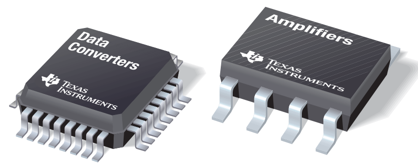
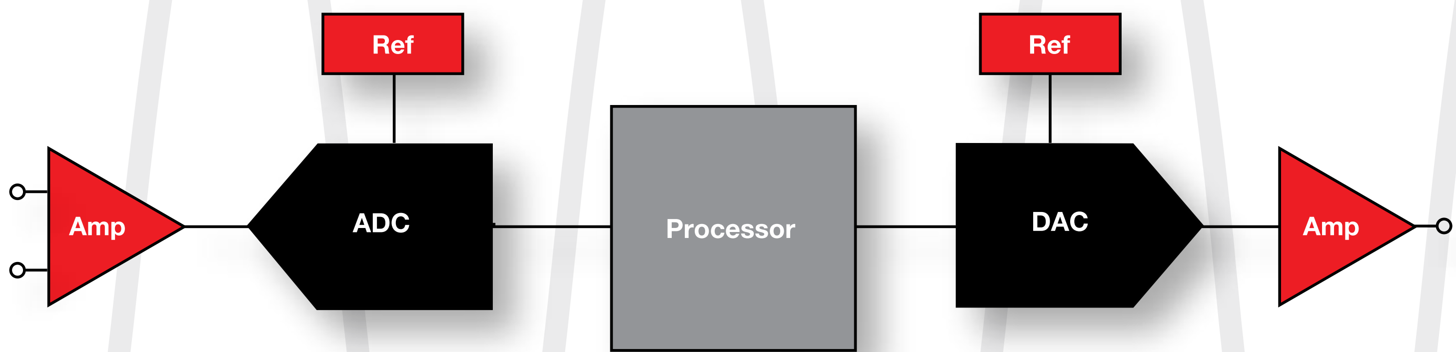
Amplifier and Data Converter Guide



Texas Instruments

Amplifiers: Operational, Instrumentation, Comparators, Special Function Analog, Power, Buffers, High Speed, Audio

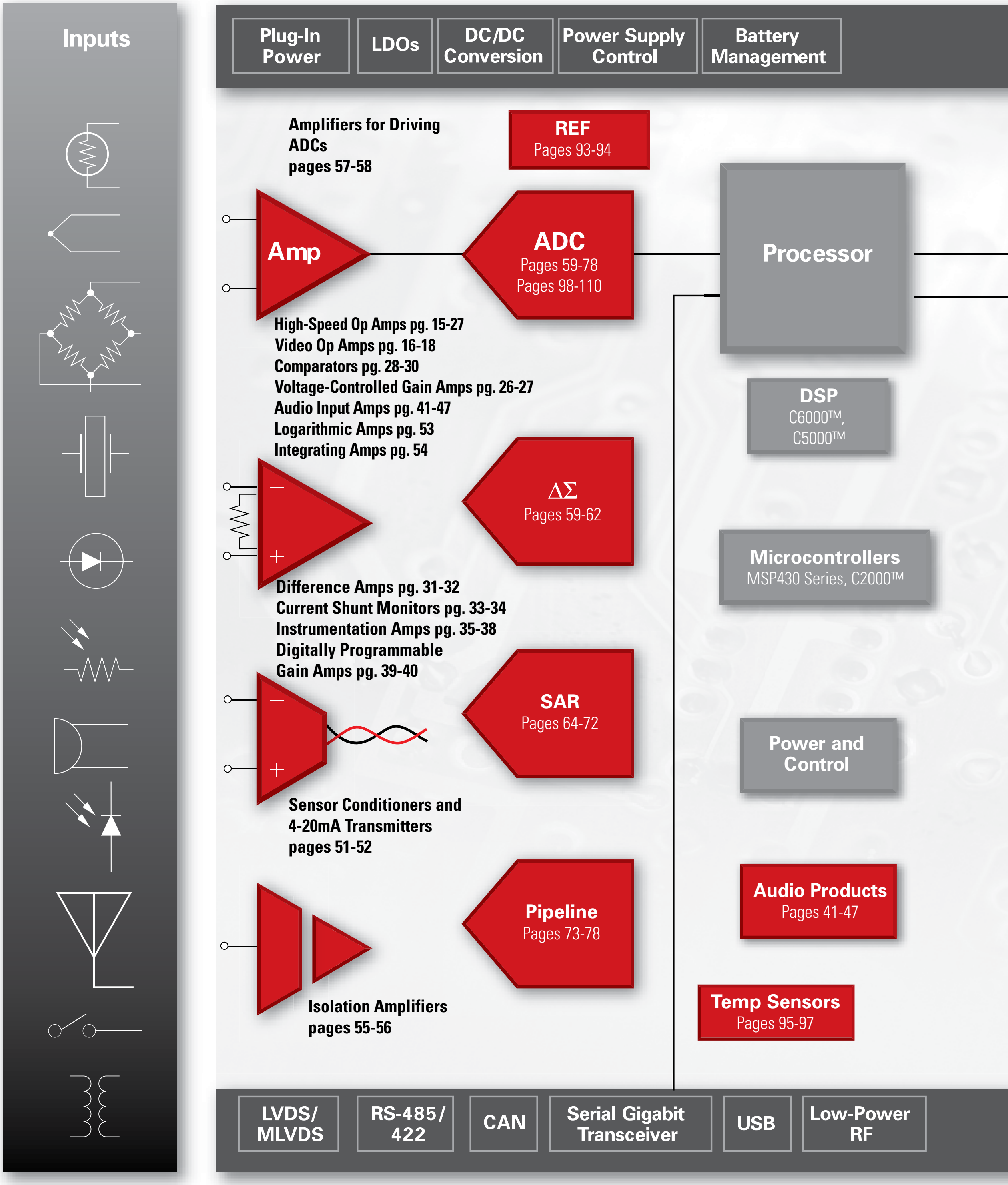
Data Converters: Delta-Sigma ADCs, SAR ADCs, Pipeline ADCs, Precision DACs, High-Speed DACs, Analog Monitoring and Control, Audio Converters



www.ti.com/amplifier
www.ti.com/dataconverters

1Q 2009

Signal Chain



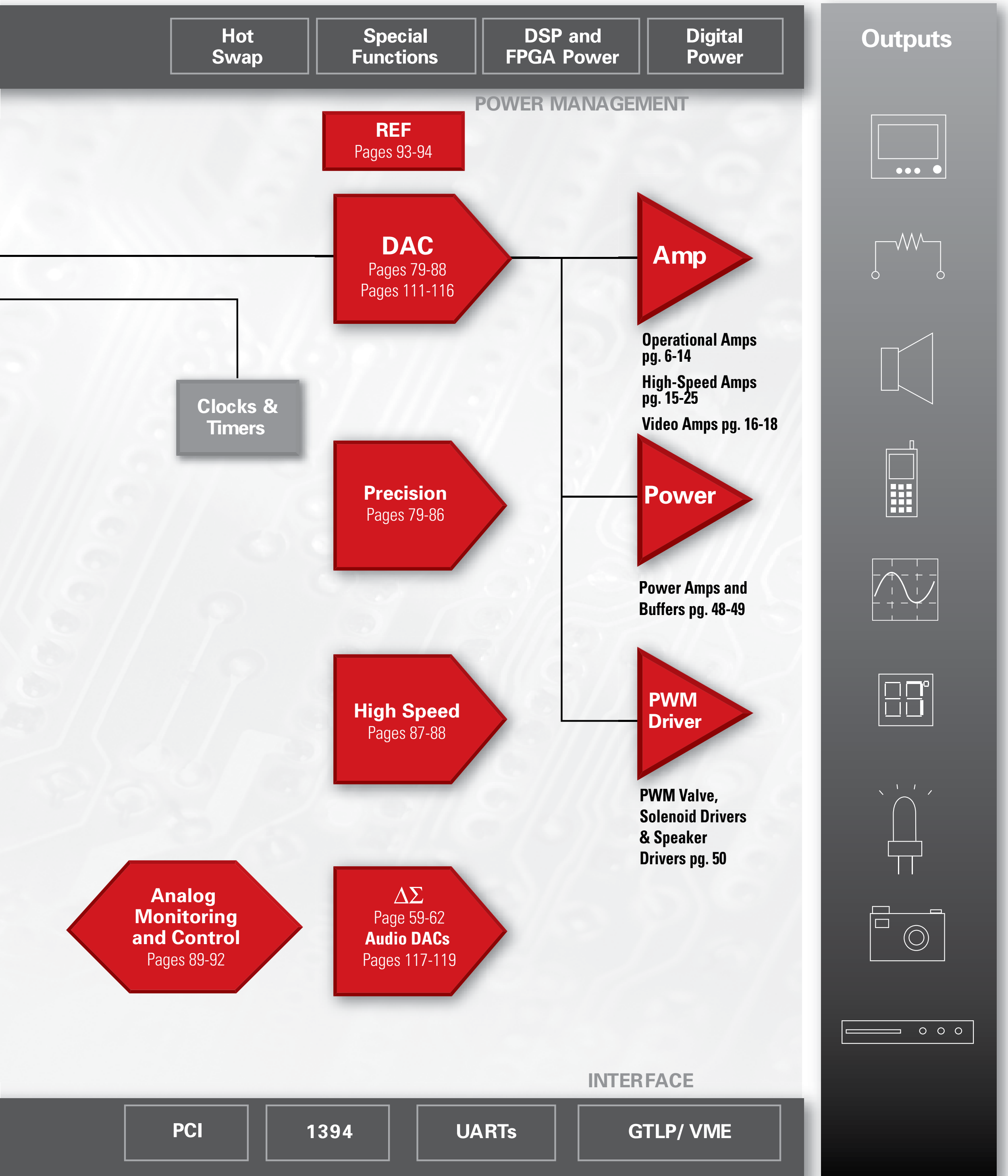

Hot Swap
Special Functions
DSP and FPGA Power
Digital Power
POWER MANAGEMENT
REF Pages 93-94
DAC Pages 79-88 Pages 111-116
Amp
Operational Amps pg. 6-14
High-Speed Amps pg. 15-25
Video Amps pg. 16-18
Clocks & Timers
Precision Pages 79-86
Power
Power Amps and Buffers pg. 48-49
High Speed Pages 87-88
PWM Driver
PWM Valve, Solenoid Drivers & Speaker Drivers pg. 50
Analog Monitoring and Control Pages 89-92
ΔΣ Page 59-62 Audio DACs Pages 117-119
INTERFACE
PCI
1394
UARTs
GTLP/ VME
Outputs

Table of Contents

Table of Contents

Texas Instruments (TI) offers a wide range of op amp types including high precision, microPower, low voltage, high voltage, high speed and rail-to-rail in several different process technologies. TI has developed the industry's largest selection of low-power and low-voltage op amps with features designed to satisfy a very wide range of applications. To help facilitate the selection process, an interactive online op amp parametric search engine is available at ***amplifier.ti.com/search*** with links to all op amp specifications.

