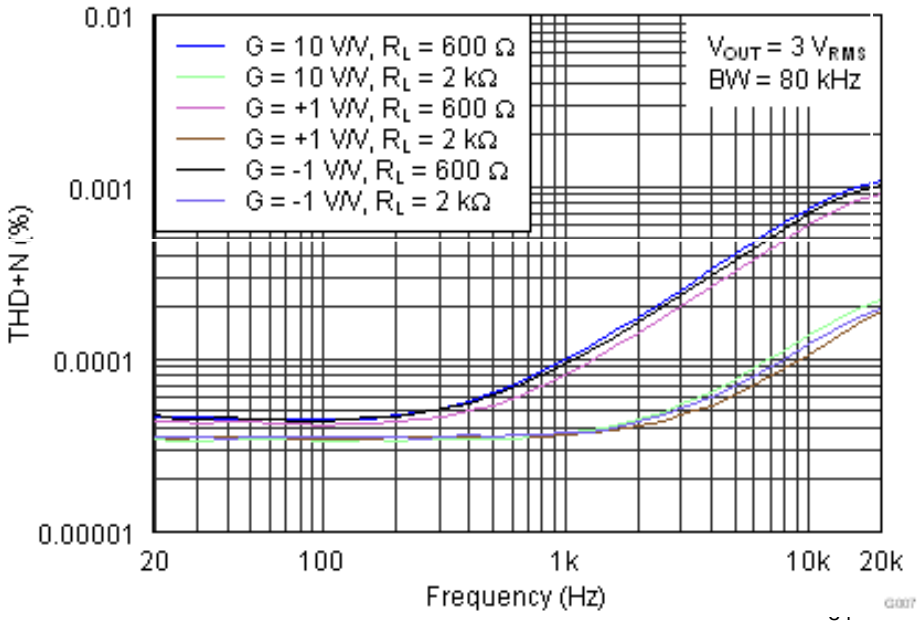
- Low Quiescent Current:1.8mA per Channel
- Low noise: 4.5nV/√Hz @ 1kHz
  - Low THD+N: 0.00005% @ 1kHz
- Slew Rate: 10V/us
- Gain Bandwidth: 18MHz
- Rail to Rail Output
- Wide supply range: +/- 2.25V to +/- 18V

Benefits

- Better performance than NE5532 or MC33078
- Low power consumption (less than half of NE5532)
- Low noise and distortion, an excellent Op Amp for Prosumer/Consumer Audio Applications
- Rail to Rail output swing, enables higher output signal levels using less power.

Applications

- USB and FireWire Audio Systems
- Analog and Digital Mixers
- Audio Effects Processors
- A/V Receivers
- DVD and Blue Ray Players
- Car Audio

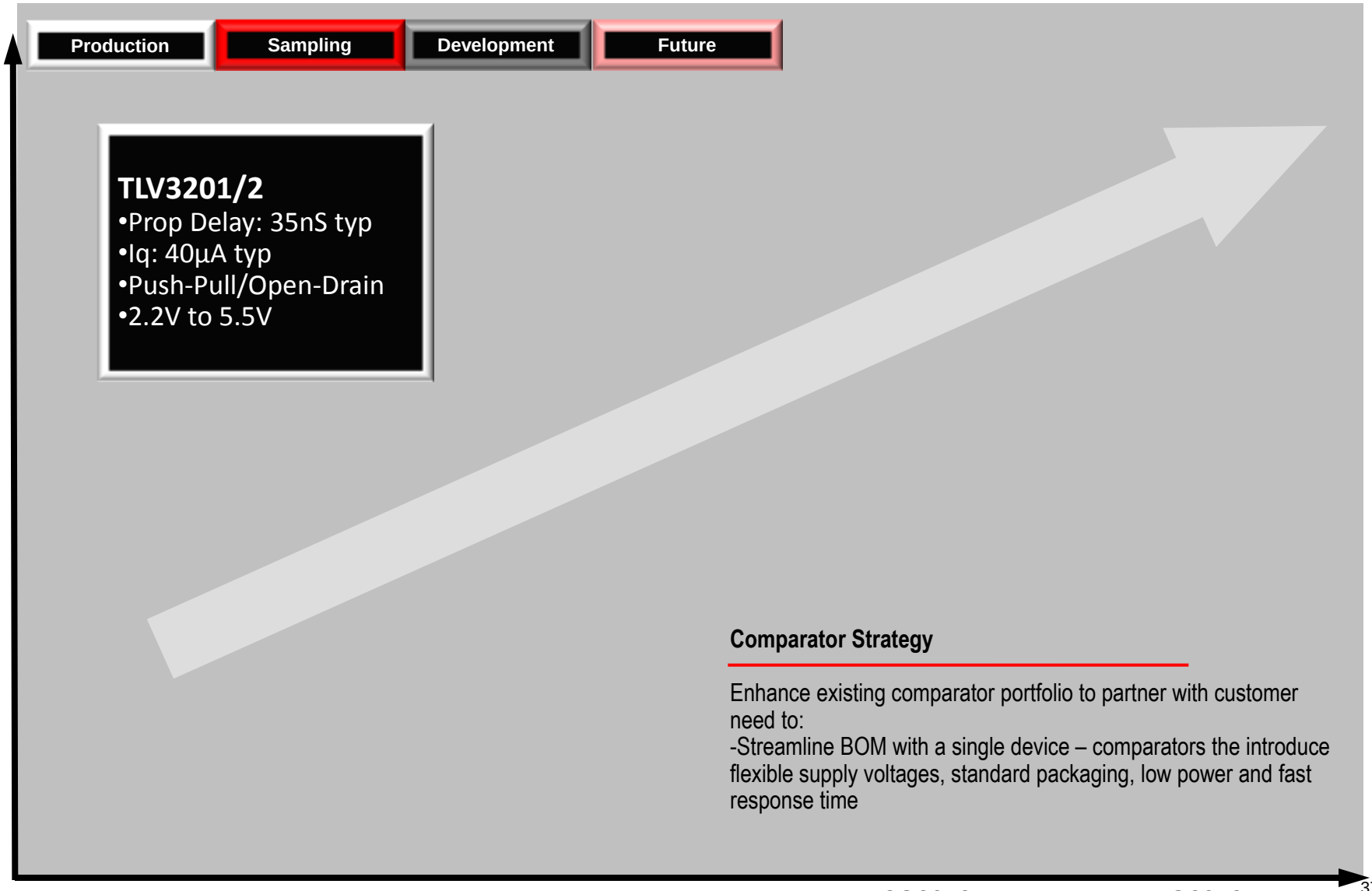


OPA1652
1ku: $0.65

OPA1654
1ku: $0.95

Packaging options:
Dual: SO-8, MSOP-8
Quad: SO-14, TSSOP-14

Comparators



TLV3201 / TLV3202

40ns micro-Power Rail-to-Rail Input | Single and Dual-Channel Comparators with Push-Pull outputs

Features

- High Speed: Propagation delay: 40nS typ.
  - Low quiescent current: 40uA, typ
- Rail-to-Rail Inputs
  - Input range up to 200mV beyond supplies
  - Supply Range: 2.7V to 5.5V
- Push-Pull output
  - Single and Dual Channel Options

Benefits

- Fastest response time for the lowest power consumption- ~23% higher speed and ~62% lower power than nearest competition
- Maintains signal integrity over full output range of rail-to-rail output amplifiers and logic circuitry
- Multiple output and channel options for wide range of applications

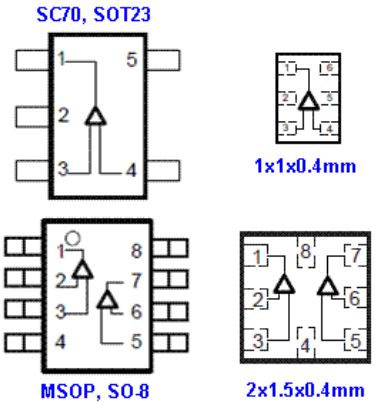
Applications

- Inspection equipment
- Test and Measurement
- High-speed Sampling Systems
- Telecom
- Base-stations
- Portable Communications

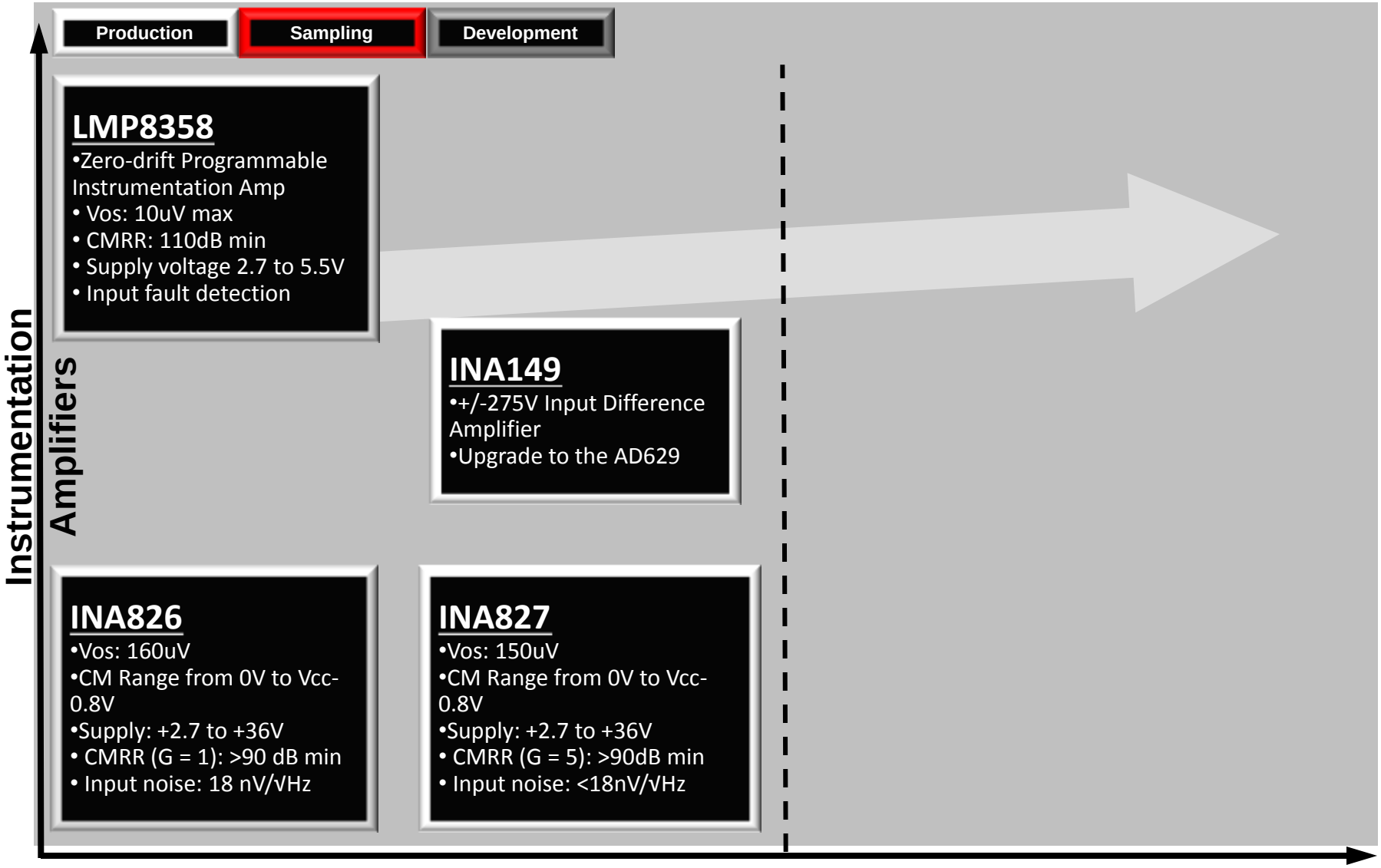
Packaging options:
Single: SOT23-5, SC70-5
Dual: SO-8, MSOP-8

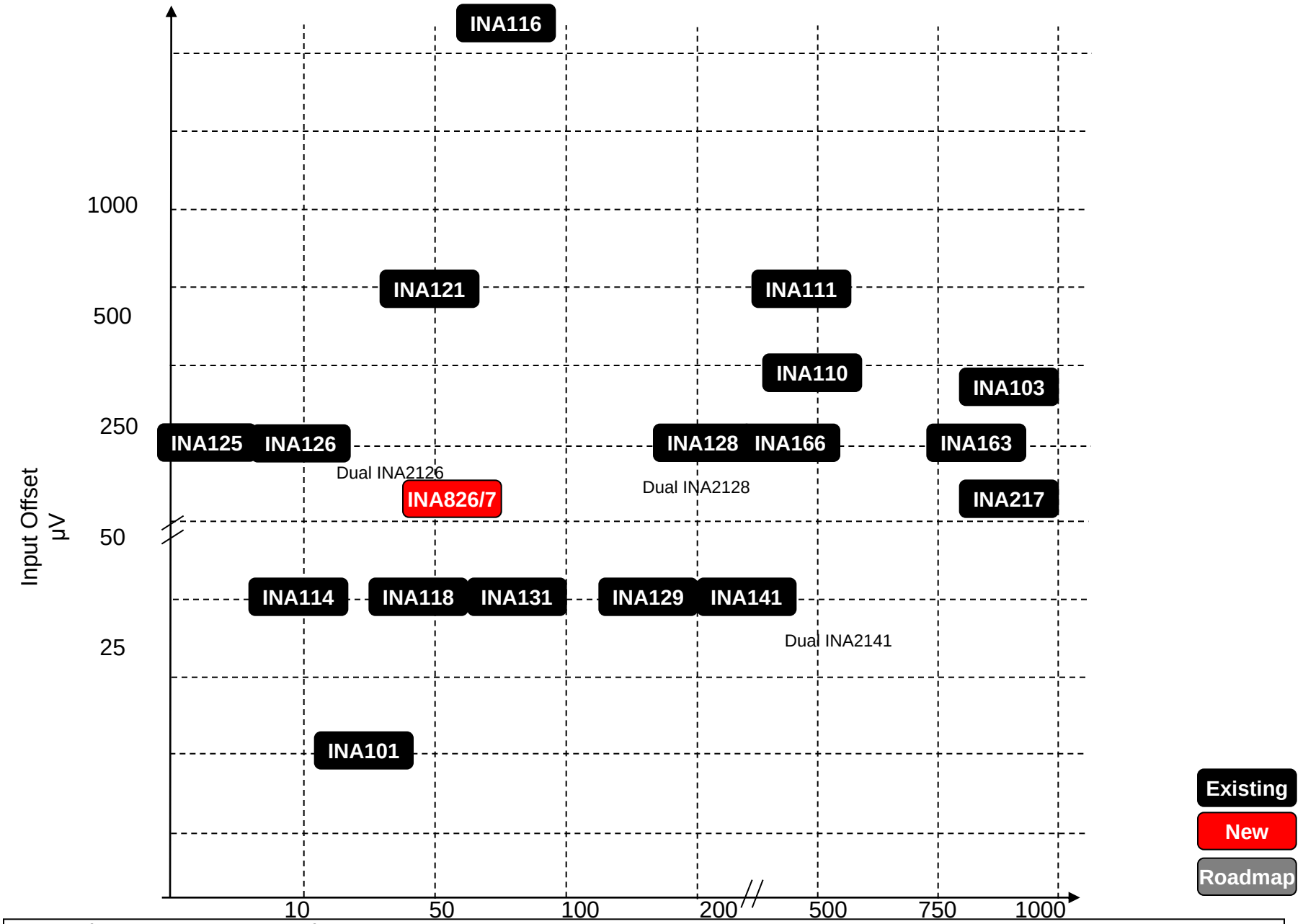
TLV3201
1ku: $0.40

TLV3202
1ku: $0.50



Instrumentation Amplifier Roadmap




INA116
1000
INA121
INA111
500
INA110
INA103
250
INA125
INA126
INA128
INA166
INA163
Dual INA2126
Dual INA2128
INA826/7
INA217
50
INA114
INA118
INA131
INA129
INA141
25
Dual INA2141
INA101
Input Offset
µV
10
50
100
200
500
750
1000
Bandwidth kHz
For G = 100
Existing
New
Roadmap

INA826

Low Power RRIO Precision Instrumentation Amplifier

Features

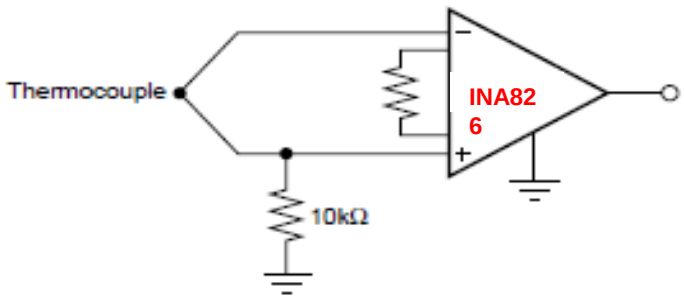
- Wide Common Mode Input Range
  - Input voltage swing below ground
  - +/-50V Input Protection
- Precision Input:
  - Low Offset Voltage: 40uV
  - EMI Hardened
  - CMRR (G = 1): 84 dB min
  - Input noise: 18 nV/√Hz
- Low Power and Wide Supply:
  - Max supply current: 250 µA
  - Supply: +2.7 to +36V, 1.35V to 18V
  - Rail-to-Rail Output
- Standard and Micro Packages
  - MSOP-8, SOIC-8, & DFN-8

Benefits

- Maximum input signal range with a single device for both single or bipolar supply industrial applications
- Achieve precision measurement with high EMI robustness.
- High performance on Low or High Vs
- DFN saves 30% of Space vs MSOP-8

Applications

- Industrial process controls
- Circuit Breakers
- Current Measurement
- Medical instrumentation
- Portable data acquisition



LMP8358

Zero-Drift Programmable Instrumentation Amplifier with Diagnostics

Features

- **Input fault detection to detect shorted, open and degraded source connections**
- Optional filtering
- Shutdown Mode
- Below Ground Sensing
- **VOS < 10µV, CMRR > 125dB**
- **Programmable gain: 10x, 20x, 50x, 100x, 200x, 500x, 1000x**
- **Input zeroing and polarity reversal switches for system-level calibration**

Benefits

- Auto-Zero Topology means virtually no Vos Drift
- **Easy to Set gain using SPI or external resistors**
- Input operates 100mV below ground for ground based sensors

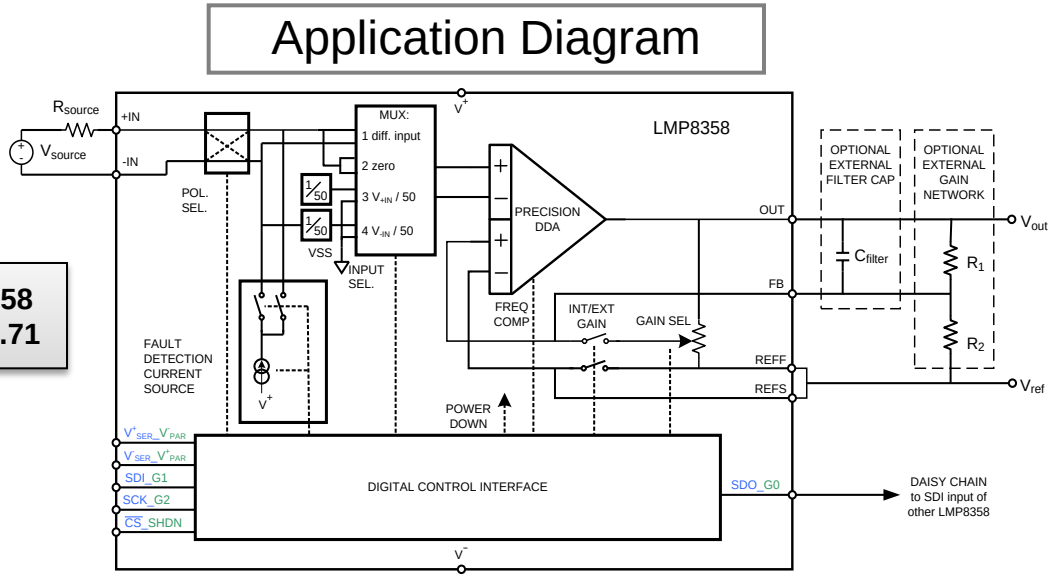
Applications

- Bridge sensor amplifier
- Thermopile amplifier
- Portable instrumentation
- Medical instrumentation
- Precision low-side current sensing

LMP8358
1ku: $2.71

EVM PART # LMP8358MAEVAL/NOPB

Application Diagram



Texas Instruments

INA149

+/- 275V Input Difference Amplifier

Improved Replacement for AD629

Features

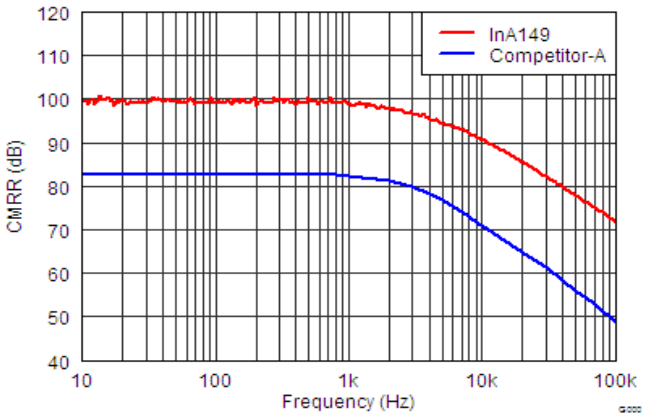
- Extended Input Common Mode Voltage:
  - 275V at Vs = 15V
  - +84V at Vs = +5V
  - Guaranteed CMRR of 90dB min. in -40 C to 125 C
- Excellent Gain Accuracy and Linearity
  - Fixed Differential Gain = 1V/V
  - Low Gain Error: 0.02% max
  - Low Non-Linearity: 0.001% max
  - 500KHz Bandwidth
- Wide Supply Range:
  - +4V to 36V or 2V to 18V
  - SO-8

Benefits

- Cuts the total accuracy error in less than half throughout the extended industrial temperature range. Using the INA149 eliminates the need to include multiple additional isolators or multiple power supplies in high common mode voltage applications.
- Maintains accuracy in the presence of high common mode voltages, allowing tight system control and faster response time to changing input signal levels.
- Drops in for industry standard pinouts and supports wide range of supply voltages for simple system upgrades in existing designs

Applications

- High-Voltage Current Sensing
- Battery Cell Voltage Monitoring
- Power-Supply Current Monitoring
- Motor Controls
- Replacement for Isolation Circuits



EVM NEW!