Design Considerations

Choosing the best op amp for an application involves consideration of a variety of inter-related requirements. In doing so, designers must often consider conflicting size, cost and performance objectives. Even experienced engineers can find the task daunting, but it need not be so. Keeping in mind the following issues, the choices can quickly be narrowed to a manageable few.

Supply voltage (V_S)—tables include low voltage (< 2.7V min) and wide voltage range (> 5V min) sections. Other op amp selection criteria (e.g., precision) can be quickly examined in the supply range column for an appropriate choice. Applications operating from a single power supply may require rail-to-rail performance and consideration of precision-related parameters.

Precision—primarily associated with input offset voltage (V_{OS}) and its change with respect to temperature drift, PSRR and CMRR. It is generally used to describe op amps with low input offset voltage and low input offset voltage temperature drift. Precision op amps are required when amplifying tiny signals from thermocouples and other low-level sensors. High-gain or multi-stage circuits may require low offset voltage.

Gain bandwidth product (GBW)—the gain bandwidth of a voltage-feedback op amp determines its useful bandwidth in an application. The maximum available bandwidth is approximately equal to the gain bandwidth divided by the closed-loop gain of the application. For voltage feedback amplifiers, GBW is a constant. Many applications benefit from choosing a much wider bandwidth/slew rate op amp to achieve low distortion, excellent linearity, good gain accuracy, gain flatness or other behavior that is influenced by feedback factors.

Power (I_Q requirements)—a significant issue in many applications. Because op amps can have a considerable impact on the overall system power budget, quiescent current, especially in battery-powered applications, is a key design consideration.

Rail-to-rail performance—rail-to-rail output provides maximum output voltage swing for widest dynamic range. This may be particularly important with low operating voltage where signal swings are limited. Rail-to-rail input capability is often required to achieve maximum signal swing in buffer (G=1) single-supply applications. It can be useful in other applications, depending on amplifier gain and biasing considerations.

Voltage noise (V_N)—amplifier-generated noise may limit the ultimate dynamic range, accuracy or resolution of a system. Low-noise op amps can improve accuracy, even in slow DC measurements.

Input bias current (I_B)—can create offset error by reacting with source or feedback impedance. Applications with high source impedance or high impedance feedback elements (such as transimpedance amplifiers or integrators) often require low input bias current. FET-Input and CMOS op amps generally provide very low input bias current.

Slew rate—the maximum rate of change of the amplifier output. It is important when driving large signals to high frequency. The available large signal bandwidth of an op amp is determined by the slew rate $SR/.707(2\pi)V_P$.

Package size—TI offers a wide variety of microPackages, including WCSP, SOT23, SC70 and small, high power-dissipating PowerPAD™ packages to meet space-sensitive and high-output drive requirements. Many TI single-channel op amps are available in SOT23, with some dual amplifiers in SOT23-8.

Shutdown mode—an enable/disable function that places the amp in a high impedance state, reducing quiescent current in many cases to less than 1µA. Allows designers to use wide bandwidth op amps in lower power applications, enabling them only when they are needed.

Decompensated amplifiers—for applications with gain greater than unity gain (G > 1), decompensated amps provide significantly higher bandwidth, improved slew rate and lower distortion over their unity-gain stable counterparts on the same quiescent current or noise.

Common Op Amp Design Questions

What is the amplitude of the input signal?
To ensure signal errors are small relative to the input signal, small input signals require high precision (e.g., low offset voltage) amplifiers. Ensure that the amplified output signal stays within the amplifier output voltage.

Will the ambient temperature vary?
Op amps are sensitive to temperature variations, so it is important to consider offset voltage drift over temperature.

Does the common-mode voltage vary?
Make sure the op amp is operated within its common-mode range and has an adequate common-mode rejection ratio (CMRR). Common-mode voltage will induce additional offset voltage.

Does the power supply voltage vary?
Power supply variations affect the offset voltage. This may be especially important in battery-powered applications.

Precision Application Examples
- High gain circuits (G > 100)
- Measuring small input signals (e.g., from a thermocouple)
- Wide operating temperature range circuits (i.e., in automotive or industrial applications)
- Single-supply ≤ 5V data-acquisition systems where input voltage span is limited

Technology Primer

Understanding the relative advantages of basic semiconductor technologies will help in selecting the proper device for a specific application.

CMOS Amps—when low voltage and/or low power consumption, excellent speed/power ratio, rail-to-rail performance, low cost and small packaging are primary design considerations, choose microPackaged CMOS amps boasting the highest precision in the industry.

High-Speed Bipolar Amps—when the highest speed at the lowest power is required, bipolar technology delivers the best performance. Extremely good power gain gives very high output power and full power bandwidths on the lowest quiescent power. Higher voltage requirements are also only satisfied in bipolar technologies.

Precision Bipolar Amps—excel in limiting errors relating to offset voltage. These amps include low offset voltage and temperature drift, high open-loop gain and common-mode rejection. Precision bipolar op amps are used extensively in applications where the source impedance is low, such as a thermocouple amplifier, and where voltage errors, offset voltage and drift, are crucial to accuracy.

Low I_B FET Amps—when input impedance is very high, FET-input amps provide better overall precision than bipolar-input amps because of very low input bias current. Using a bipolar amp in applications with high source impedance (e.g., 500MΩ pH probe), the offset, drift and noise produced by bias currents flowing through the source would render the circuit virtually useless. When low current errors are required, FET amps provide extremely low input bias current, low offset current and high input impedance.

Dielectrically Isolated FET (Difet™) Amps—Difet processing enables the design of extremely low input leakage amplifiers by eliminating the substrate junction diode present in junction isolated processes. This technique yields very high-precision, low-noise op amps. Difet processes also minimize parasitic capacitance and output transistor saturation effects, resulting in improved bandwidth and wider output swing.

Op Amp Rapid Selector

The tables on the following pages have been subdivided into several categories to help quickly narrow the alternatives.

Operational Amplifier Naming

OPA y 3 63

Channels
Single = No Character
Dual = 2
Triple = 3
Quad = 4

Base Model
100 = FET
200 = Bipolar
300 = CMOS (5.5V)
400 = High Voltage (>40V)
500 = High Power (>200mA)
600 = High-Speed (>50MHz)
700 = CMOS (12V)
800 = High Speed (>50MHz)

TLV 278 x

Amp Class
TLV = Low Supply Voltage
TLC = 5V CMOS
TLE = Wide Supply Voltage

Channels and Shutdown Options
0 = Single with Shutdown
1 = Single
2 = Dual
3 = Dual with Shutdown
4 = Quad
5 = Quad with Shutdown

THS x y 01

Amp Class
THS = High Speed

Amplifier Type
30 = Current Feedback
31 = Current Feedback
40 = Voltage Feedback
41 = Fully Differential
42 = Voltage Feedback
43 = Fast Voltage Feedback
45 = Fully Differential
46 = Transimpedance
60 = Line Receiver
61 = Line Driver
73 = Programmable Filters

Supply Voltage	Design Requirements	Typical Applications	Recommended Process	Recommended TI Amp Family
$V_S \leq 5V$	Rail-to-Rail, Low Power, Precision, Small Packages	Battery Powered, Handheld	CMOS	OPA3xx, TLVxxxx
$V_S \leq 16V$	Rail-to-Rail, Low Noise, Low Voltage Offset, Precision, Small Packages	Industrial, Automotive	CMOS	OPA3x, TLCxxxx, OPA7xx
$V_S \leq +3V$	Low Input Bias Current, Low Offset Current, High Input Impedance	Industrial, Test Equipment, Optical Networking (ONET), High-End Audio	FET, Difet™	OPA1xx, OPA627
$V_S \leq +44V$	Low Voltage Offset, Low Drift	Industrial, Test Equipment, ONET, High-End Audio	Bipolar	OPA2xx, TLExxxx
±5V to ±15V Dual Supply	High Speed on Dual Supplies	XDSL, Video, Professional Imaging, Data Converter Signal Conditioning	Difet, High-Speed Bipolar, BiCOM	OPA6xx*, OPA8xx* THSxxxx*
$2.7V \leq V_S \leq 5V$ Single Supply	High Speed on Single Supply	Consumer Imaging, Data Converter Signal Conditioning, Safety-Critical Automotive	High-Speed CMOS	OPA35x, OPA6xx*, THSxxxx*, OPA8xx*

*See High-Speed section, Page 15-25

Precision Operational Amplifiers

Low-Noise, 900kHz, 50μV, RRIO Precision Operational Amplifier

OPA378, OPA2378

PREVIEW*

Get samples and datasheets at: **www.ti.com/sc/device/OPA378**

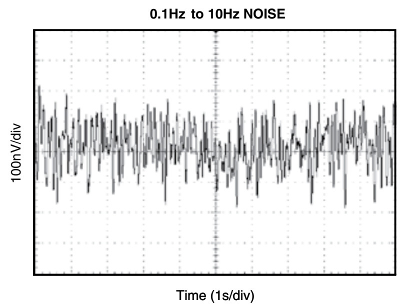
Key Features

- Low noise 0.1Hz to 10Hz: 0.4μV$_{PP}$
- Low offset voltage: 15μV (typ)
- Quiescent current: 100μA (typ)
- Offset drift: 0.1μV/°C (typ)
- Single-supply operation
- Supply voltage: 1.8V to 5.5V
- Packages: SC70-5, SOT23-5

Applications

- Battery-powered instruments
- Temperature measurement
- Medical instrumentation
- Handheld test equipment

The OPA378 (single) and OPA2378 (dual) represent a new generation of micro-power op amps by featuring a combination of rail-to-rail I/O, low input offset voltage (50μV (max)), low quiescent current and 900kHz bandwidth. It has excellent PSRR which makes it an ideal choice for applications that run direct from batteries without regulation.