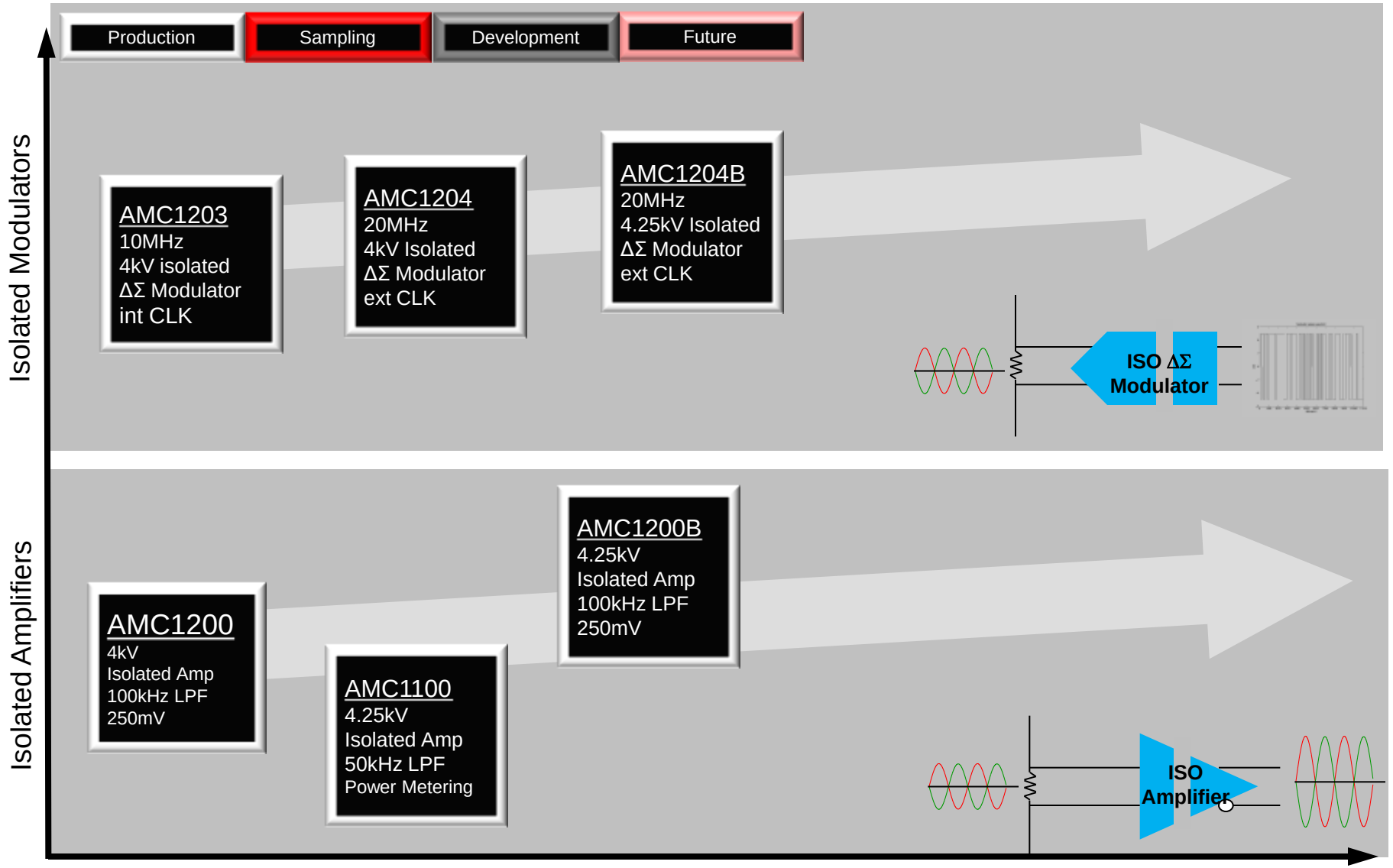
INA149EVM

INA149 Portfolio Positioning

Specification \ Device	INA149	INA117	INA148	INA146
CMRR (min.)				
Over temperature	90dB	80dB	70dB	70dB
DC	90dB	86dB	70dB	70dB
Gain				
Value	1V/V	1V/V	1V/V	1 - 100V/V
Error (max.)	0.02%FSR	0.02%FSR	0.075%FSR	0.1%FSR
Drift (max.)	10ppm/°C	10ppm/°C	10ppm/°C	10ppm/°C
Nonlinearity(max.)	10ppm	10ppm	20ppm	100ppm
Offset voltage				
Initial (max.)	1mV	1mV	5mV	5mV
Drift (max.)	10µV/°C	40µV/°C	10µV/°C (typ.)	1µV/°C(typ.)
Input operating voltage				
Common-mode range	-275V to +275V	-200V to +200V	-200V to +200V	-100V to +100V
Differential range	-13.5V to 13.5V	-10V to 10V	-	-
Dynamic response				
Small-signal bandwidth	500kHz	200kHz	100kHz	50kHz*
Slew rate (typ.)	4.2V/µs	2.6V/µs	1V/µs	0.45V/µs
Full-power bandwidth	63kHz	30kHz (min.)	-	-
Specified temperature range	-40°C to 125°C	-40°C to 85°C	-40°C to 85°C	-40°C to 85°C

* At G = 1V/V

Isolated Modulators and Amplifiers



AMC1203

16-Bit, Isolated 10Mhz Delta-Sigma Modulator

Features

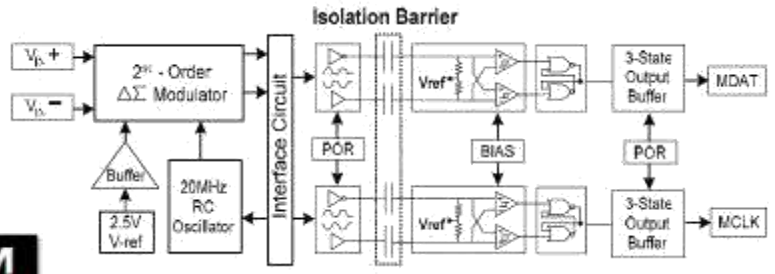
- 10Mhz 2nd Order Delta-Sigma Modulator
  - 3 LSB Max INL
  - 1 LSB Max DNL
  - 85db SNR
- Integrated Capacitive Digital Isolation
  - 560V Maximum Working Isolation Voltage
  - 4000V Maximum Transient Over Voltage
  - 15kV/uS Transient Immunity
- Available In Several Standard Package Options
  - DUB-8
  - SOIC-16 Under Development

Benefits

- Stand Alone Modulator Allows For Flexible Designs Using Custom Digital Filter or TI's AMC1210 IC Solution
- Single Chip Solution Simplifies System Design And Has Excellent Magnetic Immunity
- Simple Drop-In Upgrade For Competing Isolated Modulators
  - AD7400
  - HPCL7860

Applications

- Current Measurement
- Process Control
- Chromatography
- Portable Instrumentation



AMC1203 EVM Available

AMC1204

4kV$_{PEAK}$ Isolated 20MHz ΔΣ modulator

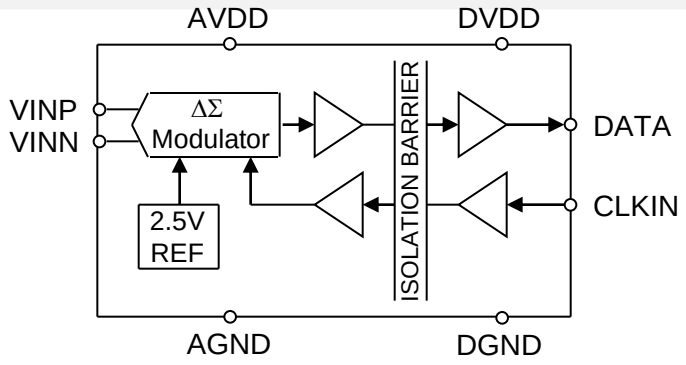
Features	Benefits
• Integrated Capacitive Isolation Barrier - Continuous working voltage: 1200V$_{PEAK}$	• Provides excellent magnetic immunity and long isolation barrier lifetime
• External Clock: 5 to 20MHz	• Enables synchronization of multiple channels
• INL: ±8LSB max	• 30% more linear vs. the nearest competitor which enables more accurate measurements
• Outstanding AC Performance: SNR: 84dB min, THD: -80dB max	• AC performance exceeds that of the nearest competitor
• Pin-to-pin compatible solution vs. HCPL7860 & AD7401A and specified over the extended industrial temperature range	• Offers a simple upgrade which reduces power while increasing performance

Applications

Shunt-based Current measurement in:

- Motor Control
- Green Energy
- Frequency Inverter Applications
- Uninterruptible Power Supplies

AMC1204 EVM Available



AMC1204B

4.25kV$_{PEAK}$ Isolated 20MHz ΔΣ modulator

Features

- Integrated Capacitive Isolation Barrier
  - Continuous working voltage: 1200V$_{PEAK}$
  - 4.25kVpeak isolation voltage enabling 300V system voltage
- External Clock: 5 to 20MHz
- INL: ±8LSB max
- Outstanding AC Performance: SNR: 84dB min, THD: -80dB max
- Pin-to-pin compatible solution vs. HCPL7860 & AD7401A and specified over the extended industrial temperature range

Benefits

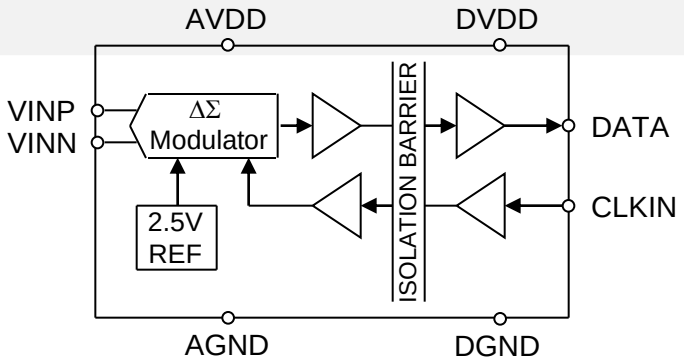
- Provides excellent magnetic immunity and long isolation barrier lifetime
- Enables synchronization of multiple channels
- 30% more linear vs. the nearest competitor which enables more accurate measurements
- AC performance exceeds that of the nearest competitor
- Offers a simple upgrade which reduces power while increasing performance

Applications

Shunt-based Current measurement in:

- Motor Control
- Green Energy
- Frequency Inverter Applications
- Uninterruptible Power Supplies

AMC1204 EVM Available



AMC1200
4kV$_{PEAK}$ Isolated Amplifier

AMC1200B
4.25kV$_{PEAK}$ Isolated Amplifier

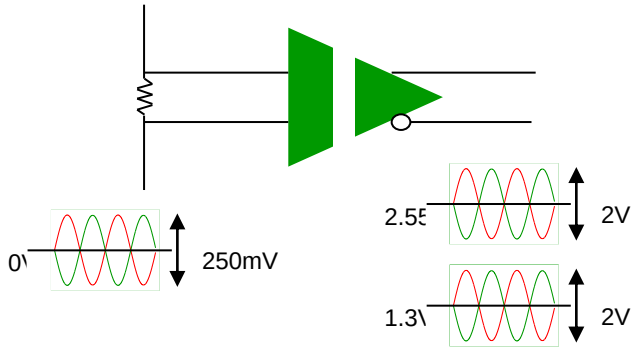
Features	Benefits

• Certified Galvanic Isolation Barrier
  • 4kV (***4.25kV***) peak Basic isolation
  • UL1777 and IEC60747-5-2 approved
  • 1.2kVpeak continuous working voltage
	• Galvanic barrier provides EMI immunity and robust isolation barrier lifetime

• ±250mV input voltage range	• Optimized for direct connection to shunt resistors or other low voltage level signal sources
• Pin-to-pin performance upgrade for HCPL7800 & HCPL7840	• Over 90% more linear, 80% less gain drift, at 50% of the power
• Specified Temperature range: -40 to 105°C	• Extended industrial range offers additional 20°C of fully specified performance

Applications

Shunt-based Current measurement in:
- Motor Control
- Green Energy
- Frequency Inverter Applications
- Uninterruptible Power Supplies



AMC1200 EVM Available

AMC1100

4kV$_{PEAK}$ Isolated Amplifier *for e-metering*

Features	Benefits

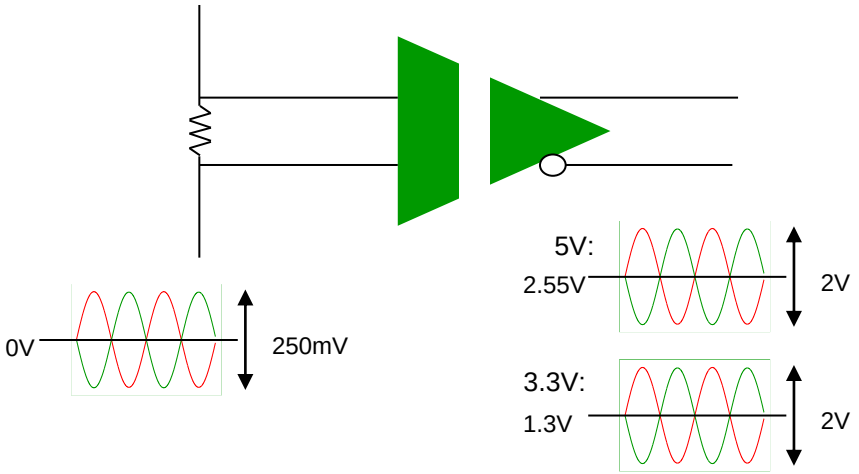
• Certified Galvanic Isolation Barrier
  • 4 kVpeak isolation voltage
  • UL1577 and IEC60747-5-2 approved
  • **2.5kV/µS Transient Immunity**
	• Galvanic barrier provides EMI immunity and robust isolation barrier lifetime and ***relaxed CMTI specs*** for cost competitive e-metering market

• ±250mV input voltage range	• Optimized for direct connection to shunt resistors or other low voltage level signal sources
• Specified Temperature range: -40 to 105°C	• Over 90% more linear, 80% less gain drift, at 50% of the power
• Pin-to-pin performance upgrade for HCPL7800 & HCPL7840	• Extended industrial range offers additional 20°C of fully specified performance

Applications

Shunt-based Current measurement in:

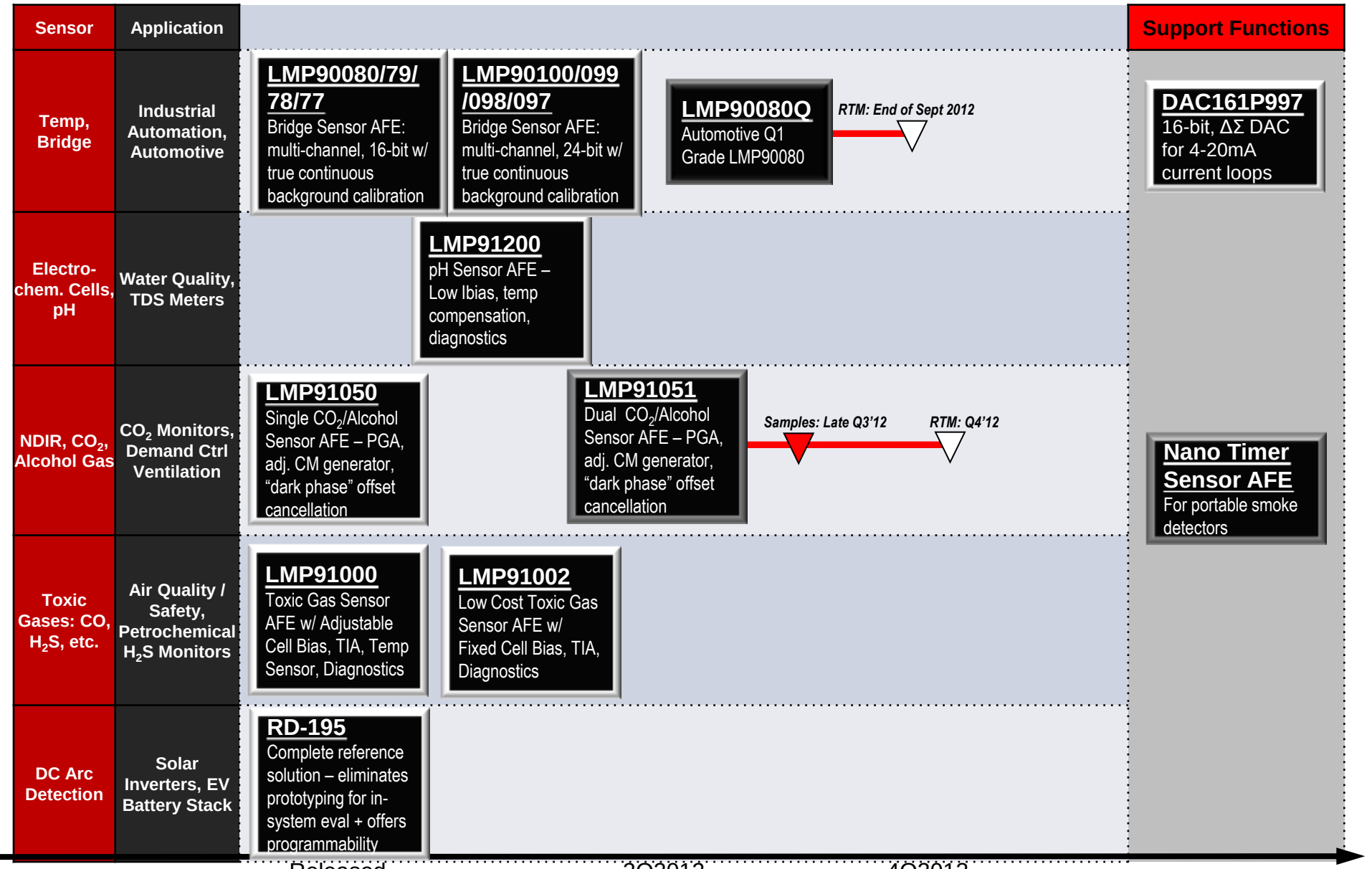
- Motor Control
- Green Energy
- Frequency Inverter Applications
- Uninterruptible Power Supplies
- Energy Metering



AMC1100 EVM Available

Sensor AFE Roadmap

Production | Sampling | Development | Future



LMP91200

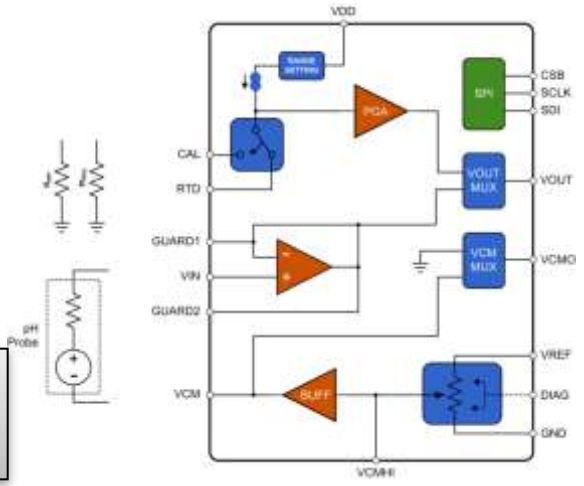
Fully Integrated Analog Front End for pH Analyzer Sensor Platforms

Features	Benefits
• Guaranteed low bias current at all operating conditions without supply • Very low Input offset voltage ±150 µV • Very low Input offset voltage drift ±2.5 µV/°C • Very low Supply current (pH mode) 50µA • Wide Supply Range 1.8V to 5.5V • Low power consumption • Operating temperature range -40°C to 125°C • Active guarding • On board sensor test	• Fully Integrated solution for pH measurement • No destruction of pH electrode at no supply situation (because of low input bias @ no supply) • Low power consumption allows intelligent sensors
• **Ease of Evaluation** • Supported by WeBench Sensor AFE Designer	• Online evaluation tool enables quick evaluation, prototyping and faster time to market

Applications

- pH Sensor Platforms
  - Chemical/Petrochemical Plants
  - Refining & Gas production
  - Emission Monitoring
  - Steam & Water quality monitoring

LMP91200EVAL

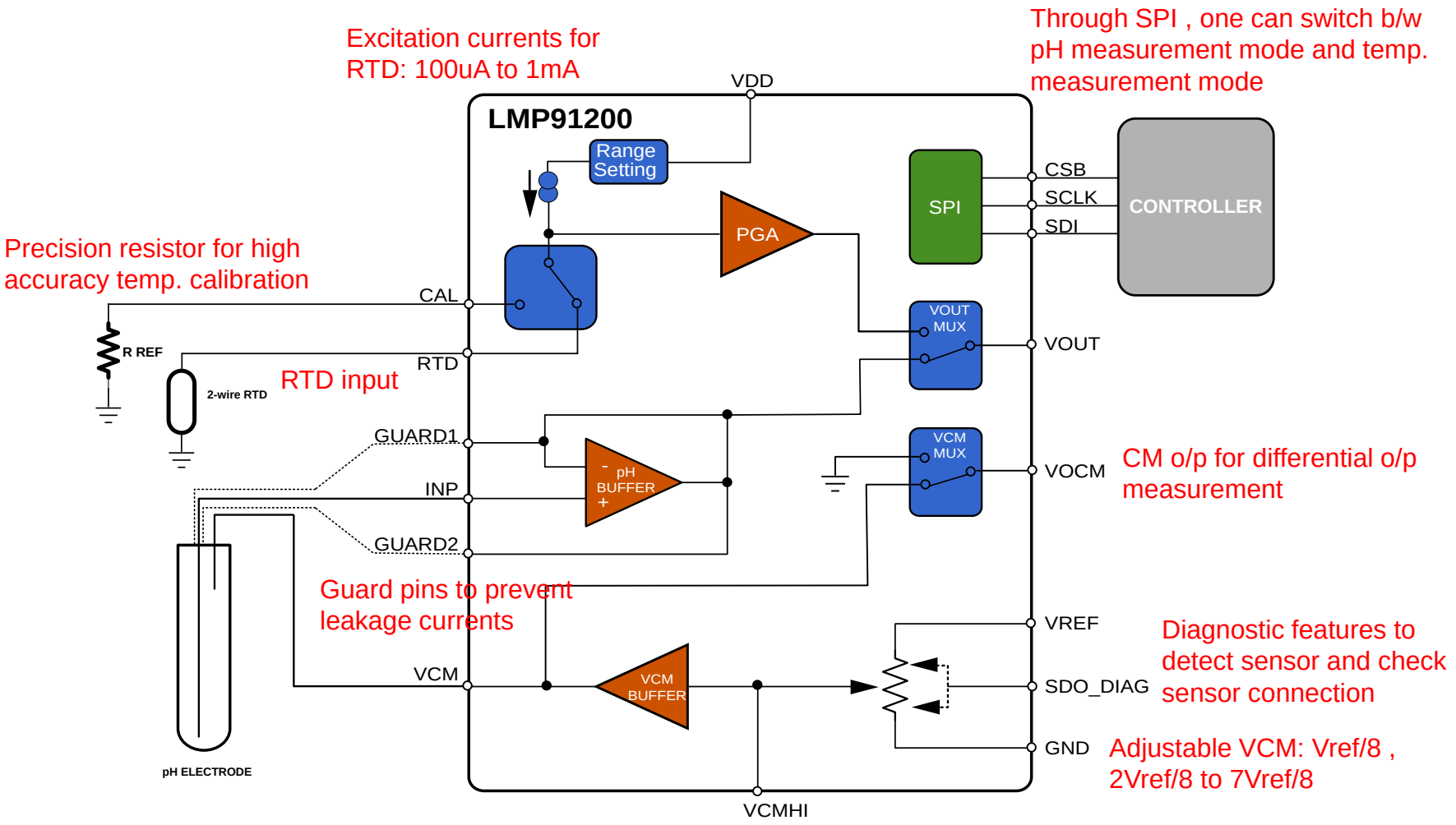


LMP91050
1ku: $1.32

Texas Instruments

LMP91200 Application Diagram

pH sensing



LMP91000

Configurable AFE Potentiostat for Low-Power Chemical Sensing Applications

Features	Benefits

• **Integration**
  • On board TIA, Cell Bias, Temperature sensor
  • On board sensor test
	• Integrates multiple discrete components to save board space, reduce cost and minimize design time

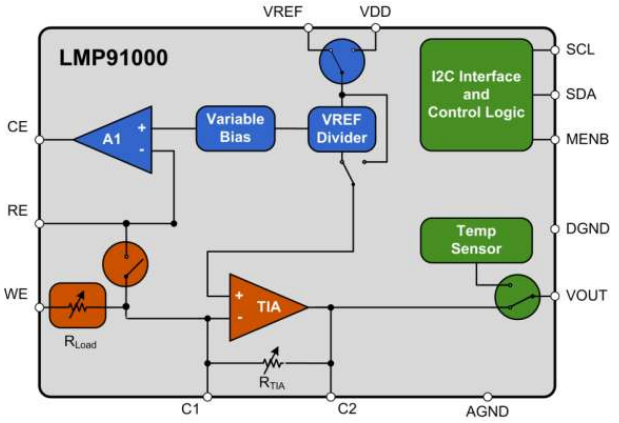
• **Industry's first Fully Programmable AFE Potentiostat**
  • Programmable transimpedance gain
  • Programmable cell bias voltage with low drift
  • Cell conditioning currents up to 10mA
  • Reference Electrode Bias Current 1000pA (max)
	• Flexible solution allows use of LMP91000 for a wide variety of gases and wide range of gas concentrations from 0.5 nA/ppm to 9.5 nA/ppm

• **Ultra Low Power Consumption**
  • Supply current (Average over time) <10uA
  • Operating supply range: 2.7V to 5.5 V
	• Optimal for battery-operated systems, as well as 4mA to 20mA transmitter applications

• **Ease of Evaluation** • Supported by Webench Sensor AFE Designer	• Online evaluation tool enables quick evaluation, prototyping and faster time to market

Applications

- Toxic gas detection platforms
- Amperometric applications
- Chemical species detection
- Electrochemical blood glucose meter
- 3 lead toxic gas sensors
- 2 lead galvanic cell sensors



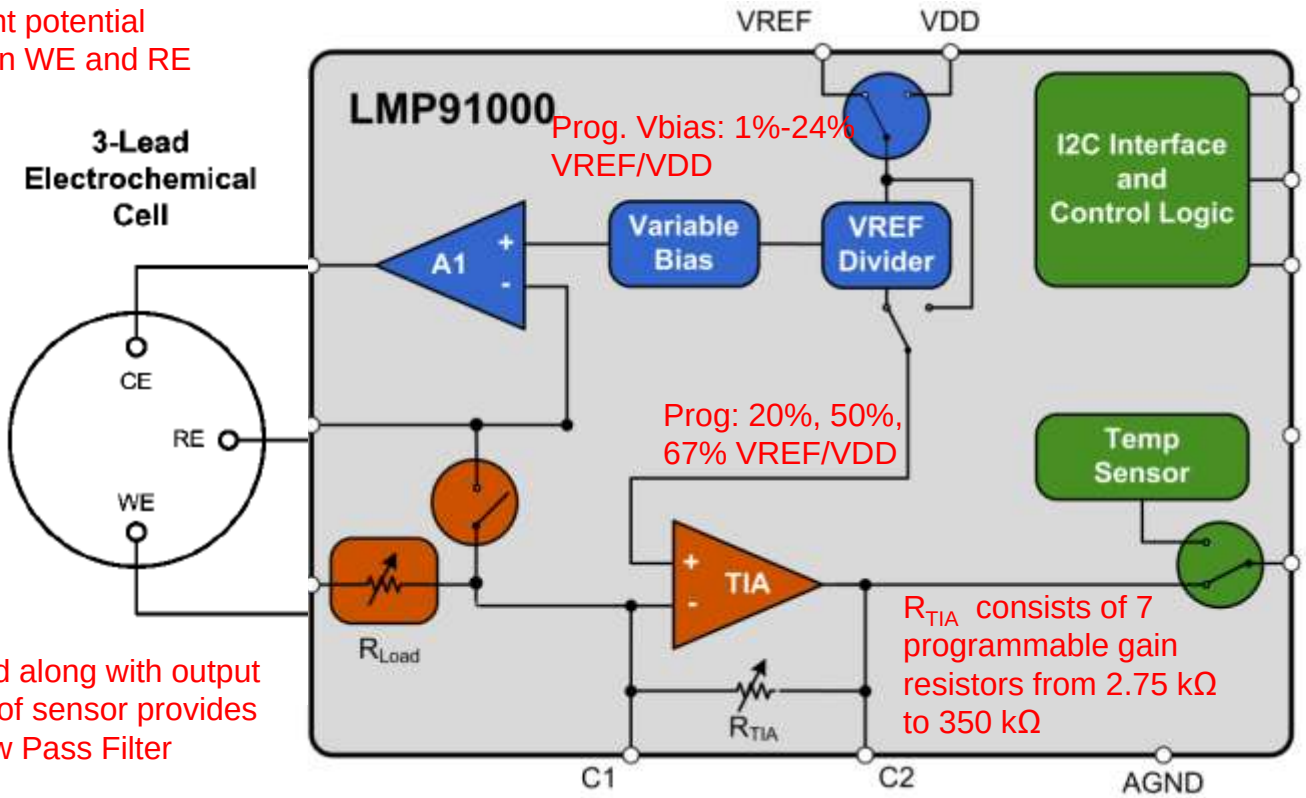
LMP91000SDE/NOPB

Texas Instruments

LMP91000 – Functional Blocks

CE helps maintain constant potential between WE and RE

A1 provides initial charge and bias voltage to the sensor



Prog. Vbias: 1%-24% VREF/VDD

I2C interface supports standard mode 100 KHz

Prog: 20%, 50%, 67% VREF/VDD

Integrated temp sensor ±3°C accuracy from -40°C to 85°C

R_{TIA} consists of 7 programmable gain resistors from 2.75 kΩ to 350 kΩ

Rload along with output cap. of sensor provides a Low Pass Filter

Connections for external resistor for different TIA Gain

C2 can be used to measure TIA output while VOUT is used to monitor temp.

LMP91002

Configurable AFE for Low-Power H2S and CO Sensing Applications

Features	Benefits

• **Programmable AFE Potentiostat**
  • Programmable transimpedance gain
  • Cell conditioning currents up to 10mA
  • Reference Electrode Bias Current 900pA (max)
	• Programmable chip provides single solution for H2S and CO sensors vs discrete solutions for a wide range of gas concentrations from 0.5 nA/ppm to 9500 nA/ppm, current ranges from 5 uA to 750 uA

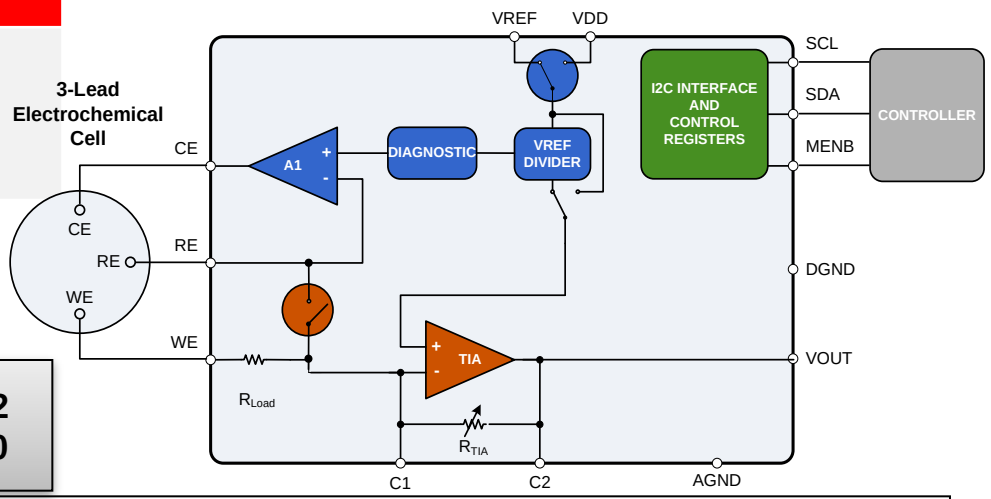
• **Integration and Reliability** • On board TIA, Sensor diagnostics via I2C	• Integrates multiple discrete components reducing cost , enhancing system reliability and minimizing design time

• **Ultra Low Power Consumption**
  • Supply current (Average over time) <10uA
  • Operating supply range: 2.7V to 3.6 V
	• Optimal for portable battery-operated systems, as well as 4mA to 20mA transmitter applications

• **Ease of Evaluation** • Supported by WeBench Sensor AFE Designer	• Online evaluation tool enables quick evaluation, prototyping and faster time to market

Applications

- Toxic gas detection platforms
  - Zero bias sensors: H2S, CO
- Amperometric applications
- Chemical species detection



EVM PART # LMP91000SDE/NOPB

LMP91002
1ku: $1.80

Texas Instruments

LMP91002: Optimized for Zero Bias 3-Lead Cells

Feature	LMP91000	LMP91002 (LMP91000 lite!)
Sensor Types	3-lead and 2-lead cells Carbon Monoxide Hydrogen Sulfide Oxygen, and many others	3-lead cells Carbon Monoxide Hydrogen Sulfide
Detector Type	Multi Gas Detectors	Single Gas detectors (most common are H2S and CO)
Supply Voltage Max	5.25 V	3.6 V
Cell Bias Voltage	Programmable Range +/- 0.24 * Vref	0 V
Load Resistor	Programmable Range 10 – 100 Ohms	10 Ohms
Integrated Temperature Sensor	Yes	No
Availability	Released	Samples Now RTM May 2012
Pricing @ 1 Ku	$2.80	$1.80

LMP91050 / LMP91051

1-ch and 2-ch Configurable AFE for Optical/NDIR Platforms

Features	Benefits

• **Integration and programmability**
  • Programmable gain amplifier (163V/V to 8000V/V)
  • On chip “Dark Signal” offset cancellation
  • Adjustable CMgenerator (1.15V/2.59V)
  • 8 bit DAC
  • Offset removal and output common mode shifting
  • Low gain drift (0.1% max) and phase delay (3.6 us)
  • Low noise (0.1 uVrms)
	• Industry’s complete NDIR Sensor Analog Front End (AFE) circuit which interfaces to most of today’s thermopile. Programmability enables
	  • A modular approach for our customers
	  • One solution for multiple devices
	  • Lower assembly and handling cost
	  • And finally helps them get their products to market faster!

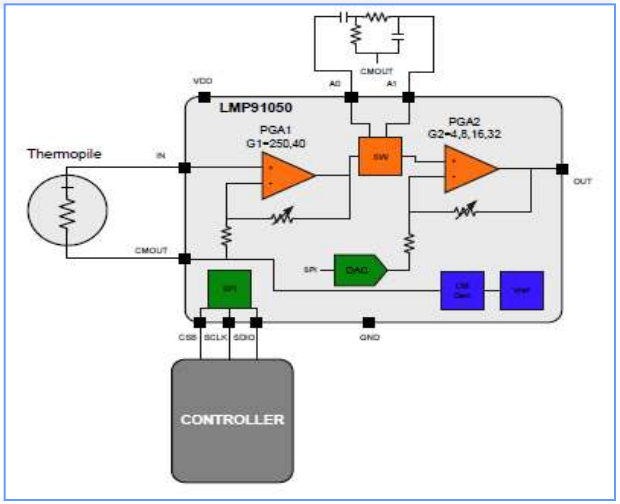
• **Small Package:** 10 pin MSOP package	• Small package helps save board space
• **Ease of Evaluation** • Supported by WeBench Sensor AFE Designer	• Online evaluation tool enables quick evaluation, prototyping and faster time to market

Applications

- Non dispersive Infrared (NDIR) sensing
- Demand control ventilation
- Building monitoring
- CO2 cabin control, Alcohol detection – Automotive
- Industrial safety and security
- Green house gases (GHG) & Freons detection platforms

LMP91050
1ku: $1.25

LMP91051
1ku: $1.45
RTM: Dec 2012



LMP91050SDEVAL

EVM NEW!

Texas Instruments

LMP90100 Family

Multi-Channel, Low Power 24-Bit Sensor AFE with True Continuous Background Calibration

Features

- 24-Bit Low Power Sigma Delta ADC
- 4 Diff or 7 SE inputs (mix and match)
- **True Continuous Background Calibration and Background Diagnostics at all gains**
- Low-Noise 1x to 128x PGA
- Part of Pin - Compatible Family
- **Ease of Evaluation**
  - Supported by WeBench Sensor AFE Designer

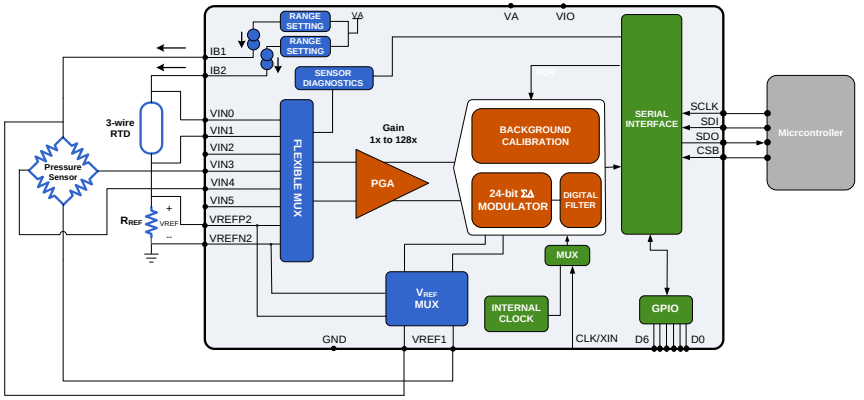
Benefits

- LMP90100 supported with Web Design Tool and Bench-top Development System
- Single board layout supports multiple resolutions and Configurations
- Performance stated for each gain/speed combination (Web Design tool and datasheet)
- Very Low Power
- Online evaluation tool enables quick evaluation, prototyping and faster time to market

Applications

- Transducers and Transmitters
- RTD, Thermocouple, Temperature Sensors
- Pressure, Load and Force Sensing
- Data Acquisition

Resolution	Current Sources	4 Diff. / 7SE	2 Diff. / 4SE
24 Bit	Yes	LMP90100	LMP90098
24 Bit	No	LMP90099	LMP90097
16 Bit	Yes	**LMP90080**	LMP90078
16 Bit	No	LMP90079	LMP90077

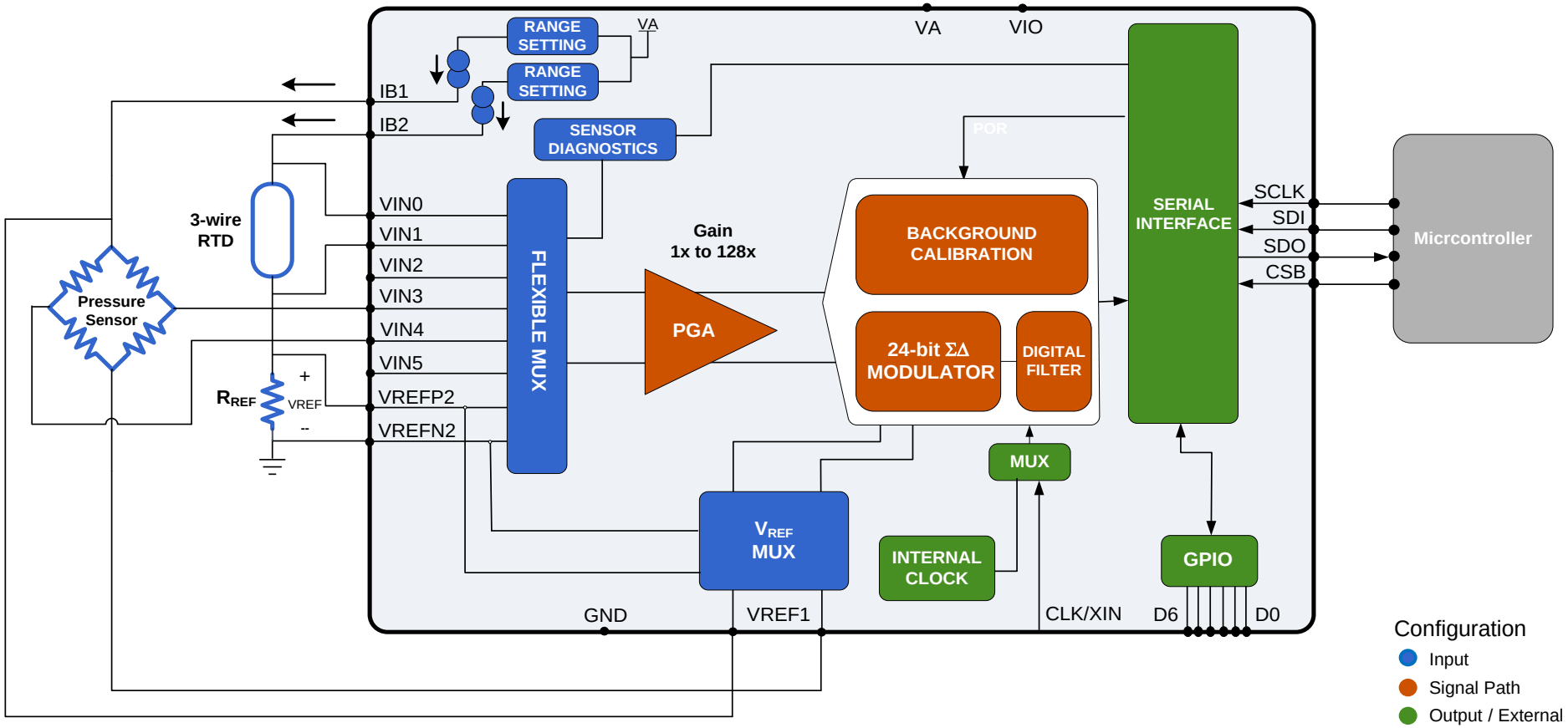


Configuration
- Input
- Signal Path
- Output / External

EVM PART # LMP90100EB/NOPB

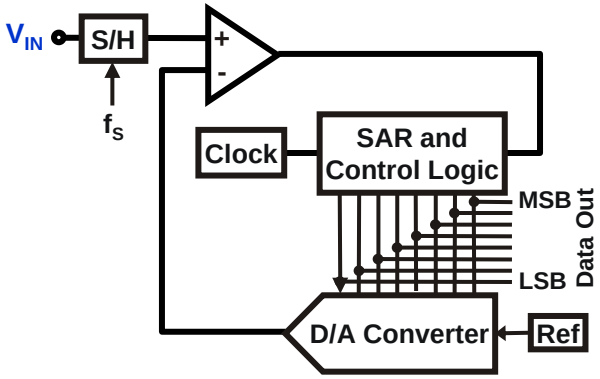
LMP90100
1ku: $3.33

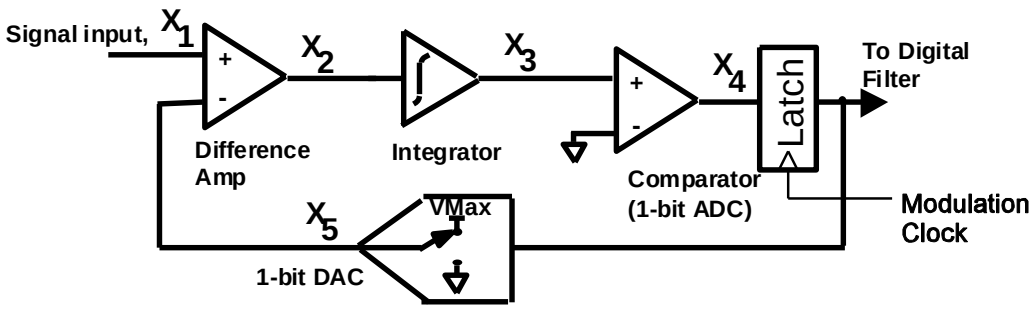
LMP90100: Overview and Family



Resolution	Current Sources	4 Diff. / 7SE	2 Diff. / 4SE
24 Bit	Yes	LMP90100	LMP90098
24 Bit	No	LMP90099	LMP90097
16 Bit	Yes	LMP90080	LMP90078
16 Bit	No	LMP90079	LMP90077

ADC Architectures





SAR / Nyquist

- **"Workhorses" of ADCs**
  - Data Loggers
  - Temp Sensors
  - Bridge Sensors
  - General Purpose
- **SAR ADC Performance**
  - 8 to 18 bits of resolution
  - Speed range: > DC to < 5 Msps

Delta-Sigma / Oversampling

- **Best suited for precision applications**
  - Weigh Scales
  - Temperature Measurement
  - Pressure Measurement
  - Wheatstone Bridges
- **Delta-Sigma ADC Performance**
  - 16 to 24 bits of resolution
  - Speed range: > DC to < 10 Msps

Delta-Sigma ADC Roadmaps

Medical

ECG, EEG, X-Ray

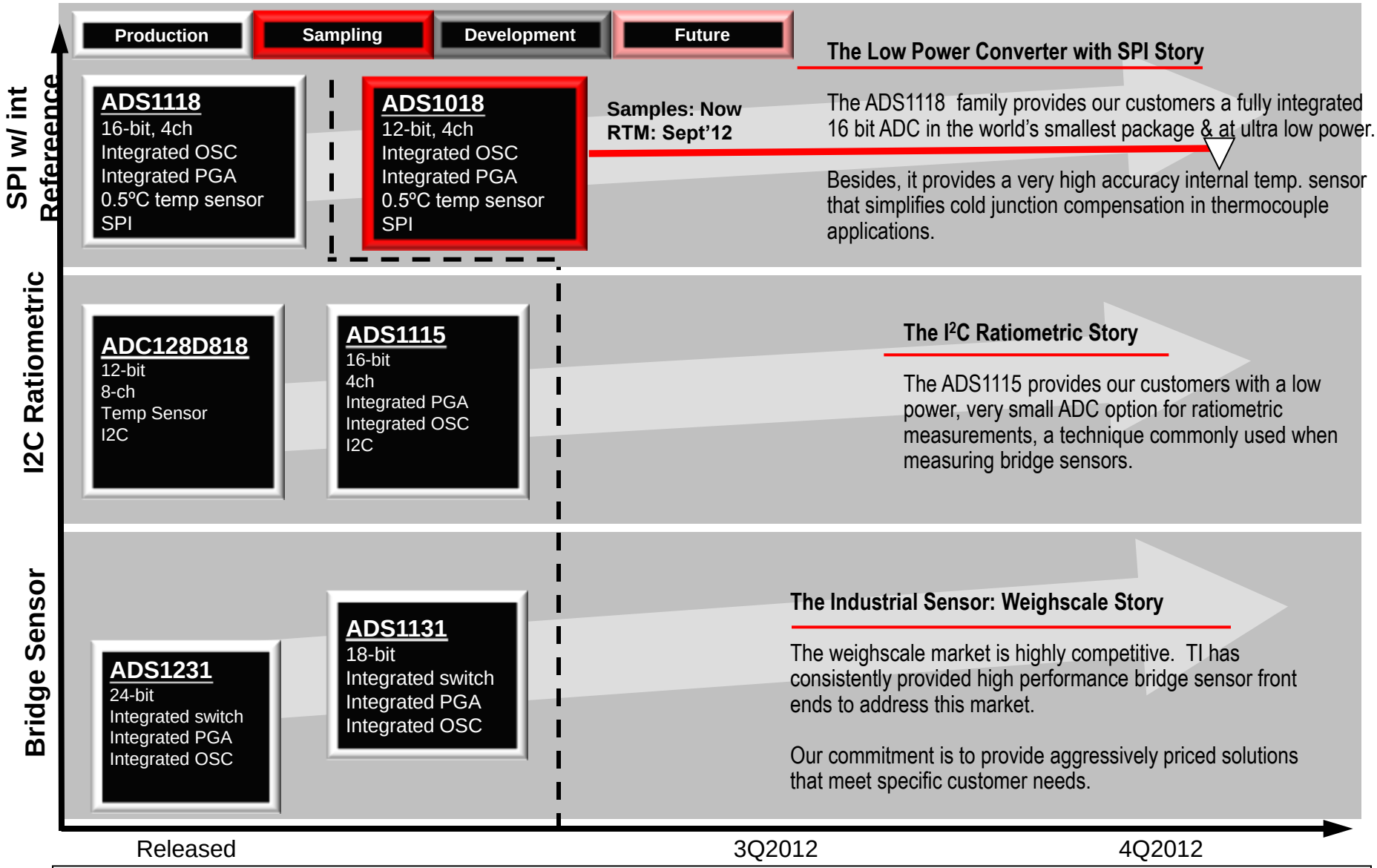
Low Power

- I^2C, SPI Interfaces
- High-Integration: PGAs, Muxes, Filters, OSC, Temp Sensors, etc..
- Small packages make them perfect for portable electronics

Industrial

- 24-bits of resolution
- Up to 38kSPS
- Current DACs for ratiometric measurements

Low Power ΔΣ Converter Roadmap



ADS1018

World's Smallest 12-bit ADC w/0.5ºC (max) Accurate Temp Sensor

Features

•Complete set of integrated functions:

- Four multiplexed analog inputs
- PGA (gains: 0.33, x0.5, x1, x2, x4 or x8)
- Data rates from 8 to 3300 SPS
- Internal temperature sensor (0.5ºC max)

•Small QFN package (2.05mm x 1.55mm x 0.4mm)

•Versatile supply range and low power consumption

- Low supply current: 150uA typ
- Supply 2.0V – 5.5V

Benefits

• A single ADS1018 can perform data acquisition of multiple signals from a wide variety of sensors.

• Small package that readily senses ambient temperature to perform cold junction compensation in thermocouple applications.

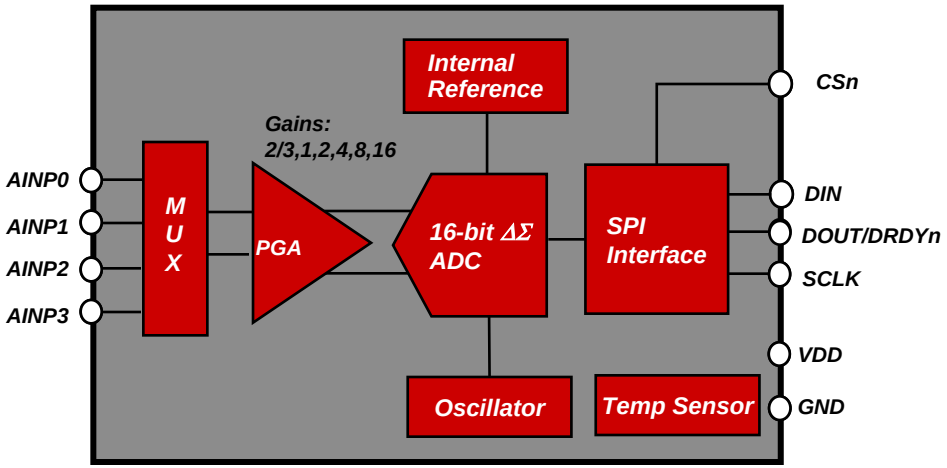
• Its size and low power consumption make the ADS1018 a great device for portable applications where extended battery life is critical

Applications

- Temperature Measurement
- Battery Pack
- Portable Instrumentation
- Industrial Process Control
- Gas Monitoring
- Consumer Goods
- Embedded ADC Upgrade

Samples NOW!

ADS1118 EVM Available



Tiny QFN(RUG) or MSOP(DGS) Package

ADS1118

World's Smallest 16-bit ADC w/0.5ºC (max) Accurate Temp Sensor

Features

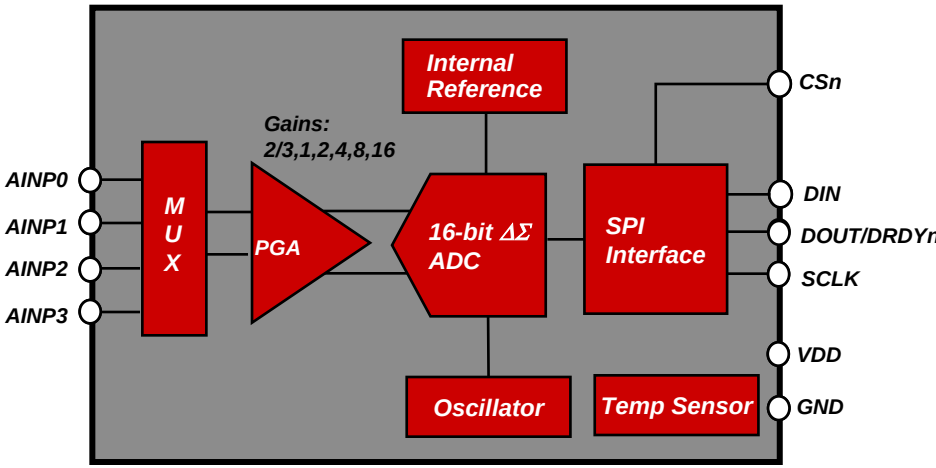
- Complete set of integrated functions:
  - Four multiplexed analog inputs
  - Four digital I/O
  - PGA (gains: 0.33, x0.5, x1, x2, x4 or x8)
  - Precision ADC with data rates from 8 to 860 SPS
  - Internal temperature sensor (0.5ºC max)
- Small QFN package (2.05mm x 1.55mm x 0.4mm)
- Versatile supply range and low power consumption
  - Low supply current: 150uA typ
  - Supply 2.0V – 5.5V

Benefits

• A single ADS1118 can perform data acquisition of multiple signals from a wide variety of sensors.

• Small package that readily senses ambient temperature to perform cold junction compensation in thermocouple applications.