OPA378 noise performance diagram. Expected release date 4Q 2008.

Low Offset Voltage Operational Amplifiers (V_{OS} < 500μV)

Device	Description/Technology	Ch.	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/μs) (typ)	V_{OS} (25°C) (mV) (max)	V_{OS} Drift (μV/°C) (typ)	I_B (pA) (max)	CMRR (dB) (min)	V_N at 1kHz (nV/√Hz) (typ)	Single Supply	Rail-to-Rail	Package(s)	Price*
OPAy334/5	Zero-Drift, SHDN, CMOS	1, 2	2.7	5.5	0.35	2	1.6	0.005	0.02	200	110	62	Y	Out	SOT23, MSOP	$1.00
OPAy734/5	12V, Zero-Drift, SHDN, CMOS	1, 2	2.7	12	0.75	1.6	1.5	0.005	0.01	200	115	135	Y	Out	SOT23, SOIC	$1.25
OPAy737	24V, e-trim™ and Zero-Cross-over, Low Offset	1, 2	2.7	24	0.4	2	2	0.25	1	10	94	35	Y	Out	SOT23, MSOP	$0.95
OPAy333	Zero Drift, CMOS, μPower	1, 2	1.8	5.5	0.025	0.35	0.16	0.01	0.02	200	106	55	Y	I/O	SC70, SOT23, SOIC	$0.95
OPAy277	High Precision, Low Power	1, 2, 4	4	36	0.825	1	0.8	0.02	0.1	1000	130	8	N	N	SON, SOIC	$0.85
OPAy378	Zero-Drift, GBW 0.9MHz, Low I_Q	1, 2	1.8	5.5	0.125	0.9	0.4	0.05	0.1	500	100	20	Y	I/O	SC70, SOT23, SOIC	$0.95
OPAy380	Zero-Drift, 85MHz, TIA, CMOS	1, 2	2.7	5.5	9.5	90	80	0.025	0.03	50	100	110	Y	Out	MSOP, SOIC	$1.95
OPAy381	Zero-Drift, 18MHz, TIA, CMOS	1, 2	2.7	5.5	1	18	12	0.025	0.03	50	95	114	Y	Out	MSOP, SON	$1.45
TLC2652	Low Offset, Chopper Stabilized	1	3.8	16	2.4	1.9	3.1	0.001	0.03	60	120	23	N	N	SOIC, PDIP	$2.20
OPAy376	e-trim, CMOS, GBW 5.5MHz	1, 2, 4	2.2	5.5	0.95	5.5	2	0.025	0.32	10	76	7.5	Y	I/O	SC70, SOT23	$0.65
OPAy211	Bipolar, Ultra-Low Noise	1, 2	4.5	36	4.5	80	27	0.125	0.35	175000	114	1.1	N	Out	MSOP, SON	$3.45
OPAy227/28	Bipolar,Low Noise, Low IB	1, 2, 4	5	36	3.8	8, 33	2.3, 11	0.075	0.1	10000	120	3	N	N	SOIC, PDIP	$1.10
OPAy827	Precision, Low Noise, JFET Input	1, 2	8	36	5.2	22	28	0.15	1	50	104	4	N	N	SOIC, MSOP	$5.75
TLE2027/37	Wide Supply, Low Noise, Bipolar	1	8	38	5.3	13, 50	2.8, 7.5	0.1	0.4	90000	100	2.5	N	N	SOIC, PDIP	$0.90
OPAy234	Low Power, Wide Supply, Bipolar	1, 2, 4	2.7	36	0.35	0.35	0.2	0.25	0.5	25000	91	25	N	Out	MSOP, SOIC	$1.05
OPA627/37	Ultra-Low THD+N, Difet	1	9	36	7.5	16, 80	55, 135	0.25	0.8	5	106	5.2	N	N	PDIP, SOIC	$12.25
OPAy336	μPower, CMOS, Single Supply	1, 2, 4	2.3	5.5	0.032	0.1	0.03	0.125	1.5	10	80	40	Y	Out	SOT23, MSOP	$0.40
OPAy727/8	e-trim, CMOS 12V, SHDN	1, 2, 4	4	12	6.5	20	30	0.15	0.3	500	86	23	Y	Out	MSOP, SON	$0.95
OPAy245	Precision, Low Noise, RRO	1, 2, 4	4.5	36	0.75	1	0.35	0.175	0.1	5000	126	7	N	Out	SOT23, SON, DFN, QFN	$0.76
OPAy365	Zero-Crossover, Low V_{IO} & Drift	1, 2	2.2	5.5	5	50	25	0.2	1	10	100	4.5	Y	I/O	SOT23, SOIC	$0.95
OPAy241	Optimized for +5V Supply, High CMRR and A_{OL}	1, 2, 4	2.7	36	0.03	0.035	0.01	0.25	0.4	20000	80	45	Y	Out	SOIC, DIP	$1.15
OPAy251	Single Supply +36V, High CMRR and A_{OL}	1, 2, 4	2.7	36	0.038	0.035	0.01	0.25	0.5	20000	100	45	Y	Out	SOIC, DIP	$1.15
OPA124	Wide Bandwidth, Bipolar	1	10	36	3.5	1.5	1.6	0.5	2	2	94	8	N	N	SOIC	$3.95
TLC1078	Precision, CMOS	2	1.4	16	0.017	0.085	32	0.45	1.1	60	70	68	N	N	SOIC, DIP	$2.30
TLV2211	Low Power, 10V, CMOS	1	2.7	10	0.025	0.065	0.025	3	0.5	150	65	22	Y	Out	SOT23	$0.42

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue**.*

Low-Power, Rail-to-Rail, Precision JFET Operational Amplifiers

OPA369 (Preview), OPA2369 (Active)

NEW

Get samples and datasheets at: **www.ti.com/sc/device/OPA369** and **www.ti.com/sc/device/OPA2369**

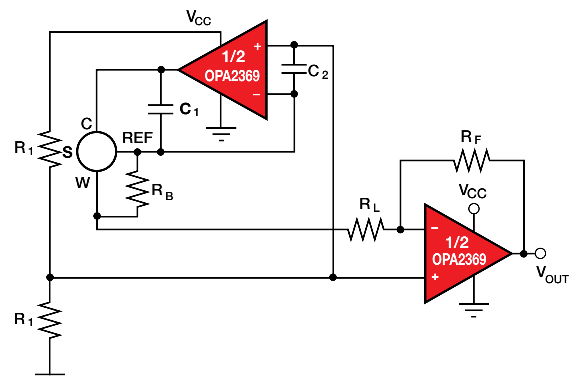
Key Features

- Ultra-low supply current: 1µA (max)
- RRIO zero-crossover input topology
- Excellent CMRR: 100dB
- Low offset voltage: 0.75mV (max)
- Excellent GBW for low power: 12kHz
- Packages: SC70-3, SOT23-3, MSOP

Applications

- Battery-powered instruments
- Portable devices
- High impedance applications
- Medical instruments
- Precision integrators
- Test equipment

The OPA369 family of operational amplifiers combines TI's rail-to-rail input/output zero-crossover input topology with ultra-low power to offer excellent precision for single-supply applications. Designed with battery powered instrumentation in mind, the OPA369 features 0.75mV offset voltage, 12kHz bandwidth, and linear input offset over the entire input range of the 1.8V to 5.5V supply range.



OPA369 as low-power gas-detection circuit.

Low-Power Operational Amplifiers (I_Q < 500µA)