• Its size and low power consumption make the ADS1118 a great device for portable applications where extended battery life is critical



Applications

- TEMPERATURE MEASUREMENT
- BATTERY PACK
- PORTABLE INSTRUMENTATION
- INDUSTRIAL PROCESS CONTROL
- GAS MONITORING
- CONSUMER GOODS
- EMBEDDED ADC UPGRADE

ADS1018
1ku: $2.25

ADS1118 EVM Available

ADS1231

24-bit Complete Front-End for Bridge Sensors w/ Bridge Switch

Features

Outstanding Performance

- 24-Bit Resolution
- Very Low Noise: 35nV$_{RMS}$ at 10SPS

Integration

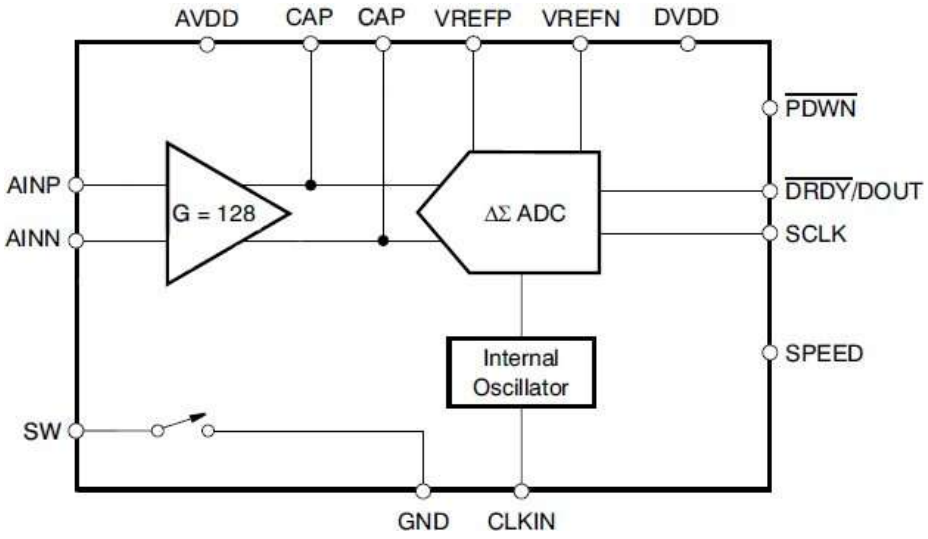
- Low-Side Bridge Switch
- EMI Filter
- Amplifier with Gain of 128
- Selectable Oscillator

Simple yet Flexible

- External Voltage Reference up to 5V for Ratiometric Measurements
- Pin-Selectable 10SPS or 80SPS Data Rates
- Simultaneous 50Hz and 60Hz Rejection at 10SPS
- Two-Wire Read-only Serial Digital Interface
- Wide Supply Range: 3V to 5.3V
- 16-pin SOIC Package
- –40°C to +85°C Temperature Range

Benefits

- Offering a 20% improvement over the competition, the ADS1231 offers the lowest noise in its class
- Integrated bridge switch reduces system power consumption between conversions
- Pin-configurable simplicity with no registers to program reduces design time and complexity



Applications

- **Weigh Scales**
- **Strain Gauges**
- **Industrial Process Control**

ADS1231REF Available

ADS1131
18-bit Complete front-end for bridge sensors

Features

•Very low input referred noise: 53nV$_{RMS}$ at 10SPS

•Integration
- Low-side bridge switch
- EMI filter
- Amplifier with gain of 64
- Selectable oscillator

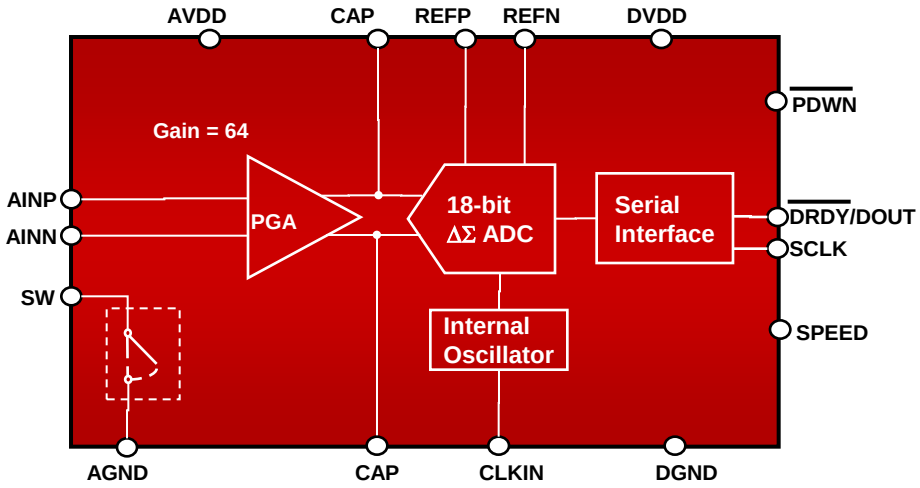
•Simple yet flexible
- External VREF for ratiometric measurements
- Pin-selectable 10SPS or 80SPS data rates
- Simultaneous 50Hz and 60Hz rejection at 10SPS
- Two-wire read-only serial digital interface
- Wide supply range: 3V to 5.3V
- 16-pin SOIC package
- –40ºC to +85ºC Temperature range

Applications

- **Weigh Scales**
- **Strain Gauges**
- **Industrial Process Control**

Benefits

- Provides over 260,000 noise-free counts for input signals as low as ±39mV
- Integrated bridge switch reduces system power consumption between conversions and internal amplifier reduces system component count
- Simple pin-configurable choice of data rates with no registers to program reduces design time and software complexity



ADC128D818

12-Bit 8-channel Sigma Delta ADC with Internal Reference and Temperature Sensor

Features

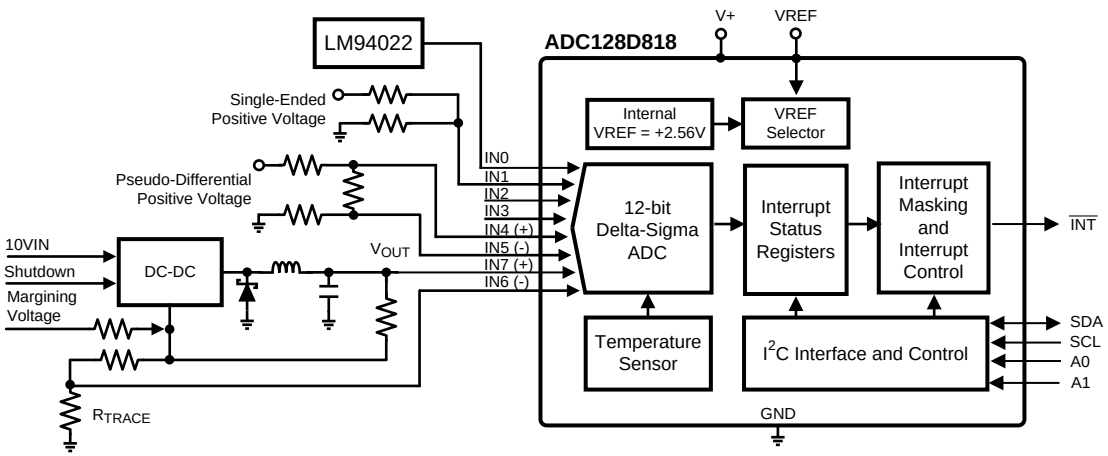
- Precision Sigma Delta ADC Performance
  - 12-Bit Resolution
  - +/- 1 LSB MAX INL
  - +/- 1 LSB MAX DNL
  - TUE of -0.45/+0.2% (including reference error!)
- ±2°C Accurate Temperature Sensor (-25°C to +100°C)
- Flexible multiplexer (8 Single-Ended, 4 Pseudo-Diff, or 2 PP + 4SE) with sequencer
- Internal 2.5V reference
- Wide supply range – 3.0V to 5.5V
- I^2C Interface
- Specified from -40°C to 125°C
- TSSOP16

Benefits

- Sigma Delta ADC architecture provides noise free performance
- Excellent Linearity and DC performance for high-density multi-channel applications in a small form factor
- Reduces cost in temperature measurement applications
- Removes the need for an external reference
- Specified over the full operating temperature range
- Low power consumption with individual channel and deep shutdown modes to limit power consumption

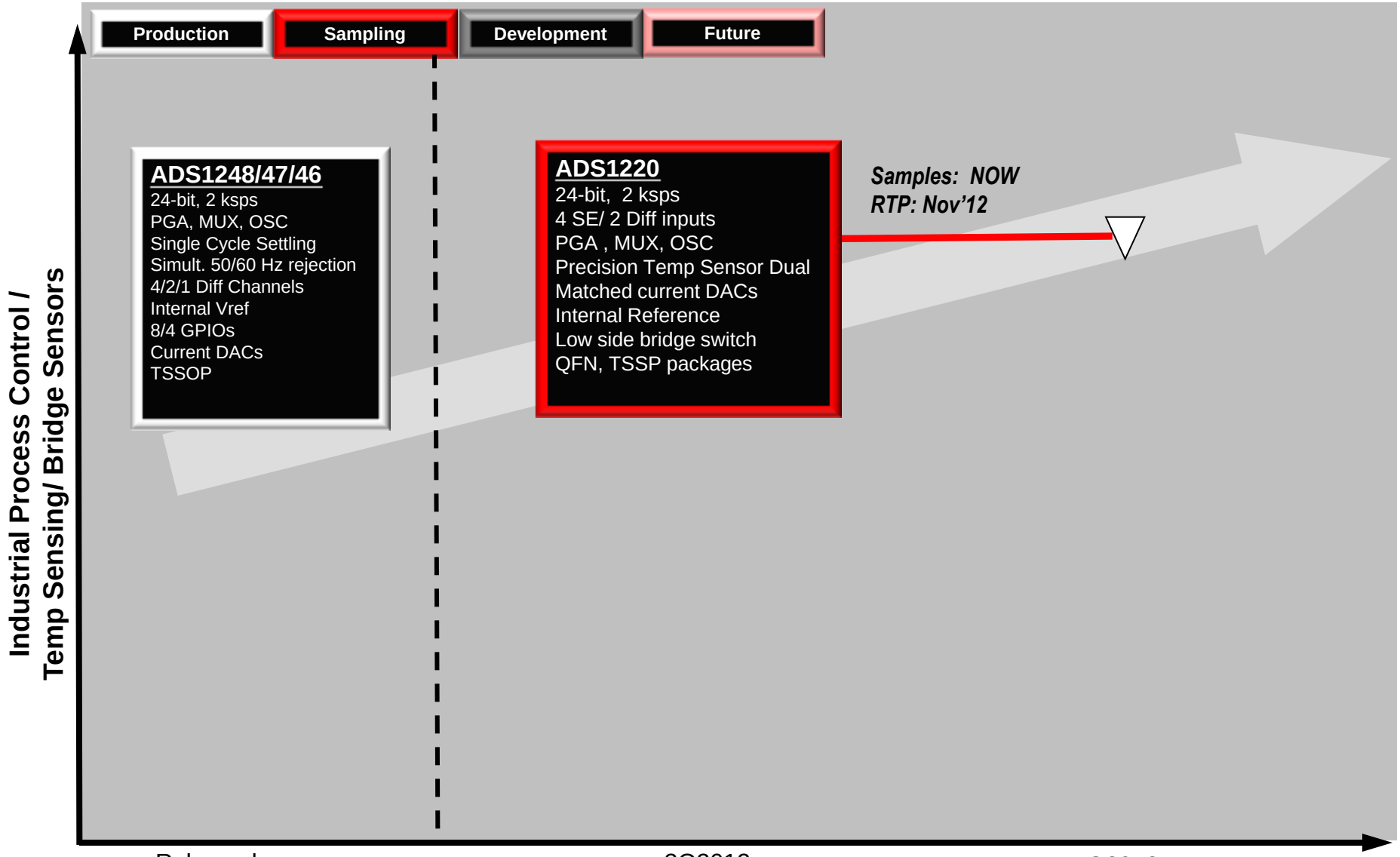
Applications

- System Monitoring of Voltage & Temperature
- Telecommunications
- Industrial Control
- Process Control
- PCB Hot-Spot Analysis



EVM PART # ADC128D818EB/NOPB

High Precision Industrial ΔΣ ADCs



ADS1220

Lowest power 24-bit integrated front end for DC sensing applications

Features

- Integration
  - 4 input MUX with 2 differential inputs
  - Low Noise PGA
  - Precision internal reference (8ppm/C typ)
  - Internal oscillator
  - Low side switch for bridges
  - Precision temp. sensor (0.5°C error)
  - Dual matched current sources (1 uA to 1.5 mA)
- Low Power Consumption
  - 120 uA in Low Power Mode
  - 350uA in High Performance mode
- Wide Supply Range : 2.3V to 5.5V
- Small package
  - 3.5 mm x 3.5 mm QFN

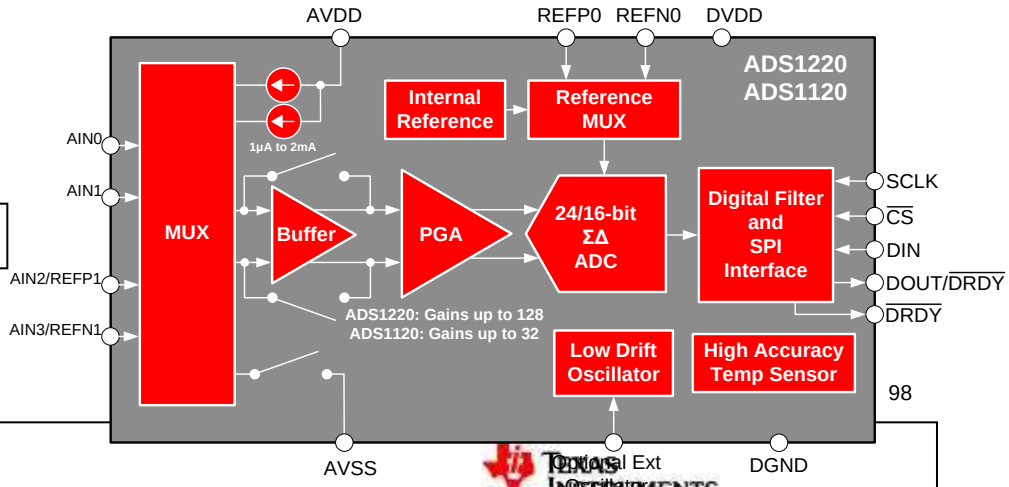
Benefits

- Feature rich ADS1220 integrates up to 7 discrete components to provide a complete front end for DC sensing applications
- 60% lesser power consumption vs. nearest competition makes it ideal for loop powered 4 to 20 mA applications
- 0.4V lower supply range makes it suitable for battery powered applications
- Small package despite higher integration allows use in space senstive sensor applications

Applications

- Temp. sensing platforms
  - RTDs (PT-100 to PT-1000, CU10)
  - Thermocouples
  - 2-, 3-, and 4-wire excitation
- Bridge sensors
- Portable Instrumentation
- Process control

Samples: Now



EVM NEW!

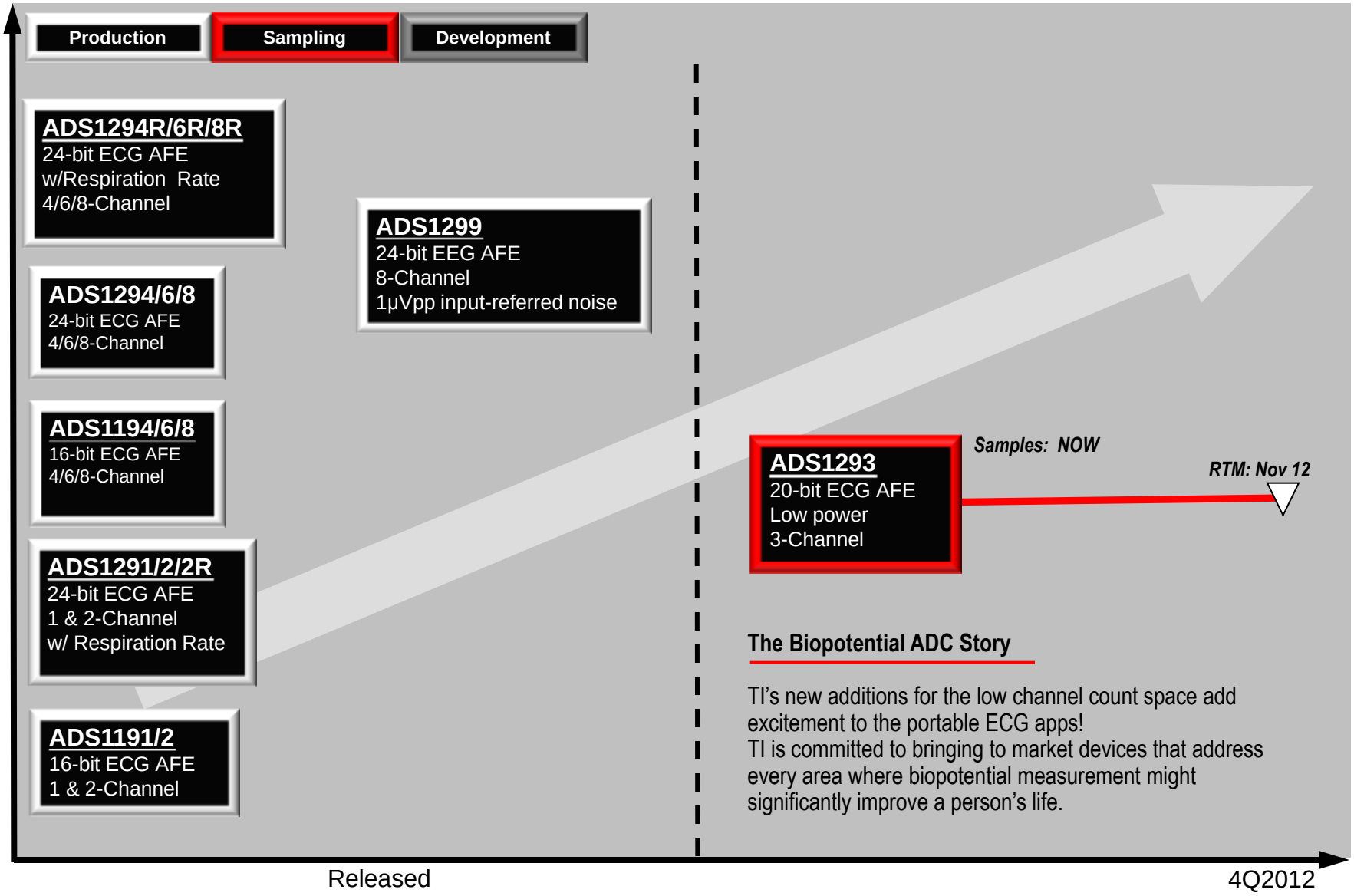
EVM PART #
ADS1220EVM

TI Sensor Front-Ends

Trading off noise for power consumption → More features, Lower noise, higher power consumption

ADS1118 ADS1018	ADS1220 ADS1120	ADS1248 ADS1148
Worlds Smallest Sensor Front-end ADCs	Worlds Lowest Power Precision Sensor Front-end ADC	Ultimate Sensor Front-end ADC

Biopotential ASSP ΔΣ Converter Roadmap



ADS1299

Low Noise, 8-Channel 24-bit Complete Analog Front End for Biopotential Measurements

Features

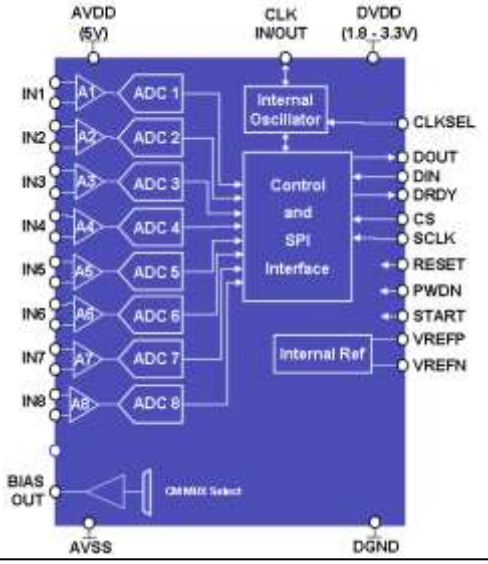
- Fully integrated solution
  - 8 low-noise programmable amps
  - 8 high-resolution ADC's
  - Test Signals, Bias Amp, Oscillator & Ref
- Outstanding performance
  - Noise: ***1μV_{PP}*** (@ 70Hz BW)
  - CMRR : ***120dB***
- Continuous lead-off detect option
- Pin compatible with ADS1298

Benefits

- Drastically reduces printed circuit board space while improving performance and system reliability. Customers can daisy-chain multiple ADS1299 units to synthesize high lead-count EEG systems
- The ADS1299 enables reliable and precise acquisition of minute extra-cranial biopotential signals even in the presence of large EMI signals
- Notifies if electrode becomes disconnected
- Direct and easy upgrade path from ADS1298

Applications

- Electroencephalography (EEG)
- Bispectral index studies (BIS)
- Evoked audio potential (EAP)
- Sleep study monitoring
- High-Precision, simultaneous, multichannel signal acquisition up to 16kSPS



TEXAS INSTRUMENTS

8-Channel AFE Family Comparison

	ADS1299	ADS1298	ADS1298R	ADS1198
Target Application	EEG, Fetal ECG	ECG	ECG	ECG
Resolution	24-bit	24-bit	24-bit	16-bit
Max Data Rates	16kSPS	32kSPS	32kSPS	8kSPS
PGA Gains	1,2,4,6,8,12,24	1,2,3,4,6,8,12	1,2,3,4,6,8,12	1,2,3,4,6,8,12
Input Referred Noise (Max)	1.6μV_{PP}*	7μV_{PP}**	7μV_{PP}**	12.6μV_{PP}***
INL	8ppm	8ppm	8ppm	±1LSB (~36ppm)
Offset error	±60µV	±500µV	±500µV	±500µV
Offset error drift	80nV/^{O}C	2µV/^{O}C	2µV/^{O}C	2µV/^{O}C
Gain error (max)	±0.5% of FS	±0.5% of FS	±0.5% of FS	±0.5% of FS
Gain drift	3ppm/^{O}C	5ppm/^{O}C	5ppm/^{O}C	5ppm/^{O}C
CMRR (Min)	-110dB	-105dB	-105dB	-100dB
PSRR	96dB	90dB	90dB	85dB
Crosstalk	-110dB	-126dB	-126dB	-100dB
SNR	121dB	112dB	112dB	97dB
THD	-99dB	-98dB	-98dB	-95dB
VREF Accuracy	±0.2%	±0.2%	±0.2%	±0.2%
VREF Drift	35ppm/^{O}C	35ppm/^{O}C	35ppm/^{O}C	35ppm/^{O}C
AVDD	4.75-5.25V	2.7-5.25V	2.7-5.25V	2.7-5.25V
Normal mode power (max)	42mW	9.5mW	9.5mW	8.2mW

* Gain = 24, 250 points, 1 second of data, -40 to +85^{O}C
**Gain = 6, 256 points, 0.5 seconds of data
***Gain = 6, 256 points, 0.5 seconds of data

ADS1293:

Low-Power 3-Ch 24-Bit Analog Front-End for Biopotential Measurements

Features

- Fully integrated Low power ECG Solution
- Low Power Consumption 1mW full function
  0.3mW /CH
- Input-Referred Noise: 10 µVpp
  (40Hz BW, G=3.5)
- Input Bias Current: 100 pA
- Data Rate: Up to 25.6kSPS
- CMRR: >100 dB
- Differential Input Voltage Range: ±400mV
- Analog Supply Voltage: +2.7V to +5.5V
- Digital I/O Supply Voltage: +1.65V to +3.6V
- Operating Temp Range: -20¡ãC to +85¡ãC
- Package: 5mm x 5mm x 0.8mm, 28-pin LLP

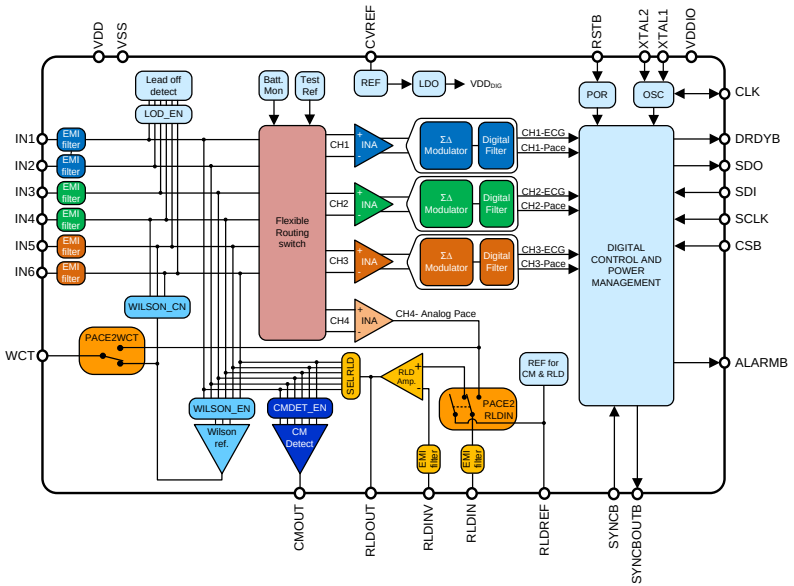
Applications

Low Power Portable ECG & Patient Monitors

- Wireless ECG , Patient monitoring modules
- Portable and battery operated ECG
- Holter Monitors
- Patches
- Heart rate monitors
- Wellness equipment

Benefits

- Simplify the design and shorten development cycle.
- Reduce components count and board space
- Significantly lower power consumption
- Minimum number of external components and small package
- Reduced overall cost



ADS1291 | ADS1292

Complete Integrated Analog Front End for ECG Applications

Features

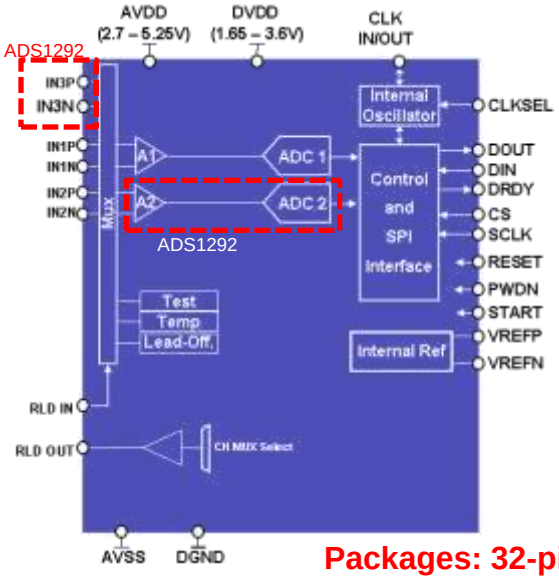
- Fully Integrated **ECG** Solution
  - Multiple Channels with low noise PGA and 24-bit ADC
    - ADS1291: 1 channel
    - ADS1292: 2 channels
  - Test Signals, RLD Amp, Oscillator, Reference
- Noise: ***8uV p-p*** (150Hz BW, G=6)
- CMRR : ***105dB*** with G = 6
- **Continuous Lead Off** detect option
- Pace Detect Channel Select (HW / SW)
- Low Power
  - **Less than 350µW**
  - Nap mode available on ADS1291

Applications

- Medical Instrumentation (ECG and EEG) including:
  - – Patient monitoring: 1-channel ECG, heart-rate, AED
- Portable sport and fitness applications

Benefits

- 95% less PCB space necessary for 8-channel solution over discrete implementation!
- Provides immediate notification if electrode becomes disconnected.
- Insures correct measurement even if external pacer is present.
- 95% less power than discrete solutions! Low power consumption lengthens battery life for Holter and other portable applications.



Packages: 32-pin TQFP (7mm x 7mm)

ADS1298 | ADS1296 | ADS1294

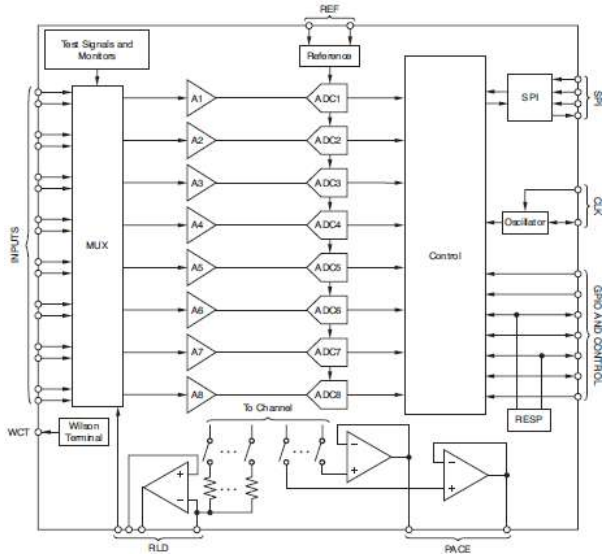
Complete Integrated Analog Front End for ECG Applications

Features

- Fully Integrated **ECG** Solution
  - Multiple Channels with low noise PGA and 24-bit ADC
    - ADS1298: 8 Channels
    - ADS1296: 6 Channels
    - ADS1294: 4 Channels
  - Test Signals, RLD Amp, Oscillator, Reference
- Noise: ***5uV p-p*** (150Hz BW, G=6)
- CMRR : ***105dB*** with G = 6
- **Continuous Lead Off** detect option
- Pace Detect Channel Select (HW / SW)
- Low Power
  - **0.75mW/Channel** (typ)
  - Multiple **Power Down** Configurations
  - **Standby (STBY)** Mode Uses 2mW

Benefits

- 95% less PCB space necessary for 8-channel solution over discrete implementation!
- Meets or exceed IEC & AAMI performance requirements.
- Provides immediate notification if electrode becomes disconnected.
- Insures correct measurement even if external pacer is present.
- 95% less power than discrete solutions! Power down and standby options lengthen battery life for Holter and other portable applications.



Applications

- Medical Instrumentation (ECG and EEG) including:
  - Patient monitoring: Holter, event, stress, and vital signs ECG; AED; fetal ECG
  - Bispectral index (BIS), Sleep study monitor
- High-Precision, Simultaneous, Multichannel Signal Acquisition

Packages: 64-ball BGA, 64-pin TQFP

ADS1298R/6R/4R

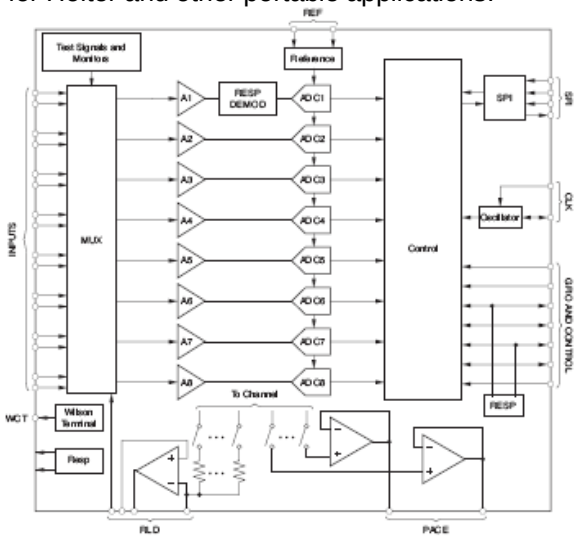
8-Channel, 24-bit ADC w/ Integrated Respiration Impedance and ECG Analog Front End

Features

- Multiple Channels with low noise PGA, 24-bit ADC, and **Integrated Respiration Impedance Measurement Circuitry**
  - ADS1298R: 8 Channels
  - ADS1296R: 6 Channels
  - ADS1294R: 4 Channels
- Fully Integrated **ECG** Solution
- 8 Low Noise **Programmable Amps**
- 8 high resolution **ADC's**
- Test Signals, RLD Amp, Oscillator, Reference
- Outstanding Performance
- Noise: ***5uV p-p*** (150Hz BW, G=6)
- CMRR : ***105dB*** with G = 6
- **Continuous Lead Off** detect option
- Pace Detect Channel Select (HW / SW)
- Low Power
- **0.75mW/Channel** (typ)
- Multiple **Power Down** Configurations
- **Standby (STBY)** Mode Uses 2mW

Benefits

- **95% less PCB space necessary for 8-channel solution over discrete implementation!**
- Meets or exceed IEC & AAMI performance requirements.
- Provides immediate notification if electrode becomes disconnected.
- Reduces BOM cost and consumes negligible power compared to discrete impedance measurement solution
- Insures correct measurement even if external pacer is present.
- 95% less power than discrete solutions! Power down and standby options lengthen battery life for Holter and other portable applications.



Packages: 64-ball BGA

Applications

- **Medical Instrumentation (ECG and EEG) including:**
  - **Patient monitoring: Holter, event, stress, and vital signs ECG; AED; fetal ECG**
  - **Bispectral index (BIS), Sleep study monitor**
- **High-Precision, Simultaneous, Multichannel Signal Acquisition**

SAR ADC Roadmaps

Low Power

- Low-Power, Low-Latency ADCs for:
  - Battery-powered applications
  - Space-constrained applications
- <10mW of power consumption

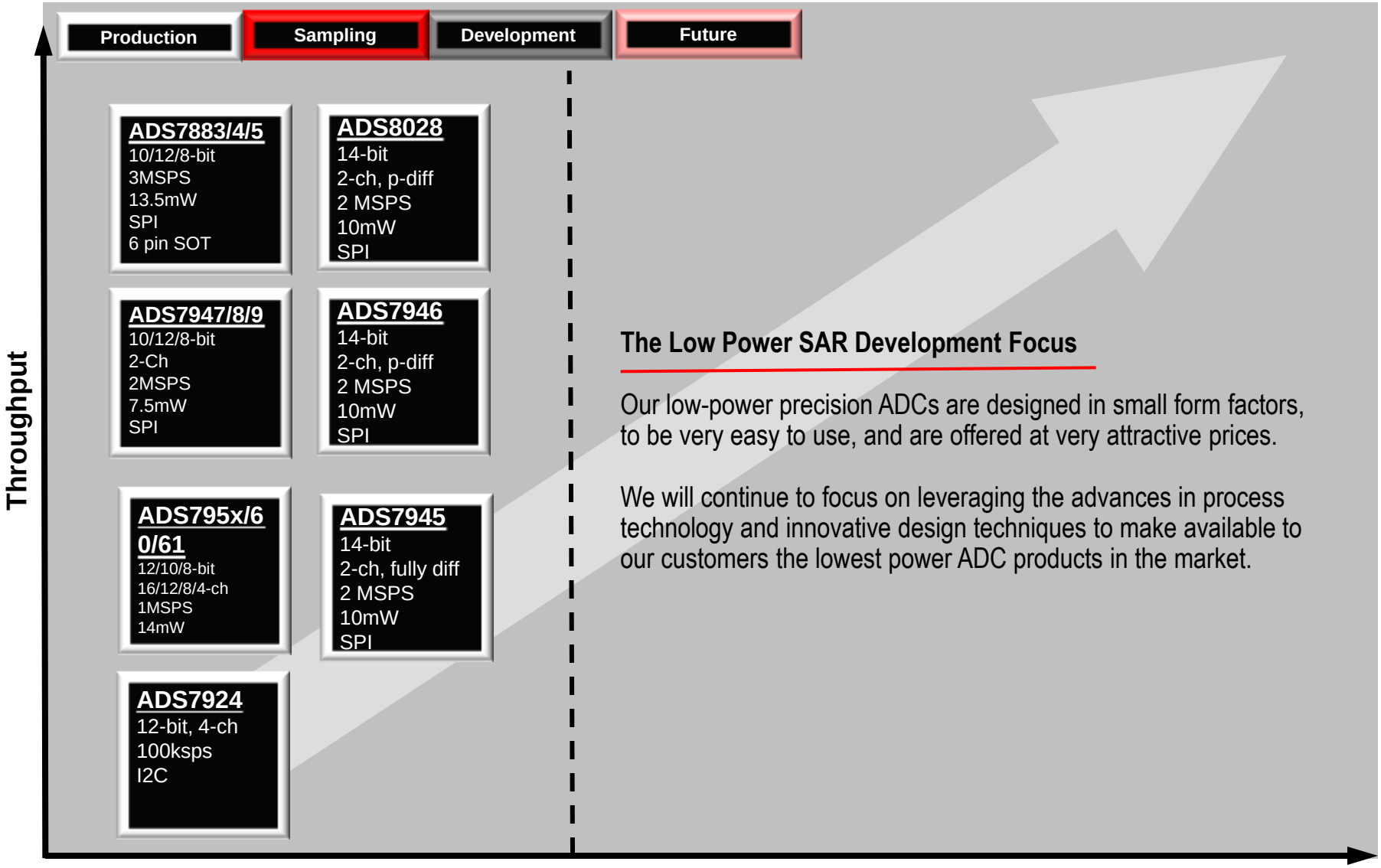
High Resolution

- High-Resolution, Low-Power, ADCs for:
  - Precision Medical Equipment
  - Instrumentation and Control
  - Optical Networking
- Up to 18-bits of resolution, with less than 10mW of power

Simultaneous Sampling

- Simultaneously sampling ADCs allow multiple inputs to be sampled at the same time
- This is in contrast to multiplexed ADCs, which can only sample multiple inputs one at a time

SAR ADC Low Power Products



The Low Power SAR Development Focus

Our low-power precision ADCs are designed in small form factors, to be very easy to use, and are offered at very attractive prices.

We will continue to focus on leveraging the advances in process technology and innovative design techniques to make available to our customers the lowest power ADC products in the market.

ADS8028 :

12-Bit | 1 MSPS | 8-chSAR w/ Internal Reference and Internal Temp Sensor

Features

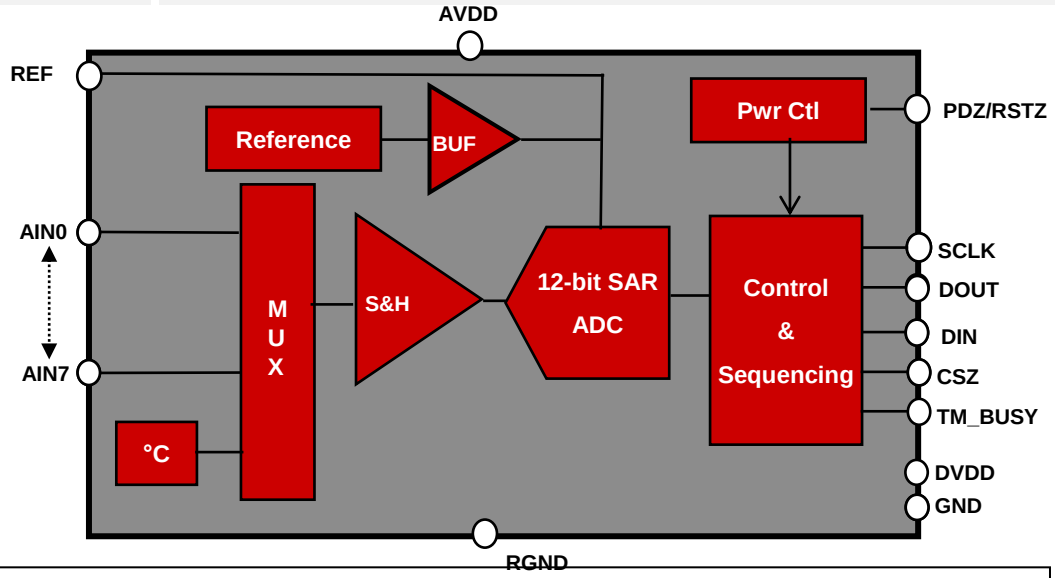
- Precision SAR ADC Performance
  - 1MSPS - 12-Bit Resolution
  - ± 1 LSB MAX INL
  - ± 1 LSB MAX DNL (**NMC**)
  - 70dB MIN SNR @ 50kHZ Input
- ±1°C Accurate Temperature Sensor
- Internal multiplexer with sequencer
- Internal 2.5V reference
- Wide supply range – 2.8V to 5.25V
- SPI Interface
- Specified from -40°C to 125°C
- 20-Thin QFN

Benefits

- Excellent Linearity and AC performance for high-density multi-channel applications in a small form factor
- Reduces cost in temp measurement applications
- Removes the need for an external reference
- Specified over full operating temperature range
- Low power consumption suited for battery powered applications
- Pin compatible to ***AD7298***

Applications

- System Monitoring of Voltage & Temperature
- Telecommunications
- Industrial Control
- Process Control
- PCB Hot-Spot Analysis



ADS7945 / ADS7946

14-Bit, 2-CH, 2 MSPS, DE/SE, Micro-power SAR

Features	Benefits

• **Outstanding Performance**
  • **1.5 LSB** offset and gain drift (typ)
  • **82dB SNR** (min)
  • **True 14-bit performance**
	• **Precision offset and gain** over temperature eliminates the need for temperature calibration and reduces system cost & complexity

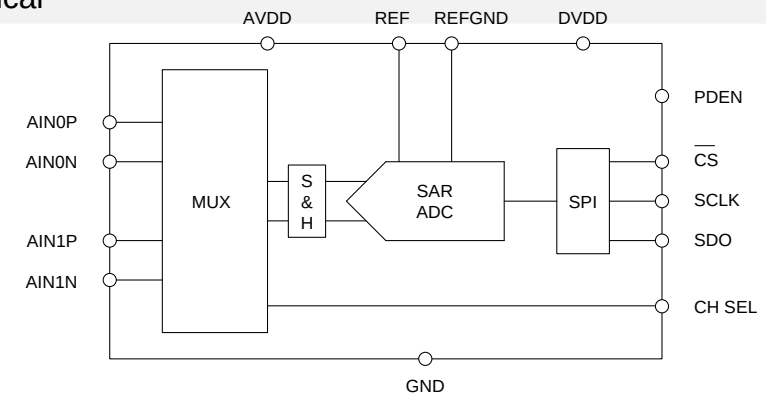
• **Differential inputs**	• **Differential inputs** reduce the need for common mode signal conditioning circuitry = lower system cost
• **Dedicated Power-down Mode Enable Pin** • Auto power-down scales to **7.7 µW/kSPS** @ 3V	• **Power down mode implementation is simple**

• **Wide-supply, reference, and I/O range**
  • 2.8V → 5.25V supply range
  • 2.5V → 5.25V reference range
  • 1.8V → 5V logic family compatible
	• **82% wider supply and reference range** as compared to 3V parts; and, can interface with all common logic interface voltages

• **Small Robust Design**
  • **3mm x 3mm QFN**
  • -40ºC → 125ºC operation
  • SPI Interface
	• **Wide temperature range** withstands harsh environments and **very small package** saves PCB space and makes it ideal for portable applications where reducing board space is critical

Applications

- Optical networking
- Instrumentation and control systems
- X-Y Positioning
- Portable systems
- Battery monitoring
- High speed data acquisition



ADS7947 / ADS7948 / ADS7949

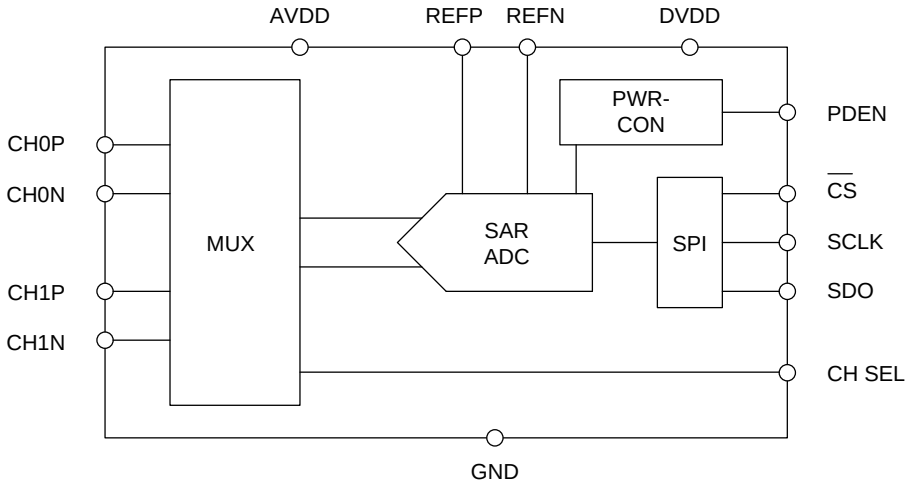
12/10/8-Bit, 2-CH, 2MSPS, SE, Micro-power SAR

Features

- **7mW** typ @ 3V (VDD) & 2MSPS
- Auto power-down: 7.7uW/kSPS @ 3V (VDD)
- 2.7 – 5.25V supply and reference range
- 1.8 to 5V logic family compatible
- 3mmx3mm QFN
- SPI Interface

Benefits

- Speed and power flexibility
- Pin compatible family enables seamless upgrade and downgrade paths
- Small package size



Applications

- Instrumentation and control systems
- Portable systems
- Battery monitoring
- Remote data acquisition
- Optical networking
- High speed data acquisition
- General housekeeping

ADS7924

Industry's First ADC with Intelligent System Power Control

Features

- Intelligent System Power Management
  - MCU wake up with programmable interrupts
  - PWRCON Pin to power down / wake up external opamp
  - Auto power down control
  - Programmable sleep period
- Intelligent System Monitoring
  - Auto-sequencing 4ch multiplexer
  - User defined independent alarm thresholds for each channel
  - Programmable Monitoring rate up to 100kHz
- Low Power 12-bit SAR core
  - Analog Supply: 2.2V to 5.5V
  - Digital Supply: 1.65V to 5.5V
  - 4 Ch scan every 1ms → 20uW
  - 4 Ch scan every 10ms → 5uW
  - <1uA of Power-Down Current

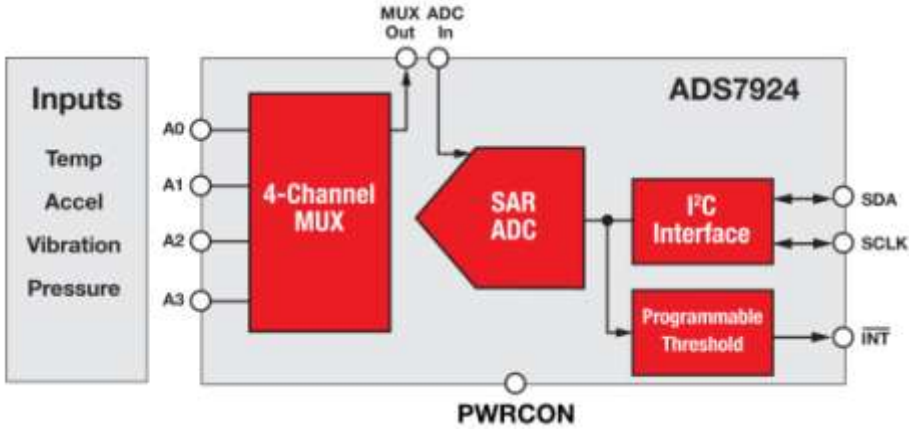
ADS7924
1ku: $1.25

Applications

- Portable / Battery Powered Systems:
  - Medical, remote sensors, signal monitoring
- Energy Harvesting

Benefits

- Enables Industry's Lowest System Power
  - Enables MCU to be powered down while ADC continues to monitor inputs
  - Greater then 50% power savings vs typical low power MCU with integrated ADC
- Offload the need for MCU monitoring to save power and microprocessor bandwidth.
- Compatible with single cell lithium ion battery systems and direct interface with low voltage processors.