Device	Description	Ch.	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/µs) (typ)	V_{OS} (mV) (25°C) (max)	Offset Drift (µV/°C) (typ)	I_B (pA) (max)	CMRR (dB) (min)	V_N at 1kHz (nV/√Hz) (typ)	Rail-to-Rail	Package(s)	Price*
TLV240x	2.5V, Sub-µPower, SS, CMOS	1, 2, 4	2.5	16	0.00095	0.0055	0.0025	1.2	3	300	63	800	I/O	MSOP, SOIC, SOT23	$0.65
TLV224x	Low Voltage, 1µA, SS, CMOS	1, 2, 4	2.5	12	0.0012	0.0055	0.002	3	3	500	55	500	I/O	MSOP, SOIC, SOT23	$0.60
OPAy369	1µA, SS, Zero Crossover, CMOS	1, 2	1.8	5.5	0.001	0.012	0.005	0.75	0.4	50	100	120	I/O	SC70, SOT23, MSOP	$0.95
OPAy349	2µA, SS, CMOS	1, 2	1.8	5.5	0.002	0.07	0.02	10	15	10	52	300	I/O	SC70, SOIC, SOT23	$0.50
OPAy333	17µA, SS, RRIO, Zero-Drift, CMOS	1, 2	1.8	5.5	0.025	0.35	0.16	0.01	0.02	200	106	55	I/O	SC70, SOT23, SOIC	$0.95
OPAy379	1.8V, Ultra-Low Power, CMOS	1, 2, 4	1.8	5.5	0.0055	0.09	0.03	1.5	2.7	50	90	80	I/O	SC70, SOT23, SOIC	$0.75
TLC1078	Low Voltage, 1.4V, Precision Bipolar	2	1.4	16	0.017	0.085	0.032	0.45	1.1	60	70	68	Out	SOIC, PDIP	$2.30
OPAy241	Optimized for +5V Supply, High CMRR and A_{OL}	1, 2, 4	2.7	36	0.03	0.035	0.1	0.25	0.4	20000	80	45	Out	PDIP, SOIC	$1.15
OPAy703	12V, RRIO, GBW 1MHz	1, 2, 4	4	12	0.2	1	0.6	0.75	4	10	70	45	I/O	SOT23, MSOP, SOIC	$1.30
OPAy704	12V, RRIO, GBW 3MHz	1, 2, 4	4	12	0.2	3	3	0.75	4	10	70	45	I/O	SOT23, MSOP, SOIC	$1.30
OPAy336	µPower, SS, CMOS	1, 2, 4	2.3	5.5	0.032	0.1	0.03	0.125	1.5	10	80	40	Out	SOT23, SOIC	$0.40
OPAy347	µPower, Low Cost, SS, CMOS	1, 2, 4	2.3	5.5	0.034	0.35	0.17	6	3	10	70	60	I/O	SC70, SOT23, WCP	$0.48
TLV245x	µPower, SS, CMOS	1, 2, 4	2.7	6	0.042	0.22	0.11	1.5	0.3	5000	70	52	I/O	SOT23, SOIC, PDIP	$0.60
OPAy251	Single Supply +36V, High CMRR and A_{OL}	1, 2, 4	2.7	36	0.038	0.035	0.01	0.25	0.5	20000	100	45	Out	SOIC, PDIP	$1.15
OPAy378	Zero-Drift, GBW 0.9MHz, Low I_Q	1, 2	1.8	5.5	0.125	0.9	0.4	0.05	0.1	500	100	20	I/O	SC70, SOT23	$0.95
OPAy244	µPower, SS, Low Cost, Bipolar	1, 2, 4	2.2	36	0.06	0.43	0.1	1.5	4	25000	84	22	Out	SOIC, SOT23	$0.55
OPAy348	High Open-Loop Gain, SS, CMOS	1, 2, 4	2.1	5.5	0.065	1	0.5	5	4	10	70	35	I/O	SC70, SOIC, SOT23	$0.25
OPAy345	Wideband, Single-Supply	1, 2, 4	2.5	5.5	0.25	3	2	1	3	10	76	32	I/O	SOT23, SOIC, MSOP	$0.55
OPAy137	Low Cost, FET-Input	1, 2, 4	4.5	36	0.27	1	3.5	3	15	100	76	45	N	SOT23, SOIC, DIP	$0.60
OPAy234	Low Power, Precision	1, 2, 4	2.7	36	0.35	0.35	0.2	0.25	0.5	25000	91	25	Out	MSOP, SOIC	$1.05
OPAy334/5	Zero-Drift, CMOS, SS, SHDN	1, 2	2.7	5.5	0.35	2	1.6	0.005	0.02	200	110	62	Out	MSOP, SOIC, SOT23	$1.00

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue***

Precision Operational Amplifiers

High Precision, Low Noise, Rail-to-Rail Output Operational Amplifier in SOT23-5

OPA245, OPA2245, OPA4245

PREVIEW*

Get samples and datasheets at: **www.ti.com/sc/device/OPA245**

Key Features

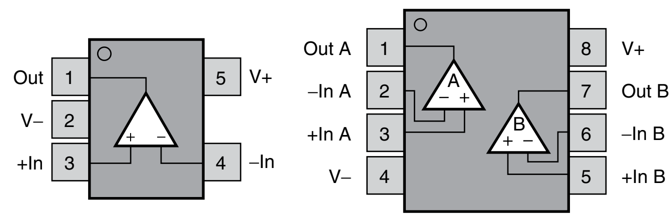
- Low offset voltage: 175µV (max)
- Low drift: 1.5µV/°C (max)
- Rail-to-rail output swing
- High CMRR, PSRR: A_{OL} ≥ 120dB
- Low bias current: 5nA (max)
- Low input voltage noise: 7nV/√Hz at 1kHz
- Wide supply range: ±2.25V to ±18V
- Low supply current: 750µV/amplifier (max)
- Packages: SOT23-5, DNF-8 (3x3mm), MSOP-8, TSSOP-14, QFN-16 (4x4mm)

Applications

- Transducer amplifiers
- Bridge amplifiers
- Temperature measurement
- Strain gage amplifiers
- Precision integrators
- Battery powered instruments
- Test equipment

The OPA245 family of operational amplifiers offers exceptional DC precision in microPackages and the rail-to-rail output stage helps to maximize the dynamic range for low supply voltage applications.

These amplifiers feature a unique combination of extremely low offset voltage, low drift, low input bias current, low noise, and low power consumption. Additionally, these amplifiers do not exhibit phase inversion, and the amplifiers are stable with capacitances as high as 1nF.



OPA245 package options, SOT23-5 and DFN-8. Expected release date 4Q 2008.

Low-Noise Operational Amplifiers (V_N ≤ 10nV/√Hz)

Device	Description/Technology	Ch.	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/µs) (typ)	V_{OS} (25°C) (mV) (max)	V_{OS} Drift (µV/°C) (typ)	I_B (pA) (max)	CMRR (dB) (min)	V_N at 1kHz (nV/√Hz) (typ)	Single Supply	Rail-to-Rail	Package(s)	Price*
OPAy211	Bipolar, Ultra-Low Noise	1, 2	4.5	36	4.5	80	27	0.125	0.35	175000	114	1.1	N	N	MSOP, SOIC, SON	$3.45
TLE2027	Excalibur, Low Noise, Bipolar	1	8	38	5.3	13	2.8	0.1	0.4	90000	100	2.5	N	N	SOIC, PDIP	$0.90
TLE2037	Excalibur™, Low Noise, Bipolar	1	8	38	5.3	50	7.5	0.1	0.4	90000	100	2.5	N	N	SOIC, PDIP	$0.90
OPAy300	Low Noise, 16-Bit Accurate, Shutdown (10µA)	1, 2	2.7	5.5	12	150	80	5	2.5	5	66	3	Y	Out	SOT23, MSOP, SOIC	$1.25
OPAy301	Low Noise, 16-Bit Accurate, CMOS	1, 2	2.7	5.5	12	150	80	5	2.5	5	66	3	Y	Out	SOT23, MSOP, SOIC	$1.25
OPAy227	Precision, Low Noise, Bipolar	1, 2, 4	5	36	3.8	8	2.3	0.075	0.1	10000	120	3	N	N	PDIP, SOIC	$1.10
OPAy228	Precision, Low Noise, G≥5, Bipolar	1, 2, 4	5	36	3.8	33	11	0.075	0.1	10000	120	3	N	N	PDIP, SOIC	$1.10
OPAy827	Ultra-Low THD+N, High Precision, Low Noise, JFET	1, 2	8	36	5.2	22	28	0.15	1	50	104	4	N	N	MSOP, SOIC	$5.75
OPAy350	Excellent ADC Driver, Low Noise	1, 2, 4	2.5	5.5	7.5	38	22	0.5	4	10	66	18	Y	I/O	PDIP, MSOP, SOIC, SSOP	$0.95
OPAy365	High Speed, Zero-Crossover, CMOS	1, 2	2.2	5.5	5	50	25	0.2	1	10	100	13	Y	I/O	SOT23, SOIC	$0.95
OPAy353	Good ADC Driver, RRIO, Low THD+Noise	1, 2, 4	2.5	5.5	8	44	22	8	5	10	76	18	Y	I/O	SOT-23, MSOP, SOIC, SSOP	$1.00
OPA376	Low Offset, 5.5MHz, ADC Buffer	1, 2, 4	2.2	5.5	0.95	5.5	2	0.025	0.26	10	76	7.5	Y	I/O	SC70, SOT23, MSOP, SOIC, TSSOP	$0.65
OPA627	Ultra-Low THD+N, Difet™	1	9	36	7.5	16	55	0.25	0.8	5	106	5.2	N	N	PDIP, SOIC	$12.25
OPA637	Ultra-Low THD+N,G≥5, Difet	1	9	36	7.5	80	135	0.25	0.8	5	106	5.2	N	N	PDIP, SOIC	$12.25
OPA121	Precision, Difet	1	10	36	4.5	2	2	3	3	10	82	10	N	N	SOIC	$5.10
OPAy277	High Precision, Low Power	1, 2, 4	4	36	0.825	1	0.8	0.02	0.1	1000	130	8	N	N	SON, SOIC, PDIP	$0.85
OPA124	Low Noise, Precision, Bipolar	1	10	36	3.5	1.5	1.6	0.5	2	2	94	8	N	N	SOIC	$3.95
TLC220x	Precision, Low Noise, LinCMOS	1, 2	4.6	16	1.5	1.9	2.7	0.5	0.5	100	90	8	Y	Out	SOIC, PDIP, SO	$1.65
OPAy132	Wide Bandwidth, FET-Input	1, 2, 4	5	36	4.8	8	20	0.5	2	50	96	8	N	N	PDIP, SOIC	$1.45
OPAy245	Precision, Low Noise, RRO	1, 2, 4	4.5	36	0.75	1	0.35	0.175	1.5	5000	126	7	N	Out	SOIC, SOT23, SON, DFN, QFN	$0.75
OPA1611	High Performance, Bipolar-Input, Audio Amp	1,2	4.5	36	4.5	80	27	0.5	—	175000	110	1	N	N	SOIC	$1.75