3X3 QFN Package

ADS7883 / ADS7884 / ADS7885

12/10/8-Bit 3MSPS Miniature SAR ADCs in SOT-23

Features

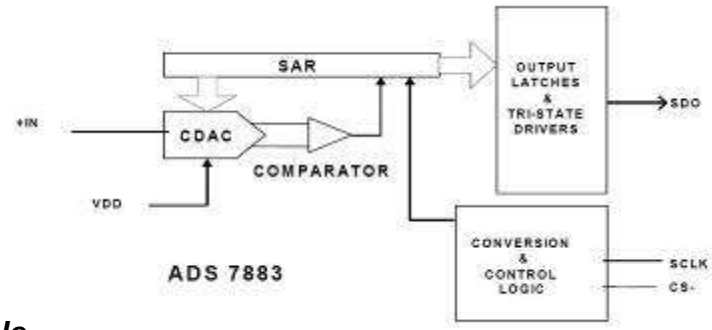
- Excellent Linearity at 3MSPS
  - ±1.25 LSB Max INL – 12-Bit ADS7883
  - ±0.8 LSB Max INL – 10-Bit ADS7884
  - ±0.4 LSB Max INL – 8-Bit ADS7885
- Excellent AC Performance @ 100kHZ
  - SINAD 71db MIN – 12-Bit ADS7883
  - SINAD 60db MIN – 10-Bit ADS7884
  - SINAD 49db MIN – 8-Bit ADS7885
- Lowest Power and Smallest Package
  - 13.5mW @ 3MSPS with 5V VDD
  - 6.45mW @ 2.5MSPS with 3V VDD
  - Power-Down Current @ 1 µA
- Supply Range: 2.7 V to 5.5 V
- Available in SOT-23

Benefits

- Precision High-Speed Conversion Enables Faster Reaction Times In Control Loops
- Increase Accuracy When Sampling Higher Frequency Signals (>1MHz)
- Enable wide dynamic range and performance of the overall system with strong AC specs
- 50% lower power consumption than the competitors
- Decreased Board Space and Power Requirements Allow For Higher Channel Counts And Remote Data Acquisition
- 2x's the supply range of competitive parts

Applications

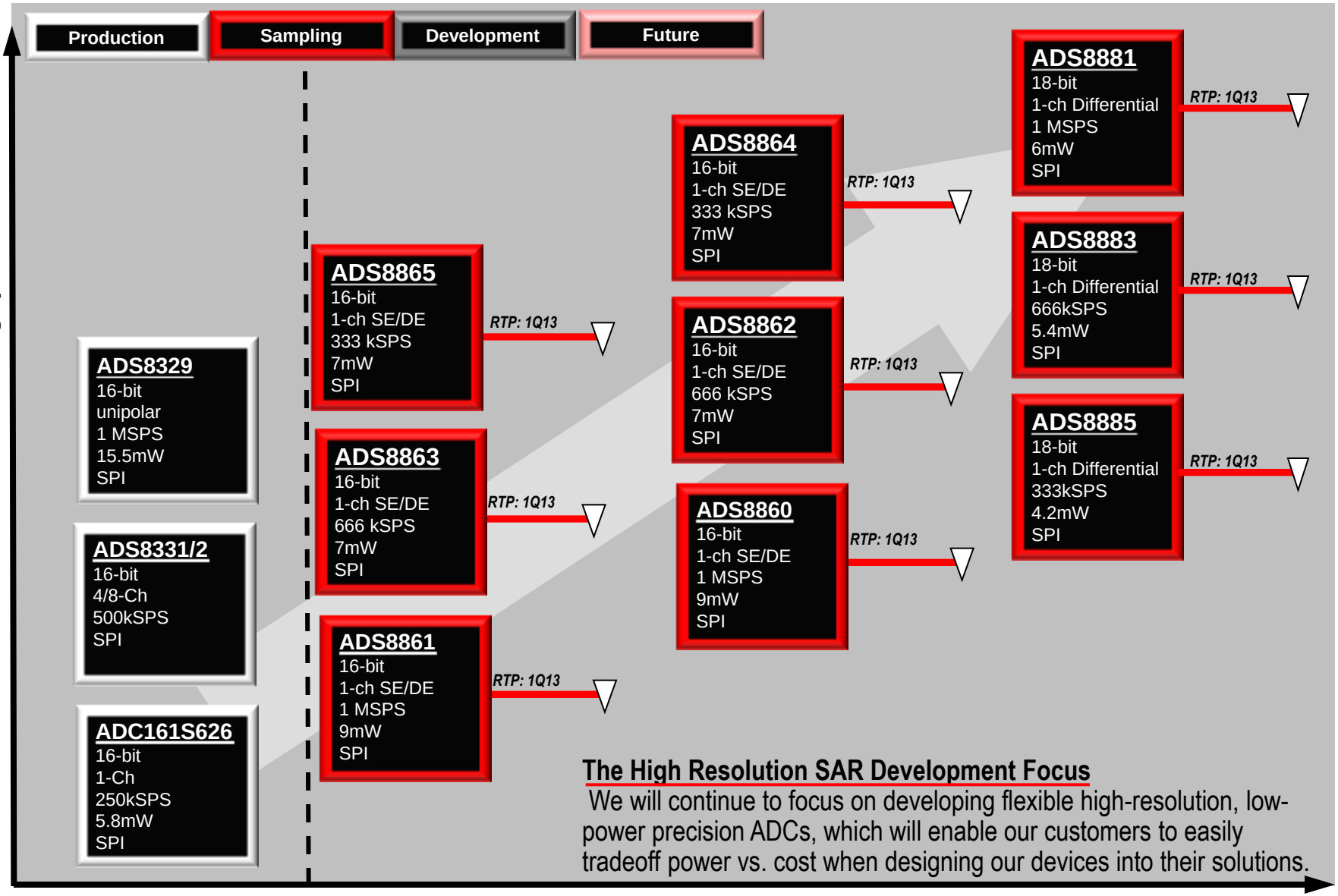
- Medical Instruments
- Battery Powered Systems
- Current / Voltage Sensing in Digital Drives
- Optical Sensors
- High-Speed Control Loops



EVM

ADS7883/4/5 EVM *Available*

SAR ADC High Resolution Products



ADS8331 / ADS8332

16-Bit | 500KSPS | Low Power | 4/8 Channel Precision ADCs

Features

- Precision SAR ADC Performance
  - 16-Bit NMC Over temperature
  - ± 1.2 LSB TYP INL @2.7V
  - ±0.6 LSB TYP DNL @2.7V
- Wide Supply range: VA=2.7-5.5V, VBD=1.65-5.5V
- Excellent AC Performance
  - 91.5db SNR
  - 101db SFDR
  - -100db THD
- Simple To Use Interface
  - Global CONVST Independent of CS
  - Programmable Status EOC/INT
  - MUX breakout
- Deep Power Savings Modes

Benefits

- Precision 16-Bit performance for multi-channel applications with pin compatible flexibility between 4/8 channels

- Low Supply operation enables over 50% power savings over the competition

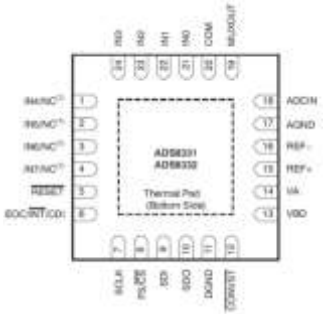
- Allows for systems with an improved dynamic range

- Global synchronization of ADCs allows for coherent signal acquisition.

- MUX breakout enable 50% space and power savings versus a discrete solution

Applications

- Portable Data Logging
- Battery Powered Equipment
- Isolated Data Acquisition
- Transducer Interface
- Data Acquisition Systems
- Medical Instrumentation



4x4mm QFN Package, TSSOP 24LD

ADS8329/ADS8330

16-Bit | 1MSPS | 15.5mW 1-ch/2-ch Precision ADCs

Features

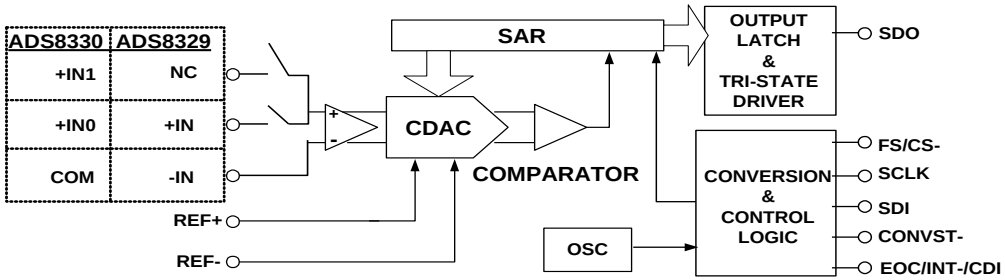
- Precision SAR ADC Performance
  - 1 MSPS - 16-Bit Resolution
  - +/- 1.75 LSB MAX INL
  - +/- 1 LSB MAX DNL
- Excellent AC Performance at 100kHz
  - 92dB SNR
  - 102dB SFDR
  - -102dB THD
- Simple To Use Interface
  - Global CONVST Independent of CS
  - Programmable Status EOC/INT
- 4x4mm QFN-16 & TSSOP-16 Packages

Benefits

- Reduce system power consumption without sacrificing performance
  - Only 15.5mw @ 1MSPS with 3V supply
- Allows for systems with an improved dynamic range
- Global synchronization of ADCs allows for coherent signal acquisition.
- Increases channel densities and reduces system footprint

Applications

- Portable Medical Instruments
- Multi-Channel Data Acquisition Systems
- Automated Test Equipment



EVM

ADS8329/ADS8330 EVM
Available

ADC161S626

16-Bit | 50 to 250 kSPS | Differential Input µPower ADC

Features

- 16-bit resolution with no missing codes
- Guaranteed performance from 50 to 250 kSPS
- ±0.003% of span signal accuracy
- True differential input
- Zero-Power Track Mode with 0 µsec wake-up delay
- SPI™ compatible Serial Interface
- Small MSOP-10 package

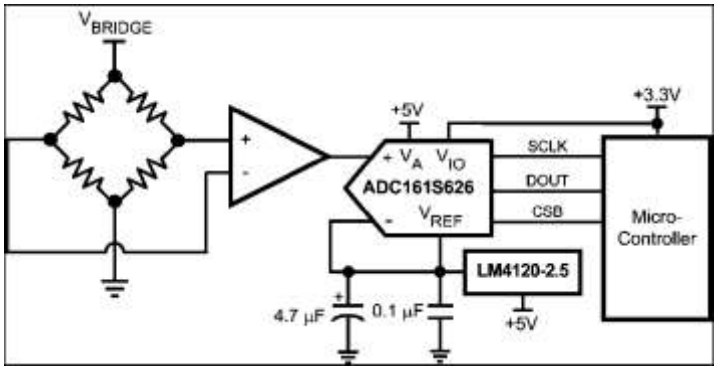
Benefits

- Performance guaranteed at the application sample rate
- True Differential Inputs
- 16 bit resolution with no missing codes
- Wide input common-mode input range
- Very low power

Applications

- Sensor Interface
- I/O Modules, Data Acquisition
- Portable Systems
- Motor Control
- Instrumentation and Control Systems
- Medical Systems

ADC161S626
1ku: $3.50



Typical Application Circuit

ADS8881:

18-bit | 1MSPS | True Differential |Serial | µPower ADC

Preview

Features

- Excellent Performance
  - 3 LSB INL (max), +2/-1 LSB MAX DNL
  - 99dB SNR (typ) at 1 kHz
- Wide Input, Signal, & Reference Ranges
  - ***0V to Vref Common Mode Input***
  - -0.1V to 5.1V Signal
  - 2.5V to 5V Reference
- Low Power
  - ***6mW/1MSPS, 0.6mW/100KSPS***
  - 2.7 - 3.6V Analog supply
  - 2.7 - 3.6V I/O supply
- SPI Serial Interface w/Daisy Chain
- MSOP-10, 3X3 SON-10 Package

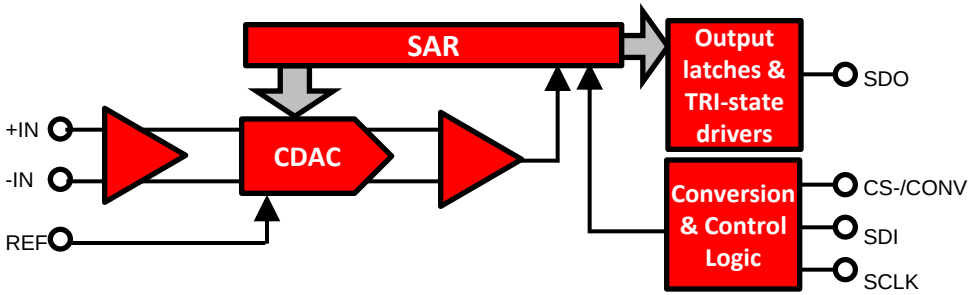
Benefits

- Wide dynamic range
- Reduces complexity of input signal circuitry with ***2x wider common mode input range*** than competition
- Ideal for battery powered as well as high channel count applications where low power is critical
- Enables coherent sampling configurations and reduces the # of interface signals required by at least ***25% per additional ADC channel***
- Small packaging is ideal for portable applications

Applications

- ATE
- Data Acquisition Systems
- Spectroscopy
- Electronic Whiteboards
- Optical Communication
- CT Scanners

Samples available



Texas Instruments

ADS8883 :

18-bit | 666kSPS | True Differential |Serial | µPower ADC

Preview

Features

- Excellent Performance
  - 3 LSB INL (max), +2/-1 LSB MAX DNL
  - 99dB SNR (typ) at 1 kHz
- Wide Input, Signal, & Reference Ranges
  - ***0V to Vref Common Mode Input***
  - -0.1V to 5.1V Signal
  - 2.5V to 5V Reference
- Low Power
  - ***5.4mW/666KSPS, 0.8mW/100KSPS***
  - 2.7 - 3.6V Analog supply
  - 2.7 - 3.6V I/O supply
- SPI Serial Interface w/Daisy Chain
- MSOP-10, 3X3 SON-10 Package

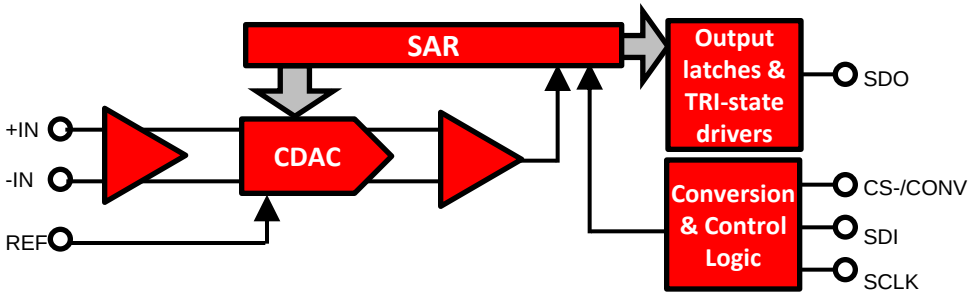
Benefits

- Wide dynamic range
- Reduces complexity of input signal circuitry with ***2x wider common mode input range*** than competition
- Ideal for battery powered as well as high channel count applications where low power is critical
- Enables coherent sampling configurations and reduces the # of interface signals required by at least ***25% per additional ADC channel***
- Small packaging is ideal for portable applications

Applications

- ATE
- Data Acquisition Systems
- Spectroscopy
- Electronic Whiteboards
- Optical Communication
- CT Scanners

Samples available



ADS8885:

18-bit | 333kSPS | True Differential |Serial | µPower ADC

Preview

Features

- Excellent Performance
  - 3 LSB INL (max), +2/-1 LSB MAX DNL
  - 99dB SNR (typ) at 1 kHz
- Wide Input, Signal, & Reference Ranges
  - ***0V to Vref Common Mode Input***
  - -0.1V to 5.1V Signal
  - 2.5V to 5V Reference
- Low Power
  - ***4.2mW/333KSPS, 1.25mW/100KSPS***
  - 2.7 - 3.6V Analog supply
  - 2.7 - 3.6V I/O supply
- SPI Serial Interface w/Daisy Chain
- MSOP-10, 3X3 SON-10 Package

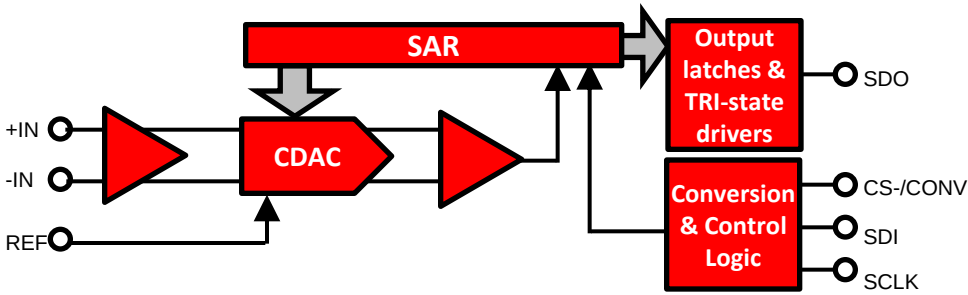
Benefits

- Wide dynamic range
- Reduces complexity of input signal circuitry with ***2x wider common mode input range*** than competition
- Ideal for battery powered as well as high channel count applications where low power is critical
- Enables coherent sampling configurations and reduces the # of interface signals required by at least ***25% per additional ADC channel***
- Small packaging is ideal for portable applications

Applications

- ATE
- Data Acquisition Systems
- Spectroscopy
- Electronic Whiteboards
- Optical Communication
- CT Scanners

Samples available



ADS8861 / ADS8863 / ADS8865

16-bit | Fully-Diff | low power | 1MSPS SAR ADC

Preview

Features

Very Low Power/Standard Package

- ADS8861 = 1Msps, ADS8863 = 666ksps, ADS8865 = 333kHz
- 700µW @ 100ksps @ V_{dd}= 3V
- MSOP-10, 3x3 SON

Flexible Throughput vs. Supply/Ref range

- 2.7V – 3.6V AVdd and 1.65V – 3.6V DVdd
- V_{in} specified for -.1V to 5.1V
- V_{ref} specified for 2.5V to 5.1V
- V_{cm} includes 0 to V_{ref}
- Performance guaranteed for entire supply and Vref range

Excellent Performance

- ±1 LSB INL (max), ±1 LSB DNL (max)
- 96dB SNR @ 1kHz
- THD = -115dB

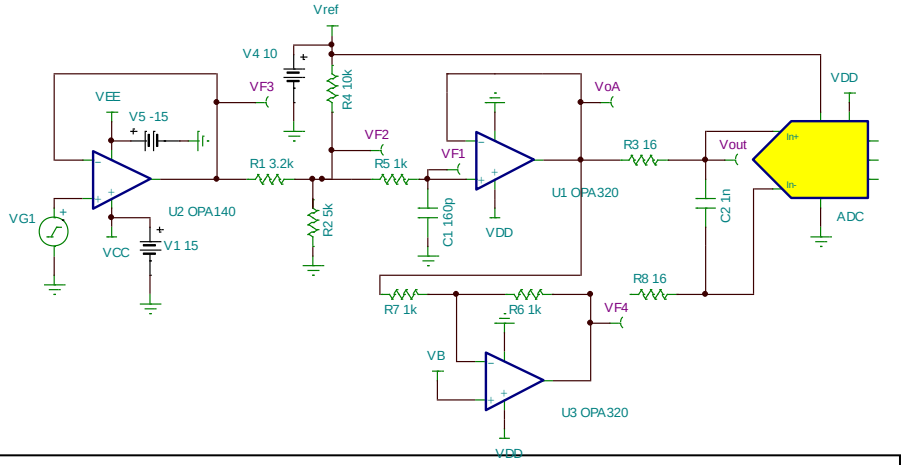
Samples available

Benefits

- Very Low Power for applications that require power scaling
- Wide Supply / Ref range for ease of integration
- 16 bits of Resolution for high precision
- High Throughput Rate (1Msps) for fast moving transients and low latency acquisition
- "TRUE" Differential Inputs Relaxes Level shifting Requirements, simplifies design

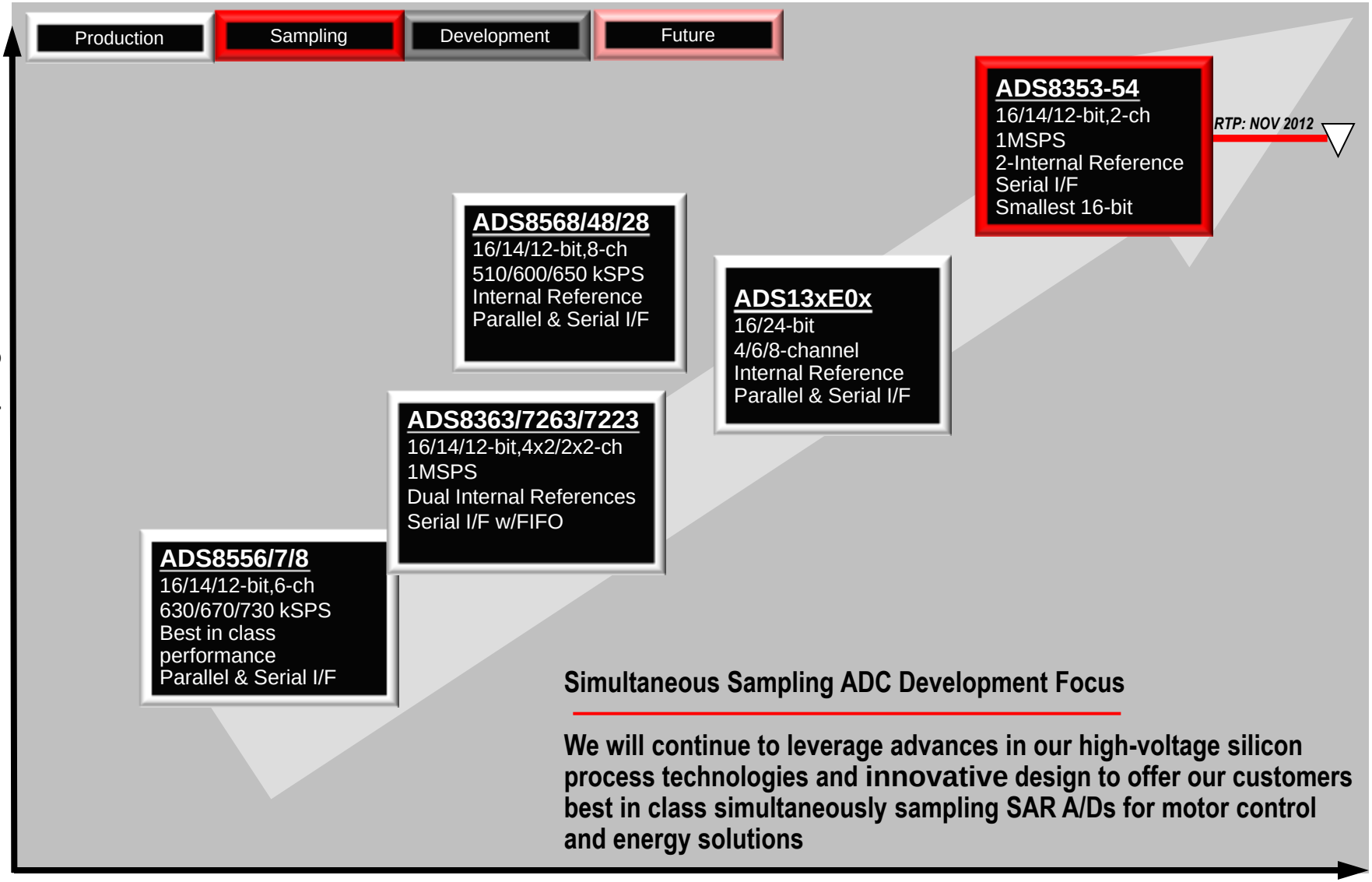
Applications

- Industrial Automation
- Sensors and Control
- Test and Measurement
- Energy Metering
- Metrology
- Optical Networking



Texas Instruments

Simultaneous Sampling Converter Roadmap



ADS131E08/06/04 | ADS130E08 :

Multi-Channel multi-bit Analog Front End for Energy Applications

Features

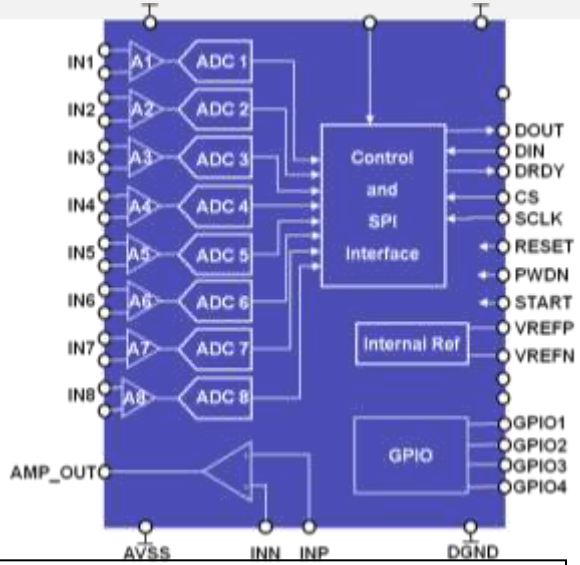
- Pin Compatible 16/24-bit, 8/6/4-channel Versions
  - 90dB SNR, 8kSPS (16-bit)
  - 103dB, 8/16/32/64kSPS (24-bit)
- Fully-Integrated device:
  - PGA w/ multiple gain options (1,2,4,8 & 12)
  - Built in Op-Amp
  - Internal reference
  - Fault detect / Alarm Comparators
  - Built in test signals
- Analog input range of ±2.4V
- Power: ***2mW/Channel***
- Operating Temp: –40°C to +105°C

Benefits

- ***Industry's widest upgrade/downgrade path*** allows customers to easily build their metrology around the ADS13xE0x products
- Fully-Integrated analog front end features allow customers to save on board space, overall design effort, time in device procurement, and significantly alleviates overall complexity of the analog signal chain
- ***Widest analog input range*** by 10%
- Allows designers to ***achieve power-sipping solutions*** for their energy applications
- Wide temperature range allows the device to be used in a range of harsh environmental conditions

Applications

- Industrial Power Applications
- Energy Metering
- Power Monitoring, Control, and Protection
- Smart Grid Solutions



ADS8568 | ADS8548 | ADS8528

Multi-Bit 8-ch Simultaneous Sampling SAR with Bipolar Inputs

Features

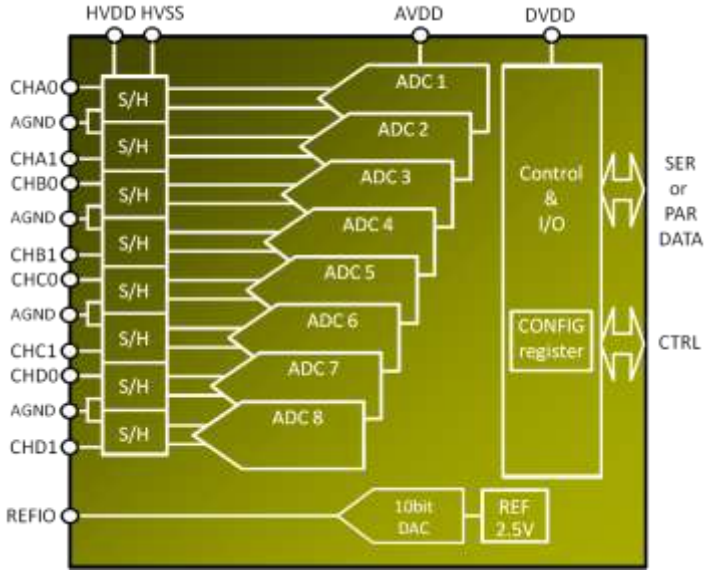
- Pin Compatible 16-/14-/12-Bit Versions
  - 510/400kSPS @ 16-bits
  - 600/450kSPS @ 14-bits
  - 650/480kSPS @ 12-bits
- 8 True bipolar inputs support up to ±12V
- Small, Integrated Industrial Solution
  - 2.5V programmable reference
  - Fully specified from -40 to 125°C
  - QFN-64 & TQFP-64 Packages
  - Supports internal and external conversion clock
  - Supports parallel and serial data interface

Applications

- Power Automation:
  - ➢Protection Relays
  - ➢Power performance measuring and monitoring devices (PMD)
- Multiphase Motor Control
- Multi-axis positioning systems
- Industrial automation and Data Acquisition

Benefits

- Easy upgrade / downgrade path for all designs
- Enables 20% wider voltage input range than competing devices resulting in easy connectivity to a wide range of inputs and sensors
- External conversion clock for synchronization of multiple devices enables flexible and expandable systems at up to 500kSPS for parallel and 400kSPS serial interfaces