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue**.*

High Performance, Bipolar-Input Audio Operational Amplifiers
OPA1611, OPA1612

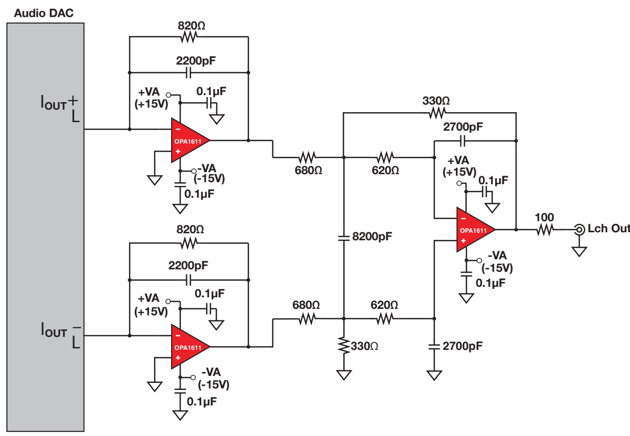
PREVIEW*

Get samples and datasheets at: **www.ti.com/sc/device/OPA1611** and **www.ti.com/sc/device/OPA1612**

Key Features
- Ultra-low distortion: 0.000015% at 1kHz
- Ultra-low noise: 1nV/√Hz at 1kHz
- High slew rate: 27V/µs
- Wide gain bandwidth product: 80MHz (G = 100) 45MHz (G = 1)
- High open loop gain: 130dB
- Unity gain stable
- Drives 600Ω loads
- Wide supply range: ±2.25V to ±18V
- Packaging: SOIC-8

Applications
- Professional audio equipment
- Broadcast equipment
- Active filters
- Preamplifiers
- Crossover networks

The OPA1611 (single) and OPA1612 (dual) bipolar-input operational amplifiers achieve very low 1nV/√Hz noise density with a supply current of only 3.6mA. A high output drive capability of ±30mA provides the ability to drive 600Ω loads effectively. The OPA1611 and OPA1612 also offer rail-to-rail output swing to within 600mV with 600Ω load, which increases headroom, thereby maximizing dynamic range.



High-performance audio DAC output filter. Expected release date 1Q 2009.

Low Input Bias Current Operational Amplifiers (I_B ≤ 10pA)

Device	Description/Technology	Ch.	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/µs) (typ)	V_{OS} (25°C) (mV) (max)	V_{OS} Drift (µV/°C) (typ)	I_B (pA) (max)	CMRR (dB) (min)	V_N at 1kHz (nV/√Hz) (typ)	Single Supply	Rail-to-Rail	Package(s)	Price*
OPA129	Ultra-Low Bias, Difet™	1	10	36	1.8	1	2.5	2	3	0.1	80	17	N	N	SOIC	$3.20
OPA124	Low Noise, High Precision	1	10	36	3.5	1.5	1.6	0.5	2	2	94	8	N	N	PDIP	$3.95
OPA627	Ultra-Low THD+N, Difet	1	9	36	7.5	16	55	0.25	0.8	5	106	5.2	N	N	PDIP, SOIC	$12.25
OPA637	Ultra-Low THD+N, G≥5, Difet	1	9	36	7.5	80	135	0.25	0.8	5	106	5.2	N	N	PDIP, SOIC	$12.25
OPAy827	Ultra-Low THD+N, High-Precision	1, 2	8	36	5.2	22	28	0.15	1	50	104	4	N	N	MSOP, SOIC	$5.75
OPAy145	Low Power Precision FET-Input	1, 2, 4	4.5	36	0.5	1.4	3.2	0.4	1	10	100	17	Y	Out	SOT23, MSOP	$1.30
OPAy344	Low Power, RRIO, SS	1, 2, 4	2.5	5.5	0.25	1	0.8	1	3	10	76	32	Y	I/O	SOT23, MSOP, TSSOP, SOIC, PDIP	$0.55
OPAy363	1.8V, RRIO, High CMRR, Shutdown (0.9µA)	1, 2	1.8	5.5	0.75	7	5	0.5	3	10	74	17	Y	I/O	MSOP, SOIC, SOT23	$0.60
OPAy364	1.8V, RRIO, High CMRR	1, 2	1.8	5.5	0.75	7	5	0.5	3	10	74	17	Y	I/O	MSOP, SOIC, SOT23	$0.60
OPAy336	SS, µPower, CMOS	1, 2, 4	2.3	5.5	0.032	0.1	0.03	0.125	1.5	10	80	40	Y	Out	SOT23, MSOP, SSOP, SOIC, PDIP	$0.40
OPAy340	CMOS, Wide Bandwidth	1, 2, 4	2.7	5.5	0.95	5.5	6	0.5	2.5	10	80	25	Y	I/O	MSOP, SOIC, SOT23, SSOP, PDIP	$0.80
OPAy350	Excellent ADC Driver, Low Noise	1, 2, 4	2.5	5.5	7.5	38	22	0.5	4	10	74	18	Y	I/O	PDIP, MSOP, SOIC, SSOP	$0.95
OPAy365	High Speed, Zero-Cross-Over, CMOS	1, 2	2.2	5.5	5	50	25	0.2	1	10	100	13	Y	I/O	SOT23, SOIC	$0.95
OPA376	Low Offset, 5MHz, e-trim™ General Purpose	1, 2, 4	2.2	5.5	0.95	5.5	2	0.025	0.26	10	76	7.5	Y	I/O	SC70, SOT23, MSOP, SOIC, TSSOP	$0.65
OPAy737	2MHz, e-trim and Zero-Crossover	1, 2, 4	2.7	24	0.4	2	2	0.25	1	10	94	35	Y	I/O	SOT23, MSOP, SOIC	TBD

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue***

Precision Operational Amplifiers

2.2V, 50MHz, 5nV/√Hz, Zero-Crossover Operational Amplifier

OPA365, OPA2365

Get samples, evaluation modules, datasheets and application reports at: **www.ti.com/OPA365**, and **www.ti.com/sc/device/OPA2365**

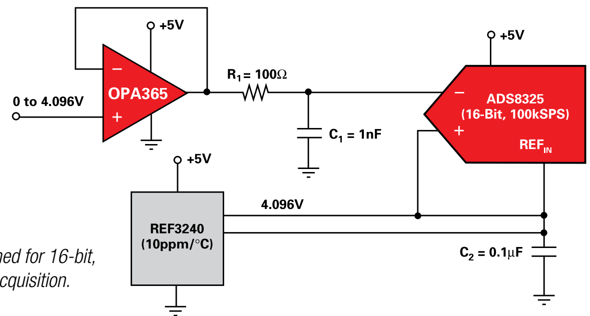
Key Features

- Wide bandwidth: 50MHz
- High slew rate: 25V/µs
- Input voltage noise: 5µ$V_{PP,}$ IF = 0.1Hz to 10Hz
- Excellent THD+N: 0.0006%
- Low offset: 200µV (max) on 5µV_{PP}
- High CMRR: 100dB
- Rail-to-rail input/output zero-crossover
- Single supply: 2.2V to 5.5V
- Packaging: SOT23-5, SO-8, DFN-8

Applications

- Precision signal conditioning
- Data acquisition
- Process control
- Test equipment
- Active filters
- Audio

The OPA365 is a member of the zero-crossover family of op amps featuring TI's patented single-supply, zero-crossover input stage designed to offer excellent performance for very-low voltage, single-supply ADC applications. These amplifiers are optimized for driving 16-bit SAR ADCs and feature precision CMRR without the crossover associated with traditional complementary input stages. The input common-mode range includes both the negative and positive supplies and the output voltage swing is 10mV beyond supply rails.



OPA365 designed for 16-bit, single-supply acquisition.

Wide-Bandwidth, Precision Operational Amplifiers (GBW > 5MHz)

Device	Description/Technology	Ch.	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/µs) (typ)	V_{OS} (25°C) (mV) (max)	V_{OS} Drift (µV/°C) (typ)	I_B (pA) (max)	CMRR (dB) (min)	V_N at 1kHz (nV/√Hz) (typ)	Single Supply	Rail-to-Rail	Package(s)	Price*
TLV2460	Lowest Power, Wide Bandwidth	1, 2, 4	2.7	6	0.575	6.4	1.6	2	2	14000	71	11	Y	I/O	SOT23, PDIP, SOIC, TSSOP	$0.65
OPAy340	Low Power, CMOS	1, 2, 4	2.7	5.5	0.95	5.5	6	0.5	2.5	10	80	25	Y	I/O	SOT23, DIP, SOIC	$0.85
OPAy343	General Purpose	1, 2, 4	2.5	5.5	1.25	5.5	6	8	3	10	74	25	Y	I/O	SOT23, SOIC	$0.60
OPAy376	Precision, Low Noise, Low I_Q	1, 2, 4	2.2	5.5	0.95	5.5	2	0.025	0.26	10	76	7.5	Y	I/O	SC70, SOT23, SOIC, MSOP, TSSOP	$0.65
OPAy363/4	1.8V, Zero-Crossover, CMOS, OPA363 SHDN (0.9µA)	1, 2, 4	1.8	5.5	0.75	7	5	0.5	3	10	74	17	Y	I/O	SOT, SOIC	$0.60
OPAy373	6.5MHz, RRIO, Low I_B, SHDN	1, 2	2.3	5.5	0.75	6.5	5	5	3	10	80	30	Y	I/O	SOT23, SOIC	$0.36
OPAy374	6.5MHz, RRIO, Low I_B	1, 2, 4	2.3	5.5	0.75	6.5	5	5	3	10	80	30	Y	I/O	DFN, SOT23, MSOP, TSSOP	$0.36
OPAy743	Precision, 12V, 7MHz, RRIO	1, 2, 4	3.5	12	1.5	7	10	7	8	10	66	30	Y	I/O	SOT23, SOIC	$1.00
OPAy227	Low Noise, Precision, Bipolar	1, 2, 4	5	36	3.8	8	2.3	0.075	0.1	10000	120	3	N	N	SOIC	$1.10
OPAy132	High Speed, FET-Input	1, 2, 4	5	36	4.8	8	20	0.5	2	50	96	8	N	N	SOIC	$1.45
TLE2027	Low Noise, Bipolar	1	8	38	5.3	13	2.8	0.1	0.4	90000	100	2.5	N	N	SOIC, PDIP	$0.90
OPA627	Precision, High Speed, Difet™	1	9	36	7.5	16	55	0.25	0.8	5	106	5.2	N	N	SOIC, PDIP	$12.25
OPA381	Precision TIA, CMOS	1, 2	2.7	5.5	1	18	12	0.025	0.03	50	95	110	Y	Out	MSOP, SON	$1.45
OPAy827	High Precision, Low Noise, JFET	1, 2	8	36	5.2	22	28	0.15	1	50	104	4	N	N	MSOP, SOIC	$5.75
OPA727/8	Precision, e-trim™, CMOS, OPA728 Shutdown (0.15µA Max)	1, 2, 4	4	12	4.3	20	30	0.15	0.3	100	86	10	Y	Out	MSOP, SON	$0.95
OPAy228	Precision, Low Noise,	1, 2, 4	5	36	3.8	33	11	0.075	0.1	10000	120	3	N	N	SOIC, PDIP	$1.10
OPAy350	Single Supply, RR	1, 2, 4	2.7	5.5	7.5	38	22	0.5	4	10	76	5	Y	I/O	MSOP, SOIC, PDIP	$1.05
THS4281	Very Low Power RRIO	1	2.7	15	1	80	35	3.5	4	10	12.5	—	Y	I/O	SOT23,MSOP	$0.95
OPAy365	High Speed, Zero-Crossover	1, 2	2.2	5.5	5	50	25	0.2	1	10	100	5	Y	I/O	SOT23, SOIC	$0.95
OPAy211	Low Noise,Bipolar	1, 2	4.5	36	4.5	80	27	0.125	0.35	175000	114	1.1	N	N	MSOP, SOIC, SON	$3.45
THS4281	Ultra-Low Power RRIO	1	2.7	15	1	80	35	3.5	4	10	12.5	—	Y	I/O	SOT23, MSOP	$0.95
OPA637	Precision, Decomp, Difet	1	9	36	7.5	80	135	0.25	0.8	5	106	5.2	N	N	DIP, SOIC	$12.25
OPA1611	High Precision, Bipolar-Input, Audio	1, 2	4.5	36	4.5	80	27	0.5	—	175000	110	1	N	N	SOIC	$1.75
OPAy380	Precision, Wideband TIA	1, 2	2.7	5.5	1	85	80	0.025	0.1	50	100	5 at 1MHz	Y	Out	MSOP, SOIC, SSOP	$1.95

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue***

Precision Operational Amplifiers

Wide Voltage Range Operational Amplifiers (±5V < V_S < ±20V) Selection Guide

Device	Description	Ch.	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW	Slew Rate (V/µs) (typ)	V_{OS} (25°C) (mV) (max)	V_{OS} Drift (µV/°C) (typ)	I_B (pA) (max)	CMRR (dB) (min)	V_N at 1kHz (nV/√Hz) (typ)	Single Supply	Rail-to-Rail	Package(s)	Price*
TLE214x	Widest Supply, Low Noise, High Speed	1, 2, 4	4	44	4.5	6	42	0.5	1.7	1500000	85	10.5	Y	N	TSSOP, PDIP, SOIC	$0.55
TLE202x	Low Power, FET-Input	1, 2, 4	4	40	0.35	2	0.65	0.2	2	70000	100	15	Y	N	SOIC, TSSOP, PDIP	$0.45
TLE2027	Excalibur™, Low Noise, Bipolar	1	8	38	5.3	13	2.8	0.1	0.4	90000	100	2.5	N	N	SOIC, PDIP	$0.90
TLE2037	Excalibur, Low Noise, G≥5, Bipolar	1	8	38	5.3	50	7.5	0.1	0.4	90000	100	2.5	N	N	SOIC, PDIP	$0.90
OPAy241	µPower, Precision, Bipolar	1, 2, 4	2.7	36	0.03		0.01	0.25	0.4	20000	80	45	Y	Out	SOIC, PDIP	$1.15
OPAy251	µPower, Precision, Bipolar	1, 2, 4	2.7	36	0.038		0.01	0.25	0.5	20000	100	45	Y	Out	PDIP, SOIC	$1.15
OPAy244	µPower, Low Cost, Bipolar	1, 2, 4	2.2	36	0.06	0.43	0.1	1.5	4	25000	84	22	Y	Out	SOT-23, SOIC, PDIP	$0.55
OPAy137	Low Cost, FET-Input	1, 2, 4	4.5	36	0.27	1	3.5	3	15	100	76	45	Y	N	SOT23, SOIC, MSOP, PDIP	$0.60
OPAy234	Low Power, Precision, Bipolar	1, 2, 4	2.7	36	0.35	0.35	0.2	0.25	0.5	25000	91	25	Y	Out	MSOP, SOIC	$1.05
OPAy237	Low Cost, Low Power, Bipolar	1, 2	2.7	36	0.475	1.5	0.5	0.95	2.5	40000	80	28	Y	N	SOT23, MSOP, SOIC	$0.55
OPAy130	Low Power, FET-Input	1, 2, 4	4.5	36	0.65	1	2	1	2	20	90	16	N	N	SOIC	$1.40
OPAy277	High Precision, Low Power, Bipolar	1, 2, 4	4	36	0.825	1	0.8	0.02	0.1	1000	130	8	N	N	SON, SOIC, PDIP	$0.85
OPAy131	General Purpose, FET-Input	1, 2, 4	9	36	1.75	4	10	0.75	2	50	80	15	N	N	SOIC, PDIP	$0.75
OPAy227	Precision, Low Noise, Bipolar	1, 2, 4	5	36	3.8	8	2.3	0.075	0.1	10000	120	3	N	N	PDIP, SOIC	$1.10
OPAy228	Precision, Low Noise, G = 5, Bipolar	1, 2, 4	5	36	3.8	33	11	0.075	0.1	10000	120	3	N	N	PDIP, SOIC	$1.10
OPAy132	Wide Bandwidth, FET-Input	1, 2, 4	5	36	4.8	8	20	0.5	2	50	96	8	N	N	PDIP, SOIC	$1.45
OPA124	Low Noise, Precision, Bipolar	1	10	36	3.5	1.5	1.6	0.5	2	2	94	8	N	N	SOIC	$3.95
OPA627	Ultra-Low THD+N, Difet™	1	9	36	7.5	16	55	0.25	0.8	5	106	5.2	N	N	PDIP, SOIC	$12.25
OPA637	Ultra-Low THD+N, G = 5, Difet	1	9	36	7.5	80	135	0.25	0.8	5	106	5.2	N	N	PDIP, SOIC	$12.25
OPAy211	Ultra-Low Noise, High-Precision	1, 2	4.5	36	4.5	80	27	0.125	0.35	175000	114	1.1	N	N	MSOP, SOIC, SON	$3.45
OPAy827	Ultra-Low THD+N, High-Precision	1, 2	8	36	5.2	22	28	0.15	1	50	104	4	N	N	MSOP, SOIC	$5.75
TLV240x	2.5V, 1µA, Bipolar	1, 2, 4	2.5	16	0.00095	0.005	0.0025	1.2	3	300	70	800	Y	I/O	SOT23, SOIC, PDIP	$0.65
TLV238x	Low Power, RRIO, Bipolar	1, 2	2.7	16	0.01	0.16	0.06	4.5	1.1	60	58	90	Y	I/O	SOT23, SOIC, PDIP	$0.60
TLC220x	Precision, Low Noise, LinCMOS	1, 2	4.6	16	1.5	1.9	2.7	0.5	0.5	100	90	8	Y	Out	SOIC, PDIP, SO	$1.65
TLC08x	Low Noise, Wide Bandwidth, Bipolar	1, 2, 4	4.5	16	2.5	10	16	1.4	1.2	50	80	8.5	Y	N	MSOP, SOIC, PDIP	$0.45
TLV237x	550µA, 3MHz, SHDN	1, 2, 4	2.7	16	0.56	2.4	2	4.5	2	60	55	39	Y	I/O	SOT23, MSOP, TSSOP, PDIP, SOIC	$0.55
OPAy703/4	12V, Low Power, SHDN, CMOS	1, 2, 4	4	12	0.2	3	3	0.75	4	10	80	45	Y	I/O	MSOP, SOIC, PDIP	$1.30
OPAy734/5	12V, Auto-Zero Precision, SHDN	1, 2	2.7	12	0.75	1.6	1.5	0.005	0.01	200	115	135	Y	Out	SOT23, SOIC	$1.25
OPAy743	12V, 7MHz, CMOS	1, 2, 4	3.5	12	1.5	7	10	7	8	10	70	30	Y	I/O	MSOP, SOT23, SOIC, PDIP	$1.00
OPAy727/8	20MHz, e-trim™ Precision CMOS	1, 2, 4	4	12	6.5	20	30	0.15	0.3	500	86	23	Y	N	MSOP, SON	$0.95
OPAy725/6	Very Low Noise, SHDN	1, 2	4	12	5.5	20	30	3	4	200	94	23	Y	Out	SOT23, SOIC	$0.90
OPAy145	Low Power-Precision FET-Input	1, 2, 4	4.5	36	0.5	1.4	3.2	0.4	1	10	100	17	Y	Out	SOT23, MSOP	$1.30
OPAy207	Precision, Low Noise, RRO	1, 2, 4	4	36	0.6	1	0.35	0.05	0.7	1000	126	7	N	Out	SOT23, SON	$1.05
OPAy245	Precision, Low Noise, RRO	1, 2, 4	4.5	36	0.75	1	0.35	0.175	1.5	5000	126	7	N	Out	SOIC, SOT23, SON, DFN, QFN	$0.75
OPA1611	High Performance, Bipolar-Input, Audio Amp	1, 2	4.5	36	4.5	80	27	0.5	—	175000	110	1	N	N	SOIC	$1.75

**Suggested resale price in U.S. dollars in quantities of 1,000. .*

*New products are listed in **bold red.** Preview products are listed in **bold blue***

Precision Operational Amplifiers

Single-Supply Operational Amplifiers (V_S (min) ≤ 2.7V)