ADS8363

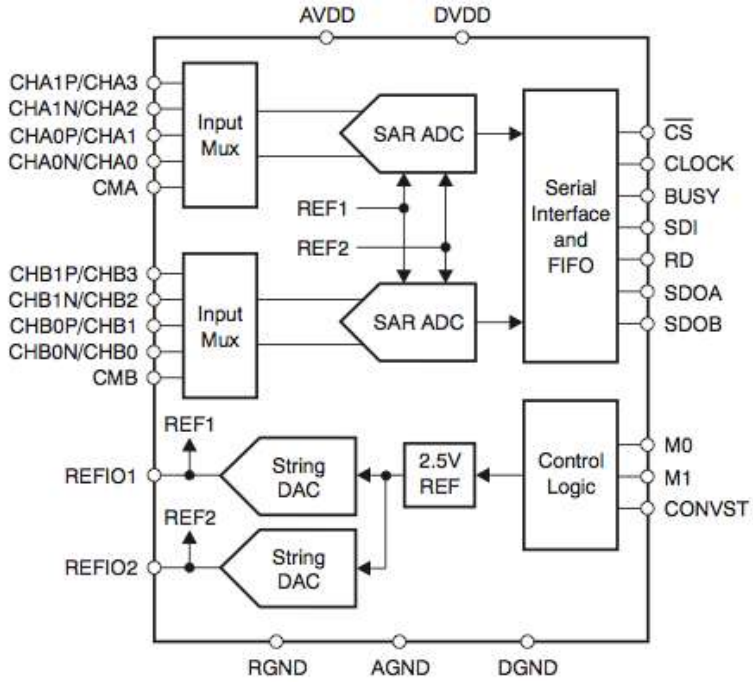
16-bit 1MSPS 4x2/2x2 Simultaneous Sampling SAR ADC

Features

- Dual,4-Ch pseudo-differential or 2-Ch differential configurable inputs coupled with a dual 2.5V programmable reference
- Dual ADCs with true 16-bit Performance
  - NMC @ 93dB SNR (typ)
- Integrated Industrial Solution
  - 4 deep per-channel FIFO
  - Auto-scan Mode
  - Extended temp range: -40 to 125°C
  - Compact packaging: QFN-32

Benefits

- Input muxes and **dual programmable internal reference** enable input range scaling and monitoring up to 8 different signals
- **Improved application accuracy**
- Integrated FIFO enables a **75% reduction** in the number of host accesses



Applications

- Motor control
- Power quality measurement
- Protection relays
- Industrial automation

Additional Device Options:
ADS7263: 14-Bit
ADS7223: 12-Bit

ADS8363 EVM Available

ADS8556 | ADS8557 | ADS8558

Multi-Bit | 6ch Simultaneous Sampling SAR w/ Bipolar Inputs

Features

• Best In Class AC/DC Performance
- •12-Bit, 0.75 LSB INL (Max), 73.9db SNR (typ)
- •14-Bit, 1 LSB INL (Max), 85db SNR (typ)
- •16-Bit, 3 LSB INL (Max), 91.5db SNR (typ)

• True bipolar inputs with software selectable input ranges up to ±12V and Selectable parallel or serial interface

•Pin-Compatible 16-/14-/12-Bit Versions
- •630/450kSPS @ 16-bits
- •670/470kSPS @ 14-bits
- •730/500kSPS @ 12-bits

•LQFP-64 Package pin compatible with ***AD7657/7/8***
- • Only 122mW @ 250kSPS

Applications

- Power quality and automation
- Protection relays
- Closed loop servo control
- Robotics

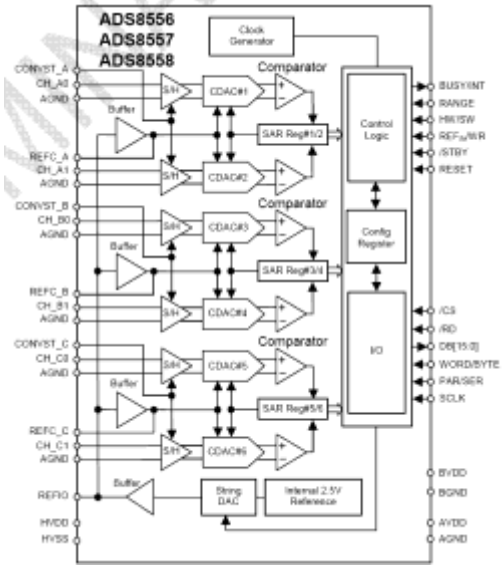
Benefits

• Excellent performance and external conversion clock for synchronization of multiple devices enables flexible and expandable systems

• Allows easy connectivity to a wide range of inputs , sensors, and host processors

• Allows for an easy upgrade / downgrade path for future designs

• Improved second source to ADI device with ~3x faster sampling rate and 0.5dB better SNR



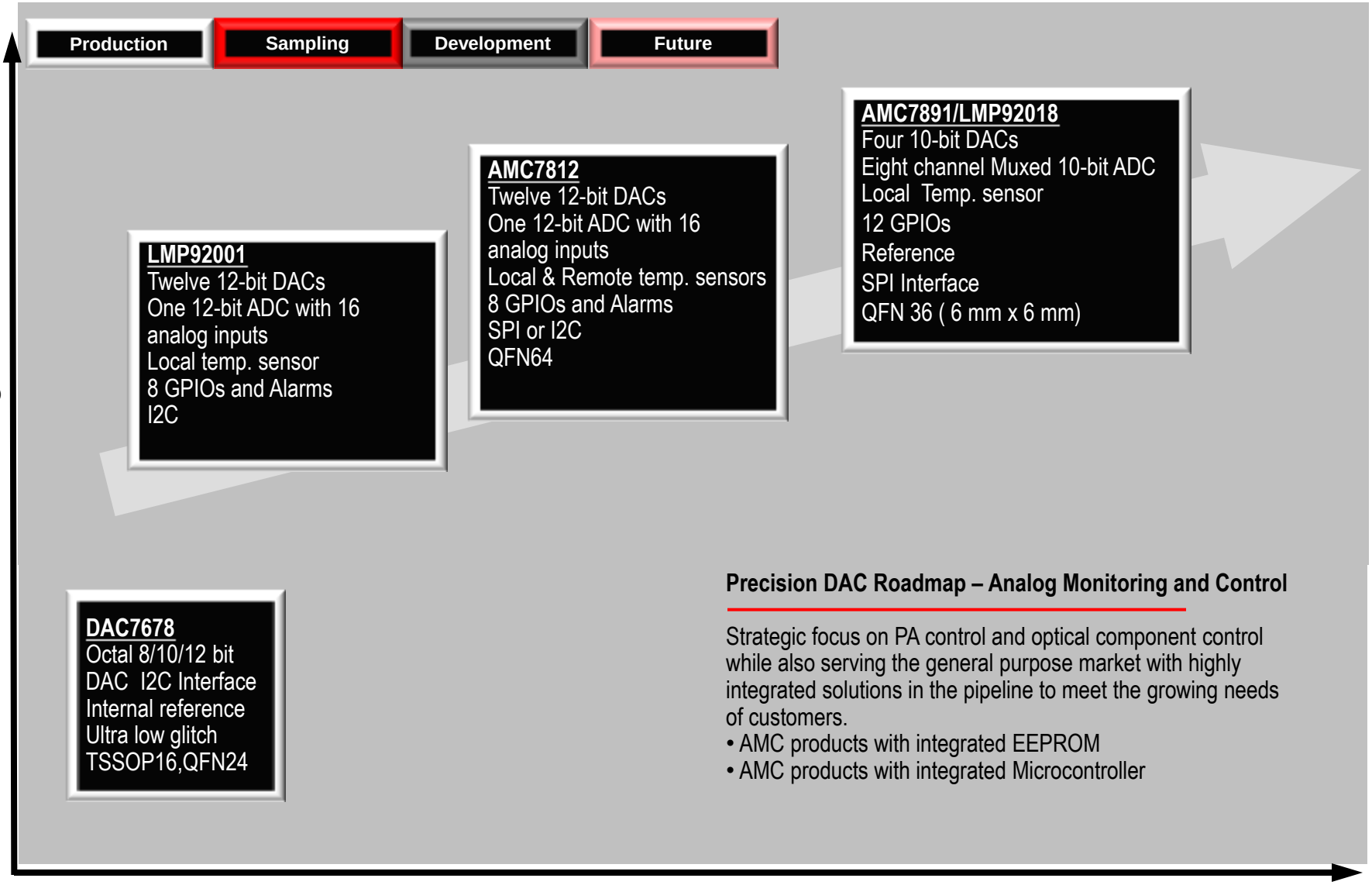
DAC Roadmaps

Analog Monitoring & Control

Industrial

General Purpose

Precision DACs – Analog Monitoring and Control



Precision DAC Roadmap – Analog Monitoring and Control

Strategic focus on PA control and optical component control while also serving the general purpose market with highly integrated solutions in the pipeline to meet the growing needs of customers.

- AMC products with integrated EEPROM
- AMC products with integrated Microcontroller

DAC5578/DAC6578/DAC7678

8/10/12 bit 8 channel DAC, Voltage Output, Internal Reference, I2C

Features

- Designed for high density applications
  - 8 channel in QFN-24 (4 x 4 mm), TSSOP16
  - I2C Interface
  - 2.5V precision reference (5 ppm/C typ.)
- Excellent low power performance(0.28 mW /ch)
  - ± 1 LSB Max INL
  - Ultra Low Glitch 0.15 nV-sec
  - 7 us settling time
- Reset to Zero Scale or Mid Scale
- Temp Range: - 40°C to +125°C

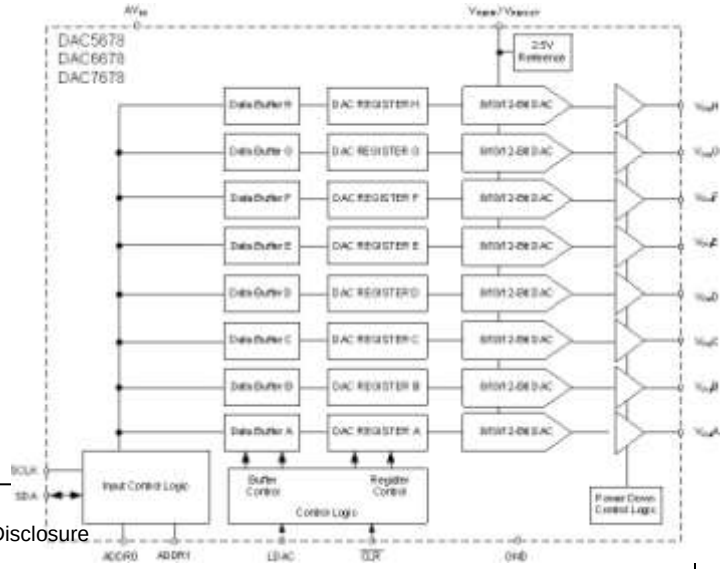
Benefits

- Simplifies layout and minimizes design time for high channel count applications
- Allows designers to achieve 1.5 LSB higher accuracy and faster loop settling with minimal power consumption over the nearest competition
- Suitable for industrial applications

Applications

- PA Control – Bias Control
- Optical Control
- Digital gain & offset control
- Average power control (APC)
- Peak power control (PPC)
- Transmit gain control (TGC)

Datasheet	Bits	Int.Ref.
DAC7678	12	Yes
DAC7578	12	No
DAC6578	10	No
DAC5578	8	No



LMP92001

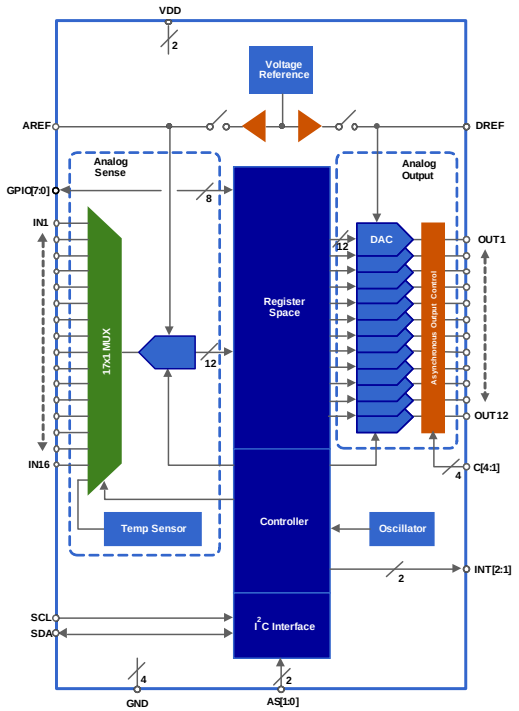
Analog System Monitor and Controller

Features

- Fully integrated System monitor and controller
- DAC output switches with Asynchronous control
- Programmable window comparator function
- Two independent voltage reference options
- Mirrored pinout and Small LLP54 package

Benefits

- Monitors 16 voltages, 1 internal temperature and controls 12 output voltage levels
- DAC output switches allow fast update of output to rail value
- Easy dual channel PCB layout
- Smallest solution size and lower cost



Applications

- RF PA monitoring and control
- Power Supply system monitoring and control
- Industrial monitoring and control

LMP92001EVM

AMC7812: 12-bit Analog Monitor and Control Solution

Features

- Twelve 12 bit DACs with programmable outputs
  - 0 to 5V or 0 to 12V; 10mA
  - Clear to Predefined Value

- ADC:
  - 12-Bit, 500ksps
  - 16 SE or 12 SE & 2 DE inputs
  - External Trigger
  - Out-Of-Range Alarm

- Two Remote Temp Sensors: - 40°C to +150°C, ±2°C accuracy
  - Internal Temp Sensor: - 40°C to +125°C, ± 2.5°C accuracy
  - Thermal Alarm

- Internal Reference: 2.5V, 25ppm/°C

- Programmable Interface
  - SPI (Up to 50MHz)or I2C Compatible (up to 3.4MHz)

- 8 GPIO pins

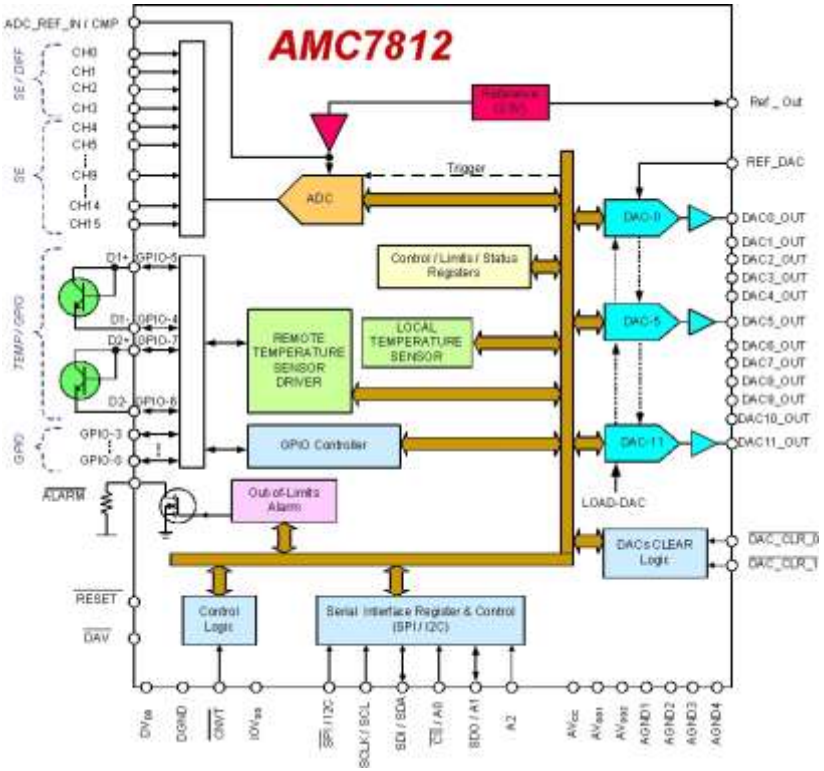
- 64-pin QFN (9mm*9mm)

Applications

- RF PA Control
- Test and Measurement
- Industrial Control
- Optical Control

Benefits

- **Highly Integrated device** for board savings, reduced cost
- **Flexible Serial Interface** for ease of use
- **GPIO's offer flexible** usage for wide range of features
- **Widest operating temperature** for harsh environments ranging from - 40°C to105°C

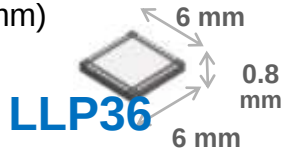


AMC7891/LMP92018

10-bit Analog Monitoring & Control Solution w/ Multichannel ADC, DACs & Temp. Sensor

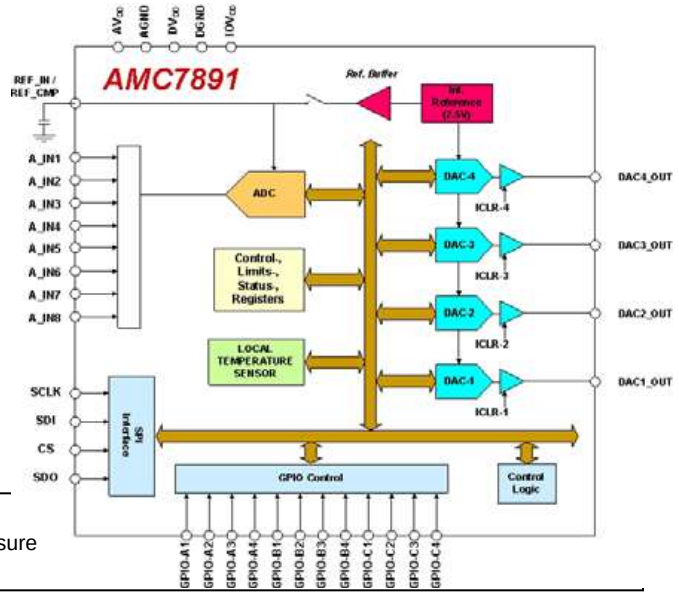
Features

- **Integration**
  - 8 channel10 bit ADC
  - 4 channel 10 bit DAC
  - 12 GPIOs
  - Local Temp Sensor: - 40°C to +125°C, ± 2.5°C accuracy
- **Flexible reference on ADC and DAC:**
  - External / Internal Reference: 2.5V, 25ppm/°C
- **Independent GPIO and SPI supply**
- **Small Package:** 36-pin QFN (6mm*6mm)



Benefits

- Highly Integrated device helps customer integrate up to 4 discrete parts in 1 chip thus saving board space, cost and design time
- Allows flexible system design and tradeoffs between system performance and cost
- Provides ability to interface to low voltage/low power microcontrollers
- 40% smaller package footprint (vs.discrete solution) helps save board space

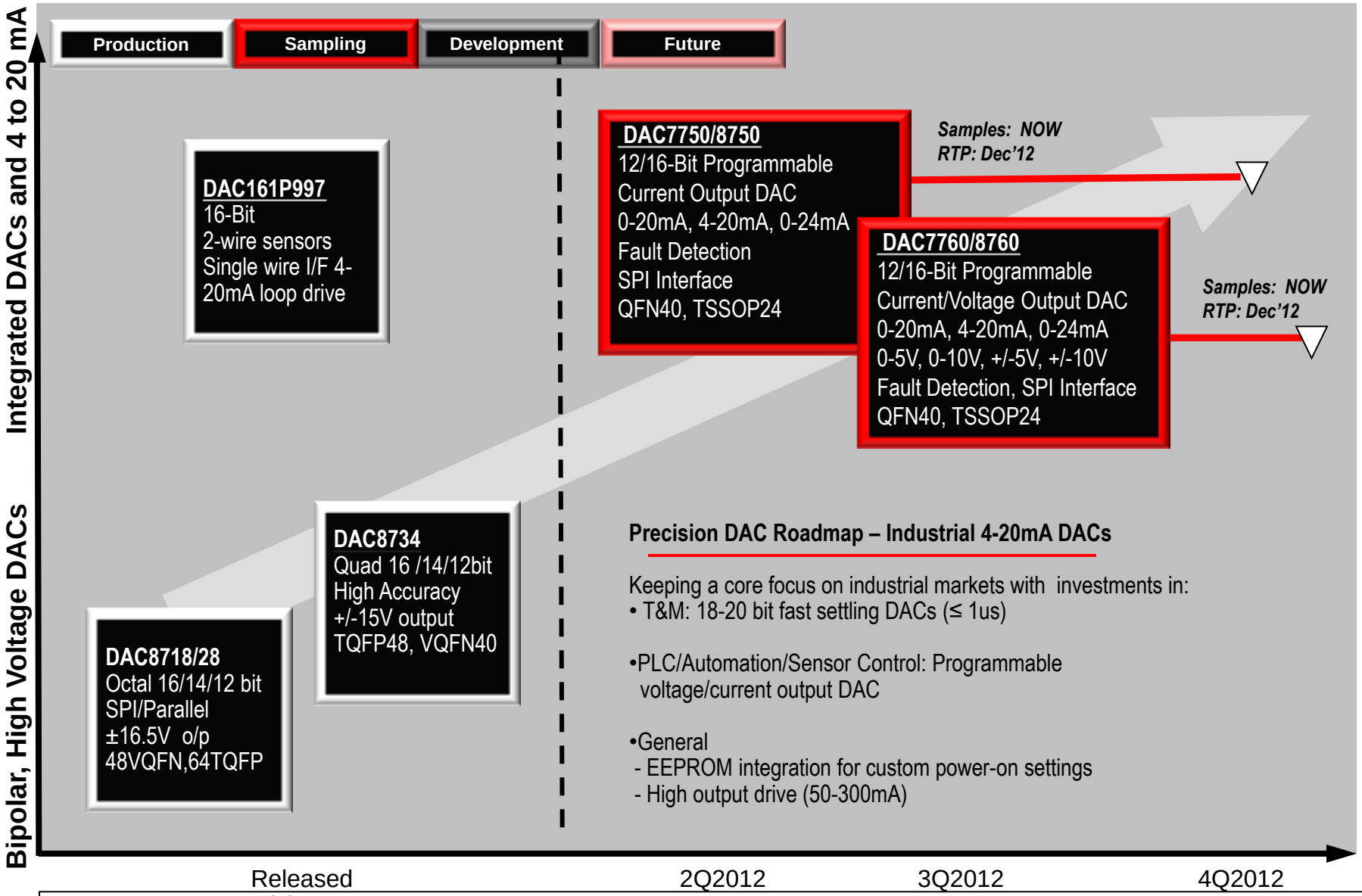


Applications

- RF PA Control in base stations
- LNA Bias and Control in base stations
- Industrial monitoring and control
- Power Supply system monitoring and control
- General purpose monitoring and control

LMP92019SQEVAL

Precision DACs – Industrial Portfolio



DAC161P997

16bit DAC with Single Wire Interface and “4-20mA” current loop drive

Features

- 16 bit DAC
- Low Power
- Single Wire Interface (SWI), with handshake
- Programmable start up condition
- Self adjusts over wide baud rate range
- Error detection and reporting
- Programmable output Error Level
- Auxiliary HART input
- Internal Reference

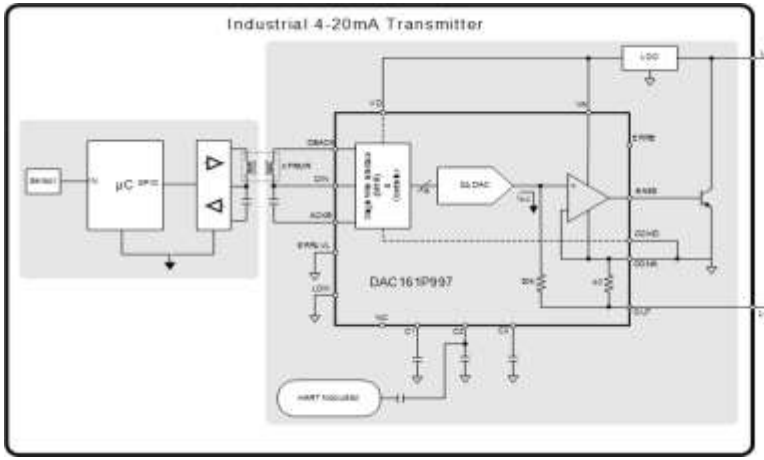
Benefits

- Fully Integrated Solution with well defined specification
  - Easy reuse of design & reduces logistics cost
  - No additional high accuracy components needed
- Satisfies system needs of total power consumption < 30mW
- SWIF interface – saves up to 3 digital isolators
- SWIF interface – low noise
- Defined Start-Up Condition 3.375mA or 21.75mA & pin programmable
- Flexible update-rate/power-consumption trade-off
- Automatic detection of error conditions

Applications

- 4to20mA loop transmitter platforms
  - 2-wire sensor systems
    - Process Control
    - Factory automation
    - Building automation

DAC161P997EVAL



DAC7750 & DAC8750

Preview

12-/16- bit DAC with 4 to 20 mA current output

Features

- **Integrated DAC and 4 to 20 mA current source**
  - Selectable Range : 0-20mA; 4-20mA; 0-24mA;
  - Internal Reference (10ppm/°C)
  - Fault Detection: Open-Circuit of I-Out
- **TUE:** 0.1% FSE
- **Enhanced Reliability Features:**
  - HART interface, Parity Error Check, Watchdog timer
- **Pin compatible to competitive solutions**
  - 40-QFN (6x6 mm) / 24-QSSOP
- **Wide Temp Range:** -40°C to +125°C