Device	Description/Technology	Ch.	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/μs) (typ)	V_{OS} (25°C) (mV) (max)	Offset Drift	I_B (pA) (max)	CMRR (dB) (min)	V_N at 1kHz (nV/√Hz) (typ)	Rail-to-Rail	Package	Price*
TLC1078/1079	LinCMOS, Dual μPower, Low Voltage	2, 4	1.4	1.6	0.017	0.085	0.032	0.45	1.1	60	70	68	Out	PDIP, SOIC	$2.30
OPAy349	2μA, Rail-to-Rail, CMOS	1, 2	1.8	5.5	0.002	0.07	0.02	10	15	15	52	300	I/O	SC70, SOT23, SOIC	$0.50
OPAy363/4	High CMRR, RRIO, SHDN (OPA363), CMOS	1, 2, 4	1.8	5.5	0.75	7	5	0.5	3	10	74	17	I/O	SOT23, SOIC, MSOP, TSSOP	$0.60
OPAy369	1μA, Zero Crossover, RRIO, CMOS	1, 2	1.8	5.5	0.001	0.012	0.005	0.75	0.4	50	100	120	I/O	SC70, SOT23	$0.95
OPAy379	1.8V, Ultra-Low Power, Low Offset	1, 2, 4	1.8	5.5	0.0055	0.09	0.03	1.5	1.5	50	90	80	I/O	SC70, SOT23, SOIC, TSSOP	$0.75
OPAy378	Wide Bandwidth μPower Zero-Drift	1, 2	1.8	5.5	0.0125	0.9	0.4	0.05	0.25	500	90	20	I/O	SC70, SOT23	$0.95
OPAy333	μPower, Zero-Drift, CMOS	1, 2	1.8	5.5	0.025	0.35	0.16	0.01	0.05	200	106	130	I/O	SC70, SOT23, SOIC	$0.95
OPA376	Low Noise, Low Offset, 5.5MHz, e-trim™	1, 2, 4	2.2	5.5	0.95	5.5	2	0.025	0.26	10	76	7.5	I/O	SC70, SOT23, MSOP, SO8, TSSOP	$0.65
TLV224x	microPower 1μA (typ) I_Q, RRIO	1, 2, 4	2.5	12	0.0012	0.0055	0.002	3	3	500	55	800	I/O	SOT23, MSOP, SOIC	$0.60
TLV237x	Precision, Low Power	1, 2, 4	2.7	15	0.66	3	2.4	4.5	2	60	50	39	I/O	SOT23, MSOP, SOIC	$0.44
TLV240x	Low Power, Sub 1μA, Low Offset	1, 2, 4	2.5	16	0.00095	0.0055	0.0025	1.2	3	300	63	800	I/O	SOT23, MSOP, SOIC, TSSOP	$0.65
TLV242x	Low Noise, Low Voltage	2	2.7	10	0.075	0.052	0.02	2	2	150	70	18	Out	SOIC, TSSOP	$0.80
TLV245x	Low Offset, General Purpose	1, 2, 4	2.7	6	0.035	0.22	0.12	1.5	0.3	5000	70	51	I/O	SOT23, MSOP, SOIC, TSSOP	$0.65
TLV246x	Wide BW, Low Noise, Low Power	1, 2, 4	2.7	6	0.575	5.2	1.6	1.6	2	14000	66	11	I/O	SOT23, MSOP, SOIC, TSSOP	$0.60
TLV247x	Low Noise, General Purpose	1, 2, 4	2.7	6	0.75	2.8	1.4	2.2	0.4	50	61	15	I/O	SOT23, SOIC	$0.60
OPAy348	1MHz, 45μA, RRIO, CMOS	1, 2, 4	2.1	5.5	0.065	1	0.5	5	2	10	70	35	I/O	SC70, SOT23, SOIC	$0.25
OPAy365	High Speed, Zero-Crossover, CMOS	1, 2	2.2	5.5	5	50	25	0.5	1	10	100	5	In	SOT23, SO8	$0.95
OPAy336	μPower, CMOS	1, 2, 4	2.3	5.5	0.032	0.1	0.03	0.125	1.5	10	80	40	Out	SOT23, SOIC	$0.40
OPAy347	Low Power, SC70, CMOS	1, 2, 4	2.3	5.5	0.034	0.35	0.17	6	2	10	70	60	I/O	SC70, SOT23, DIP, SOIC	$0.48
OPAy343	General Purpose, CMOS	1, 2, 4	2.5	5.5	1.25	5.5	6	8	3	10	74	25	I/O	SOT23, SOIC	$0.60
TLV2770	Single 2.7V, High Slew Rate, R/R Output, SHDN, CMOS	1, 2, 4	2.5	5.5	2	4.8	9	2.5	2	100	70	21	Out	MSOP, SOIC	$0.70
OPAy244	μPower, Single Supply, MicroAmplifier™ Series, Bipolar	1, 2, 4	2.2	36	0.05	0.43	0.1	1.5	4	25000	84	22	Out	SOT23, SOIC	$0.55
OPAy237	Single Supply, MicroAmplifier Series, Bipolar	1, 2	2.7	36	0.475	1.5	0.5	0.95	2.5	40000	80	28	In	SOT23, SOIC	$0.55
OPAy241	Single-Supply, μPower, Bipolar	1, 2, 4	2.7	36	0.03	0.035	0.01	0.25	0.4	20000	80	45	Out	SOIC, DIP	$1.15
OPA300/1	High Speed, Low Noise, SS, CMOS OPA300 SHDN (10μA max)	1	2.7	5.5	12	150	80	5	2.5	5	66	3	Out	SOT23, SOIC	$1.25
OPAy334/5	Zero-Drift 0.05μV/°C (max), SHDN, CMOS	1, 2	2.7	5.5	0.35	2	1.6	0.005	0.02	200	110	50	Out	SOT23	$1.00
OPAy337	120dB A_{OL}, CMOS Input	1, 2	2.7	5.5	1	3	1.2	3	2	10	74	26	Out	SOT23, MSOP, SOIC, DIP	$0.43
OPAy338	Good Speed/Power, G ≥ 5, CMOS	1, 2	2.7	5.5	1	12.5	4.6	3	2	10	74	26	Out	SOT23, SOIC	$0.43
OPAy340	5.5MHz, CMOS	1, 2, 4	2.7	5.5	0.95	5.5	6	0.5	2.5	10	80	25	I/O	SOT23, SOIC	$0.70
OPA341/2	Low Cost, Low Power, CMOS	1, 2, 4	2.7	5.5	1	5.5	6	6	2	10	74	32	I/O	SOT23, SOIC	$0.85
OPAy344	Low Power, Low Offset, CMOS	1, 2, 4	2.7	5.5	0.25	1	1	0.5	2.5	10	80	32	I/O	SOT23, SOIC	$0.55
OPAy345	Low Power, Single-Supply, R/R, MicroAmplifier Series, CMOS	1, 2, 4	2.7	5.5	0.25	4	4	0.5	2.5	10	80	32	I/O	SOT23, SOIC	$0.55
OPAy350	High Speed, Single Supply, CMOS	1, 2, 4	2.7	5.5	7.5	38	22	0.5	4	10	76	5	I/O	MSOP, SOIC	$1.05
OPAy353	Good ADC Driver, Low THD+N, CMOS	1, 2, 4	2.7	5.5	8	44	22	8	5	10	76	5	I/O	SOT23, SOIC	$1.00
OPA373	6.5MHz, 585μA, Shutdown, CMOS	1	2.7	5.5	0.75	6.5	5	5	3	10	80	30	I/O	SOT23, SOIC	$0.36
OPA374	6.5MHz, 585μA, RRIO, Low I_B, CMOS	1, 2, 4	2.7	5.5	0.75	6.5	5	5	3	10	80	30	I/O	SOT23, SOIC, MSOP, TSOP	$0.36
THS4281	High Speed, Low Power	1	2.7	15	1	40	35	3.5	7	10	92	12.5	I/O	SOT23, MSOP	$0.95

Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red**. Preview products are listed in **bold blue***

High-Speed Amplifiers

TI develops high-speed signal conditioning products using state-of-the-art processes that give leading-edge performance. Used in high-speed signal chains and analog-to-digital drive circuits, high-speed amps are broadly defined as any amplifier having at least 50MHz of bandwidth and at least 100V/µs slew rate. High-speed amps from TI come in several different types and supply voltage options.

Design Considerations

Voltage-feedback type—the most commonly used amp and the basic building block of most analog signal chains such as gain blocks, filtering, level shifting, buffering, etc. Most voltage-feedback amps are unity-gain stable, though some are decompensated to provide wider bandwidth, faster slew rate and lower noise.

Current-feedback type—most commonly seen in video or DSL line driver applications, or designs where extremely fast slew rate is needed.

Fully differential amplifier (FDA)—the fully differential input and output topology has the primary benefit of reducing even order harmonics, thereby reducing total harmonic distortion. The FDA also rejects common-mode components in the signal and provides a larger output swing to the load relative to single-ended amplifiers. Fully differential amplifiers are well-suited to driving analog-to-digital converters. A V_{COM} pin sets the output common-mode voltage required by newer, single-supply, ADCs.

FET-Input (or CMOS) amplifiers—have higher input impedance than typical bipolar amps and are more useful to interfacing to high impedance sources, such as photodiodes in transimpedance circuits.

Video amplifiers—can be used in a number of different ways, but generally are in the signal path for amplifying, buffering, filtering or driving video lines. The specifications of most interest are differential gain and differential phase. Current-feedback amps are typically used in video applications, because of their combination of high slew rate and excellent output drive at low quiescent power.

Fixed and variable gain—these amps have either a fixed gain, or a variable gain that can be set either digitally with a few control pins, or linearly with a control voltage. Fixed-gain amplifiers are fixed internally with gain setting resistors. Variable gain amplifiers can have different gain ranges, and can also be differential input and/or output.

Packaging—high-speed amplifiers typically come in surface-mount packages, because parasitics of DIP packages can limit performance. Industry standard surface-mount packages (SOIC, MSOP, TSSOP and QFN) handle the highest speed requirements. For bandwidths approaching 1GHz and higher, the QFN package decreases inductance and capacitance.