Features highlighted in Red differentiate TI from competition

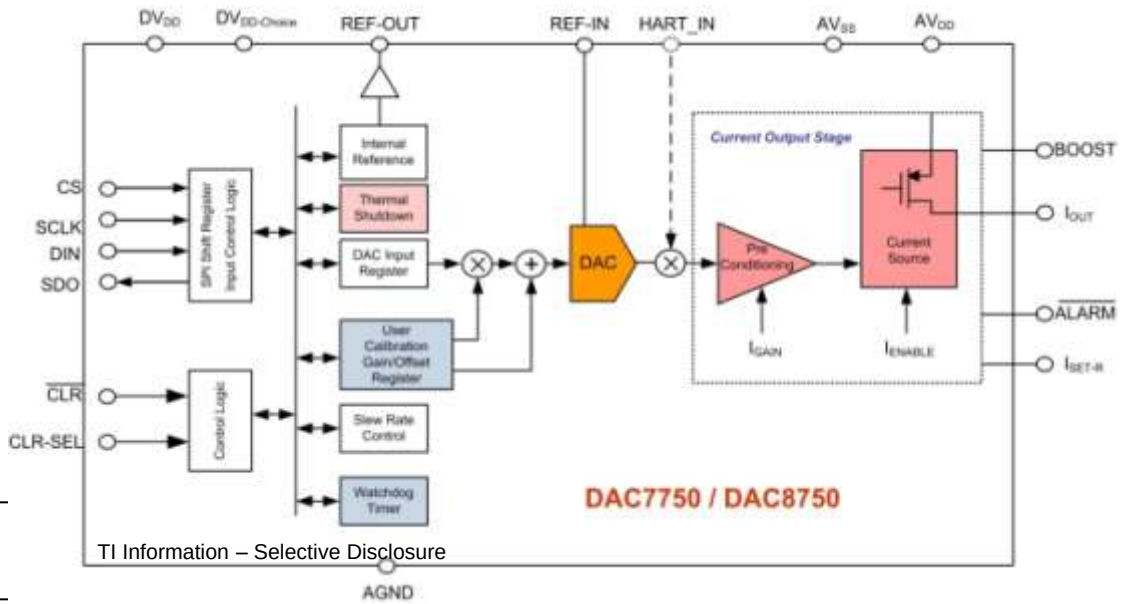
Applications

- PLC
- Industrial Automation
- Power Automation
- I/O modules

Samples: NOW

Key Differentiators

- Integrates 3 different components on board to help save board space, cost and reduce design time
- 3x higher accuracy than competition
- Only part in market with enhanced features that improve system reliability
- Allows easy upgrade from existing solutions
- Reliable operation under extended industrial temp range



DAC7760 & DAC8760

Preview

12-/16- bit DAC with 4 to 20 mA current, Voltage output

Features

- **Integrated DAC and 4 - 20 mA current, voltage source**
  - Selectable Range : 0-20mA; 4-20mA; 0-24mA
  - Selectable Range : 0 to 10V; +/-5V; +/-10V
  - Internal Reference (10ppm/°C)
  - Fault Detection: Open-Circuit of I-Out, Short-Circuit of V-out
- **TUE:** 0.1% FSE
- **Enhanced Reliability Features:**
  - HART interface, Parity Error Check, Watchdog timer
- **Pin compatible to competitive solutions**
  - 40-QFN (6x6 mm) / 24-QSSOP
- **Wide Temp Range:** -40°C to +125°C

Features highlighted in Red differentiate TI from competition

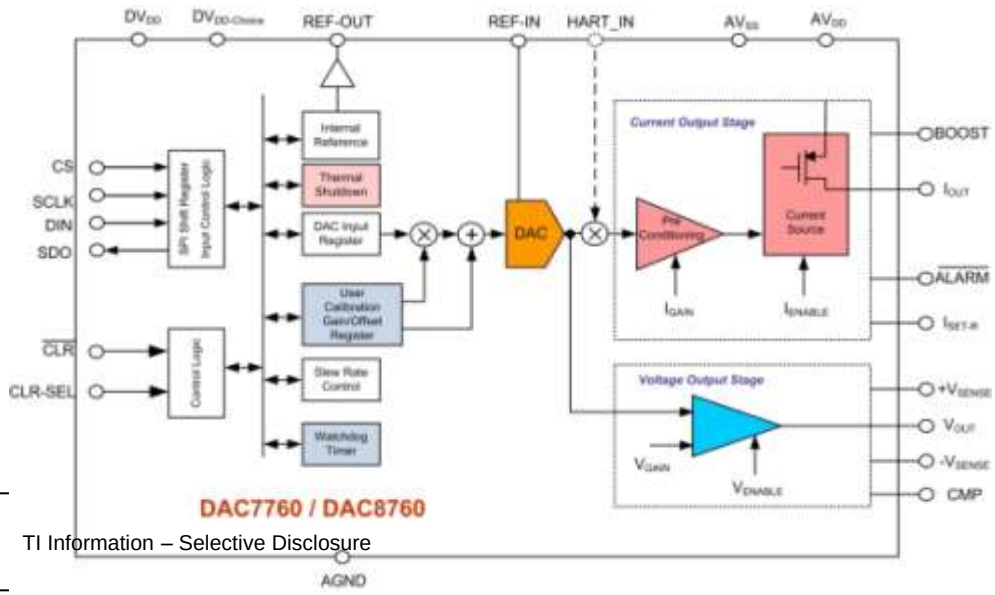
Applications

- PLC
- Industrial Automation
- Power Automation
- I/O modules

Samples: NOW

Key Differentiators

- Integrates 3 different components on board to help save board space, cost and reduce design time
- 3x higher accuracy than competition
- Only part in market with enhanced features that improve system reliability
- Allows easy upgrade from existing solutions
- Reliable operation under extended industrial temp range



DAC8734 /8234 / 7716

16 / 14 / 12 Bit | Quad Channel
High Accuracy | Bipolar DAC

Lowest Drift!!
Highest Temp and Voltage Range!!

Features

- **Widest Voltage Range**
  - Programmable Output: 2 x V_{REF} / 4 x V_{REF}:
    - ±5V to ±16V / 0 to +20V
  - Requires only a single reference voltage

- **Flexibility**
  - Widest Temperature Range: -40 C to +105 C.
  - Small Package: 6x6 40-QFN / 7x7 48-TQFP
  - 50MHz SPI interface with 1.8V/3V/5 compatible logic

- **Speed and Accuracy**
  - 6us Settling Time
  - High Accuracy: INL ±1 LSB max
  - Low Initial Zero / Gain Error: ± 0.006%FS max
  - User Calibration minimizes Gain Error to 0.0015% FS, Zero Error to 0.0002%FS.
  - Lowest Drift :
    - Gain Error +/- 0.5 ppm /^{O}C
    - Zero Error +/- 0.2 ppm / ^{O}C (Unipolar)

Applications

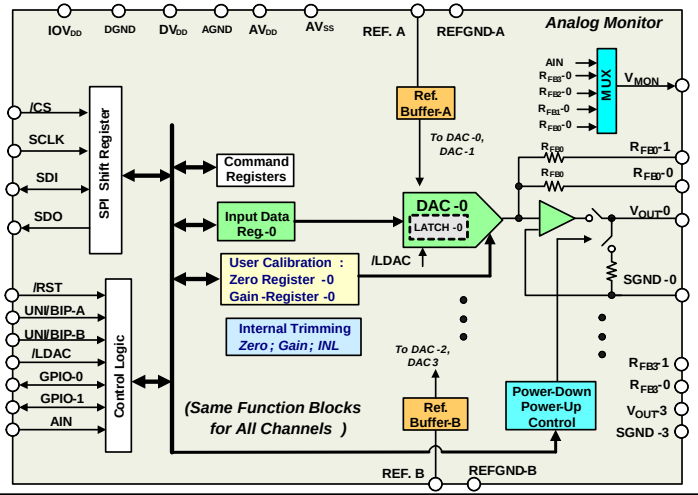
- Automatic Test Equipment
- Instrumentation
- Industry Control (PLC, DCS, etc.)
- Applications

Benefits

- **Widest voltage Range** to minimize the external gain.
- Reduce # of external components, **programmable output gain , single voltage reference**

- **Widest operating temperature** for harsh environments

- **Highest initial accuracy** reduces calibration time verses competition. **User calibration** balances out error of the entire system. **Lowest Drift.**



Texas Instruments

DAC87x8 / 82x8 / 77x8

16 / 14 / 12-bit, 8-Channel, ±16.5V output, Parallel or SPI Interface

Features

Widest Voltage Range
- •Bipolar ±16.5V or Unipolar 0-33V output w/ 4x or 6x Gain

Speed and Accuracy
- •10us Settling Time to 0.03% Accuracy
- •INL: ±4 LSB (max)
- • User Calibration Register
- • Low Glitch Energy of 4 nV-s typical

Flexibility
- • Analog Mux for monitoring output
- • Dual Offset DACs
- •Temp Range -40°C to +105°C
- • QFN-48 (7x7), QFN-56(8x8mm) & TQFP-64 (10x10mm)

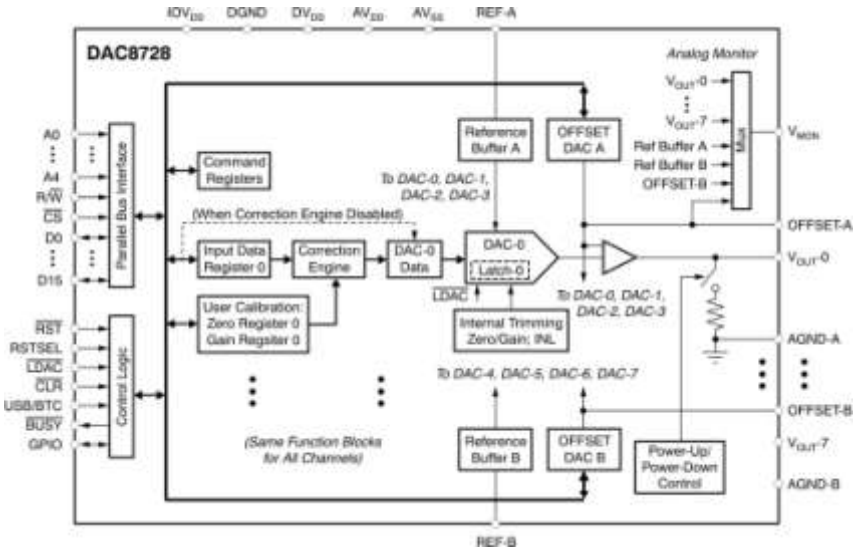
Benefits

- ➢ Eliminates need for external voltage gain circuitry
- ➢ 3x Faster settling time than competition without sacrificing accuracy
- ➢ Optimized performance based on previously stored system gain/offset errors.
- ➢ 20% lower glitch than competition
- ➢ Facilitates output monitoring and control
- ➢ Symmetrical or Asymmetrical offset of DAC output range

Applications

- • Test Equipment/ATE
- • Instrumentation
- • Industrial Process Control
- • Machine and Motion control

Datasheet	Bits	Interface
DAC8728	16	Parallel
DAC8228	14	Parallel
DAC7728	12	Parallel
DAC8718	16	SPI
DAC8218	14	SPI
DAC7718	12	SPI



EVM

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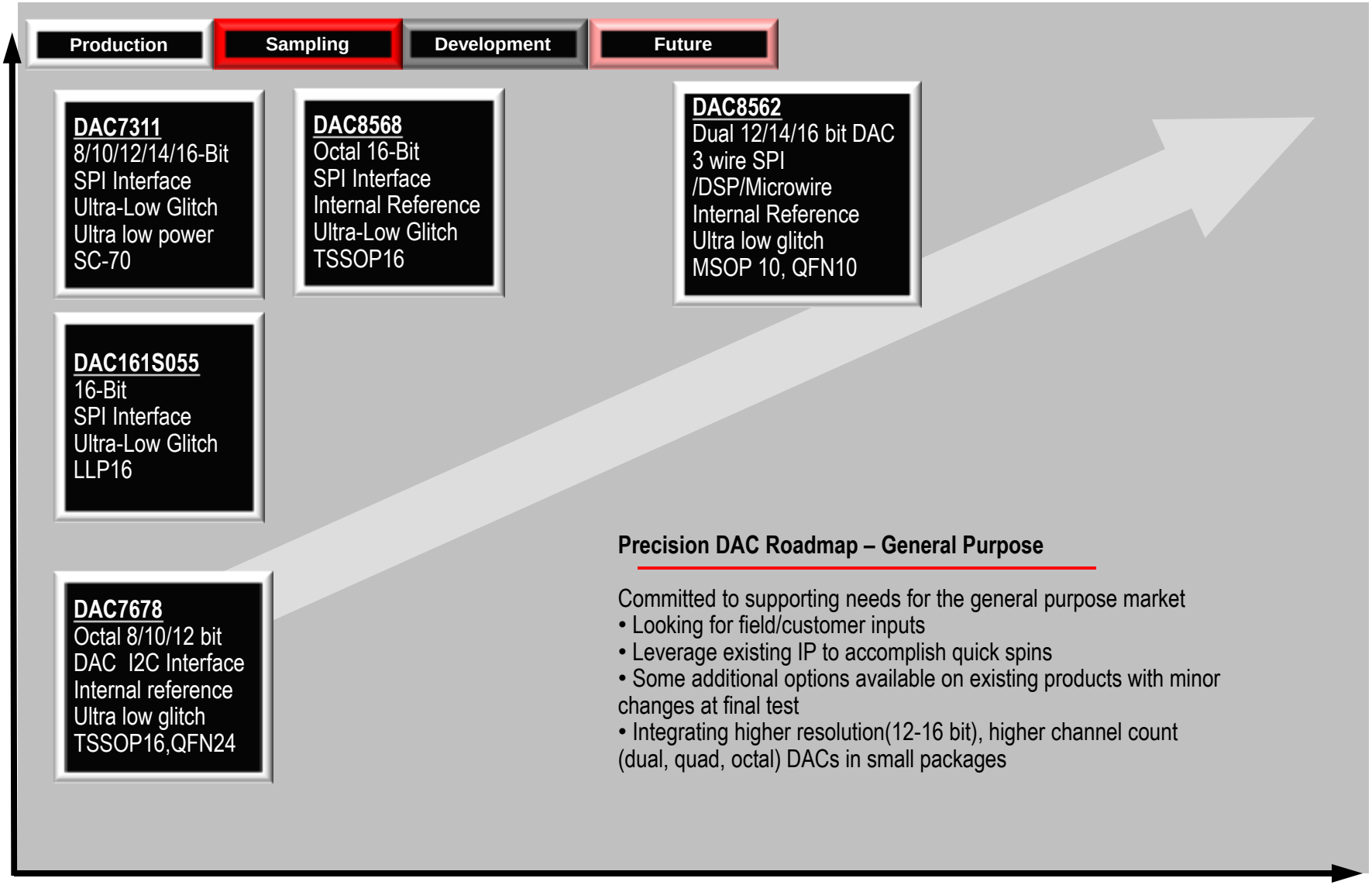
Precision DACs – General Purpose



Precision DAC Roadmap – General Purpose

Committed to supporting needs for the general purpose market
- Looking for field/customer inputs
- Leverage existing IP to accomplish quick spins
- Some additional options available on existing products with minor changes at final test
- Integrating higher resolution(12-16 bit), higher channel count (dual, quad, octal) DACs in small packages

DAC161S055

Precision 16-Bit, Buffered Voltage-Output DAC

Features

- **16-bit DAC with a two-buffer SPI interface**
- **Asynchronous load DAC and reset pins**
- **Compatibility with 1.8V controllers**
- **Buffered voltage output with rail-to-rail capability**
- **Wide voltage reference range of +2.5V to VA**
- **Wide temperature range of –40°C to +105°C**
- **Packaged in a 16-pin LLP**

Resolution	Settling Time	Device Id
16 Bit	5 µs	DAC161S055

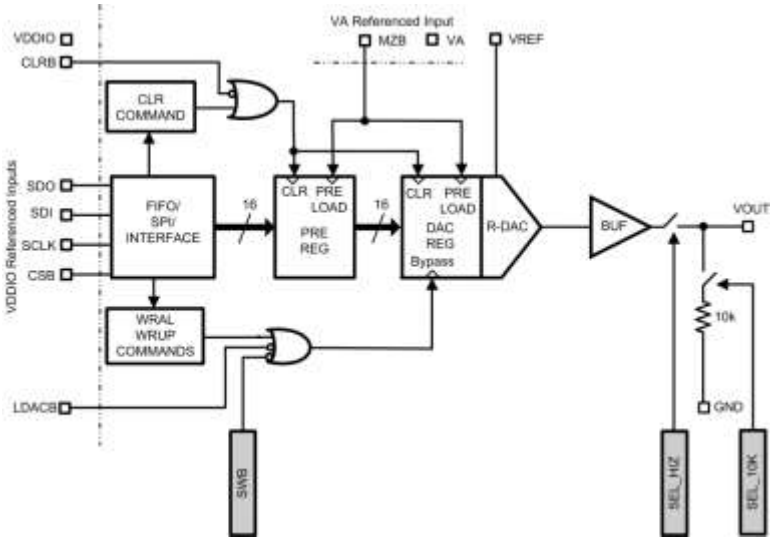
Applications

- Process control
- Automatic test equipment
- Programmable voltage sources
- Communication systems
- Data acquisition
- Industrial PLCs
- Portable battery powered instruments

EVM PART # DAC161S055EB/NOPB

Benefits

- The on-chip output buffer provides rail-to-rail output swing
- External voltage reference can be set between 2.5V and the analog supply voltage, providing the widest dynamic output range possible.
- The part is capable of Daisy Chain and Data Read Back.
- A power-on reset circuit ensures that the output powers up to a known state
- A power-down option reduces power consumption when the part is not in use.



Typical Application Circuit

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DAC8568 Family

12, 14, and 16-bit, Octal Channel, V-Out DAC with 2ppm/°C Temp Drift Internal Ref

Features

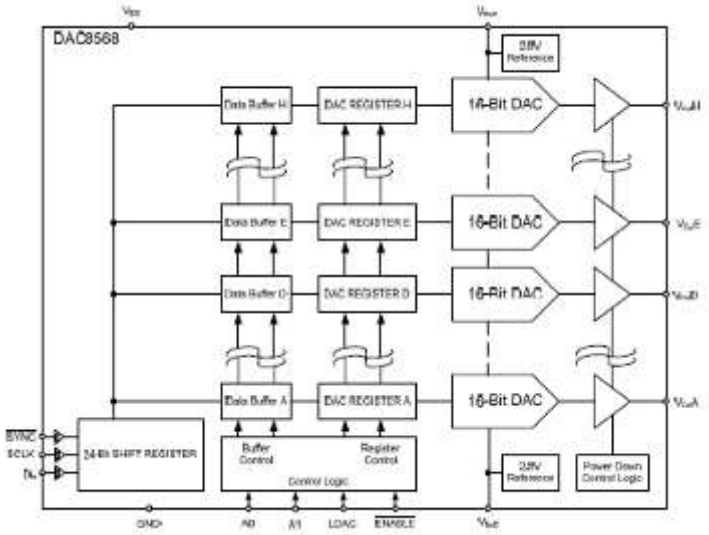
- Integrated Precision 2.5V Reference
  - Temp Drift 2 ppm/°C (typ); 5 ppm/°C (max)
  - Initial accuracy of 0.004% (typ) 0.02% (max)
- DNL: ±0.5 LSB (typ); INL: ±4 LSB (typ)
- Low Glitch: 0.15nV-Sec
- Temp Range -40°C to +105°C
- Low Power: 238µA/channel @ 2.7V

Benefits

- Lowers Component Count and mproved System Accuracy with Reduced Calibration Requirements
- More Efficient Closed-Loop Control
- Reduction of Undesired Transients and Noise leads to Lower THD when Generating Waveforms
- Performs in Extreme Environment
- Minimal impact to overall system power budget

Applications

- Portable Instrumentation
- Industrial Process Control
- Machine and Motion control
- Waveform Generation



EVM

DAC8568EVM

DAC7562/DAC8162/DAC8562:

Dual 12/14/16 bit, Low Power, Low Voltage DAC with precision internal REF and SPI interface

Features

- **Excellent low power performance**
  - INL: 0.3 LSB @ 12 bit
  - Ultra Low glitch energy: 0.1 nV-sec
  - Power: 0.2 mA @3.6V
- **Integrated precision internal reference**
  - 2.5 V reference, 5 ppm/°C max. drift
  - 1 mV initial accuracy
  - 20 mA sink/source capability
- **Ultra Small Package**
  - 10-pin MSOP(3x5mm) & 10-pin QFN(3x3mm)
- **Wide Temp Range -40°C to +125°C**

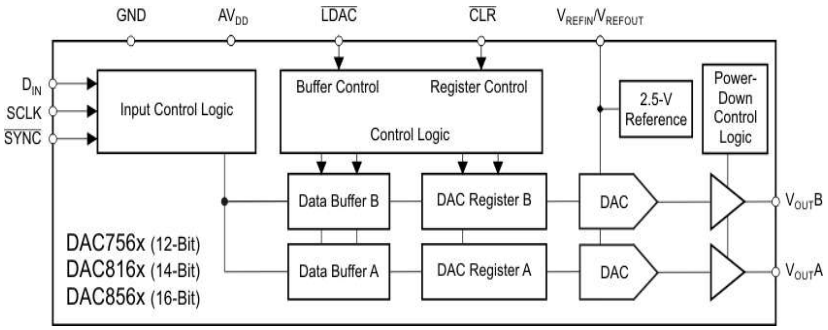
Benefits

- 90% lower glitch than competition helps reduce THD and fasten loop settling time
- Reduces system cost and board space by eliminating external reference and buffer
- Ultra small package results in space savings
- Characterized under extended industrial temp. conditions

Applications

- Portable Instrumentation
- Consumer products
- Digital gain & offset adjustment
- Industrial Process Control
- Machine and Motion control

Datasheet	Bits	Reset state
DAC8562	16	Zero
DAC8563	16	Miid-Scale
DAC8162	14	Zero
DAC8162	14	Miid-Scale
DAC7562	12	Zero
DAC7563	12	Miid-Scale



EVM

DACx311 Family

8 to 16-Bit, SC-70 package, Ultra-low glitch, low power DAC

Features

- Tiny SC-70 package
- Wide supply range: 1.8V – 5.5V
- Ultra Low Power: 80µA

- 0.15nV-sec output glitch energy
- Settling Time: 6 µs (typ)
- ±1 LSB INL (max) @ 12bits

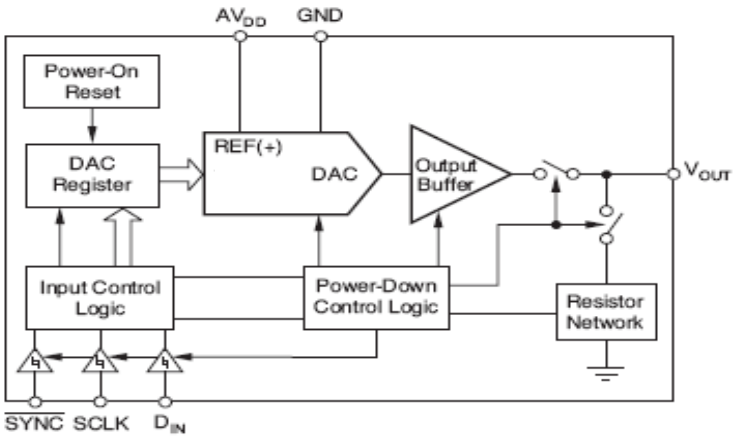
- Temp Range -40°C to +125°C

Applications

- Portable Instrumentation
- Consumer products
- Industrial Process Control

Benefits

- Small size and low power operation ideal for battery-operated portable applications
- Low cost application can now have high accuracy and best in class glitch performance
- Guaranteed performance over extended Industrial Temp Range



SC70 package, 2.2 x 2 mm

EVM

DACx311EVM

DAC5578/DAC6578/DAC7578/DAC7678

8/10/12 bit 8 channel DAC | Voltage Output | Internal Reference | I²C

Features

- Designed for high density applications
  - 8 channel in QFN-24 (4 x 4 mm), TSSOP16
  - I2C Interface
  - 2.5V precision reference (5 ppm/C typ.)
- Excellent low power performance(0.28 mW /ch)
  - ± 1 LSB Max INL
  - Ultra Low Glitch 0.15 nV-sec
  - 7 us settling time
- Reset to Zero Scale or Mid Scale
- Temp Range: - 40°C to +125°C

EVM

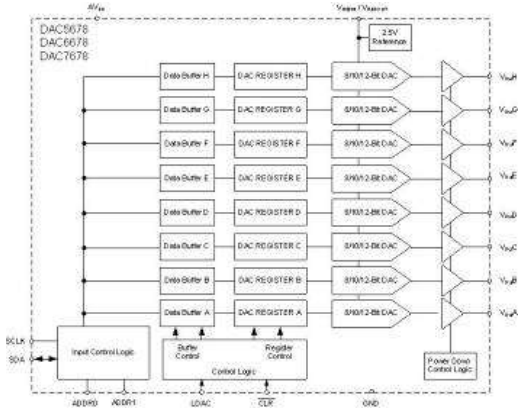
Benefits

- Simplifies layout and minimizes design time for high channel count applications
- Allows designers to achieve 1.5 LSB higher accuracy and faster loop settling with minimal power consumption over the nearest competition
- Lower inventory costs
- Suitable for industrial applications

Applications

- PA Control – Bias Control
- Optical Control
- Digital gain & offset control
- Average power control (APC)
- Peak power control (PPC)
- Transmit gain control (TGC)

Datasheet	Bits	Int.Ref.
DAC7678	12	Yes
DAC7578	12	No
DAC6578	10	No
DAC5578	8	No



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Thank you!