Evaluation boards—high-speed amps have an associated fully populated evaluation module (EVM) or an unpopulated printed circuit board (PCB). These boards are a very important part of high-speed amplifier evaluation, since layout is critical to design success. To make layout simple, Gerber files for the EVMs are available.
See page 130 for more information.

Voltage Feedback

High-Speed < 500MHz (GBW Product)
- THS4001
- THS4011/4012
- THS4051/4052
- THS4081/4082
- THS4041/4042
- OPA820/OPA4820
- OPA2613
- OPA2614
- OPA842
- OPA2652
- OPA2822
- THS4271
- OPA690/2690/3690
- OPA890/OPA2890
- OPA2889

FET or CMOS Input
- OPA656
- OPA657 (G > 7)
- OPA355/2355/3355
- OPA356/2356
- OPA354/2354/4354
- OPA357/2357
- OPA358/OPA360/OPA361
- OPA300/OPA2300
- OPA301/OPA2301
- THS4631
- OPA380/OPA2380

Low Noise ≤ 3nV/√Hz
- THS4031/4032
- OPA2822
- THS4130/4131
- THS4271
- OPA300/OPA301
- OPA820/OPA4820
- OPA842
- OPA843 (G > 3)
- OPA846/OPA2846 (G > 7)
- OPA847 (G > 12)
- OPA358
- OPA820/OPA4820

Fully Differential
- THS4120/4121
- THS4130/4131
- THS4140/4141
- THS4500/4501
- THS4502/4503
- THS4509
- THS4508
- THS4511
- THS4513
- THS4520
- **THS6204**

Low Voltage ≤ 3.3V
- THS4120/21
- OPA355/2355/3355
- OPA356/2356
- OPA354/2354/4354
- OPA357/2357
- OPA300/OPA2300
- OPA301/OPA2301
- OPA830/OPA2830/OPA4830
- OPA832/OPA2832/OPA3832

Variable and Fixed Gain
- THS7530
- VCA2612/2613/2614/2616/2618
- VCA810
- VCA8613/VCA8617
- VCA2615/VCA2617
- VCA820/VCA822
- VCA821/VCA824
- OPA860
- OPA861
- BUF602
- BUF634
- OPA615
- OPA693/OPA3693

Very High-Speed > 500MHz (GBW Products)
- OPA843
- OPA847
- OPA846/OPA2846
- THS4271
- THS4302

Rail-to-Rail Input or Output
- OPA355/2355/3355
- OPA356/2356
- THS4222/4226
- OPA354/2354/4354
- OPA357/2357
- OPA358/OPA360/OPA361
- OPA830/OPA2830/OPA4830
- OPA832/OPA2832/OPA3832

Voltage Limiting Output
- OPA698
- OPA699 (G ≥ 4)

Current Feedback

General Purpose +5V to ±5V Operational
- OPA683/2683
- OPA684/2684/3684/4684
- OPA691/2691/3691
- OPA692/3692 (G = 2 or ±1)
- OPA2677
- THS3201/02
- OPA694/OPA2694
- OPA2674
- **OPA2673**

General Purpose ±5V to ±15V Operational
- THS3112/15
- THS3122/25
- THS3110/11
- THS3120/1
- THS3091/95
- THS3092/96
- THS6184

Very High-Speed > 500MHz
- OPA695/**OPA2695**/**OPA3695**
- THS3201/THS3202
- OPA694/OPA2694

New devices appear in **Bold RED.**

Video Amplifiers

Video amplifiers—these devices can be used in a number of different ways, but generally are in the signal path for amplifying, buffering, filtering or driving video lines. The specifications of most interest for composite video signals, or CVBS, are differential gain and differential phase. For other video signals, such as $Y'P'_BP'_R$ or RGB, bandwidth (both small signal and large signal), and slew rate are of most importance. Noise and dc accuracy are also considered important in some high-end applications.

The traditional Voltage-Feedback (VFB) amplifiers are widely used because of their ability to be configured for almost any situation. Many VFB amplifiers have the ability to accept input signals going to the negative rail (or ground), allowing use in many single-supply systems. Additionally, many VFB amplifiers offer rail-to-rail outputs featuring the widest dynamic range possible on small supplies. Traditional VFB amplifiers (non-RRO) designed for video offer the ability to have very high slew rates, wide bandwidths, low noise, and very good dc characteristics. Current-feedback amps are commonly found in high-end video applications because of their combination of high slew rate and excellent output drive at low quiescent power.

High-Speed Video Multiplexers—numerous video applications, such as RGB or $Y'P'_BP'_R$ video switching, video routers, high-resolution monitors, etc. are creating an increased need for high-speed switching with multiplexers (muxes). There is also a demand for these devices to provide low power consumption as well as increased functionality, such as the ability to drive either 75Ω or 150Ω while maintaining good video performance specifications. These specifications include low crosstalk, fast settling, gain flatness, low switching glitch along with low differential gain and differential phase. The OPA875 and OPA3875 single and triple 2:1 multiplexers along with the OPA4872, 4:1 multiplexer easily meet these requirements. Using a new patented input stage switching approach, the switching glitch is much improved over earlier solutions. This technique uses current steering as the input switch while maintaining an overall closed-loop design.

TI brought new technology to the market with the introduction of the THS7303, THS7313 and THS7353. These three-channel devices were the first to offer fully independent I^2C programmability of all functions for each channel, which provides the designer the flexibility to configure a video system as required or on-the-fly, without the need for hardware upgrades or modifications. The devices are designed with integrated Butterworth filters to provide all the analog signal conditioning required in video applications such as set-top boxes, digital televisions, personal video recorders/DVD readers and portable USB devices. These highly-integrated devices provide space savings as a result of the high levels of integration and advanced package technology.

The strong combination of integrated features and optimized design make TI's THS7327 and new THS7347 well-suited for use in projectors and professional video systems. Both three-channel RGBHV video buffers offer a monitor pass-through amplifier, unity gain buffer, 2:1 input mux, I^2C control of all functions on each channel, HV sync paths with Adjustable Schmitt Trigger, selectable bias modes and rail-to-rail output that swings within 100mV of the rails to allow for either ac or dc coupling. The THS7347 incorporates a 500MHz bandwidth, 1200 V/µs unity-gain buffer making it ideal for driving ADCs and video decoders, where the THS7327 offers an integrated fifth order Butterworth anti-aliasing filter on each channel. These filters improve image quality by eliminating DAC images.

Portable Video— successfully designing a high-performance video system into low-voltage portable applications requires careful attention to many small details. Portable applications impose very challenging technical requirements beyond those required in typical video applications and demand particular trade-offs in performance, power consumption, printed circuit board space and cost. A dc-coupled solution with integrated gain, low-pass filter, level-shifter, and shutdown solves these challenges while maintaining good video performance and eliminates the need for large, expensive discrete components.

The standard definition (SDTV) THS7314 and high definition (HDTV) THS7316 easily meet these trade-offs by maintaining outstanding low-cost performance while the EDTV/SDTV line driver THS7318, with its small profile wafer chipscale package (WCSP), is ideal for board space-sensitive applications.

The new low power THS7374 and THS7375 are single-supply 3V to 5V, four-channel fully-integrated video amplifiers that can be configured for either ac or dc-coupled inputs. At 9.5MHz, they are a perfect choice for SDTV video which includes composite (CVBS), S-Video, Y'U'V', G'B'R' (R'G'B'), and component $Y'P'_BP'_R$ 480i/576i signals and SCART systems. Their rail-to-rail output swings within 100mV from the rails supports driving two lines per channel and allowing for ac or dc output coupling. Incorporating a 6^{th}-order Butterworth filter for data converter image rejection, they can also be used as a DAC reconstruction filter. The THS7374 provides a 6dB (2V/V) gain and the 6^{th}-order Butterworth filter features a 150MHz (–3dB) filter bypass mode. The low 9.6mA total quiescent current at 3.3V operation makes the THS7374 an excellent choice for USB powered or other power sensitive video applications. The THS7375 with its 15dB (5.6V/V) gain makes it an ideal interface for TI's DaVinci™ Processors.

3-Channel HDTV Video Amplifier with 5th-Order Filters and 6dB Gain

THS7316

Get samples, datasheets, evaluation modules and application reports at: **www.ti.com/sc/device/THS7316**

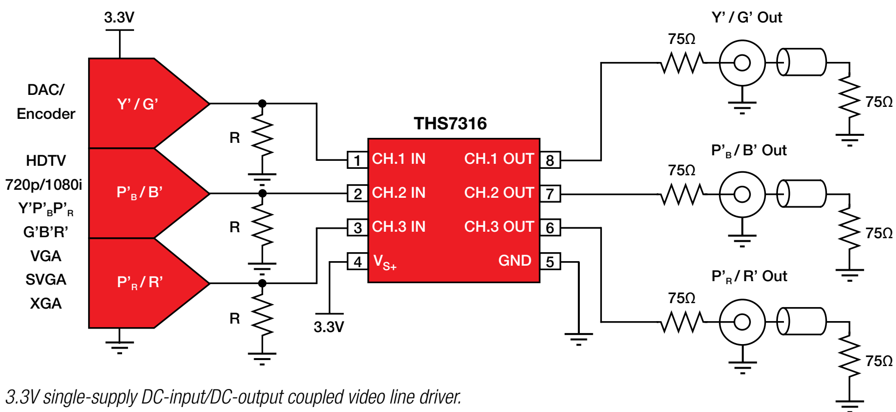
Key Features

- 5th-order 36MHz (–3dB) Butterworth filter
- Flexible input configuration
- Built-in 6dB gain
- Total quiescent current: 18.3mA at 3.3V
- Low differential gain/phase: 0.1%/0.1°
- Rail-to-rail output

Applications

- Set-top-box output video buffering
- PVR/DVDR output buffering
- Portable/USB low-power video buffering

The THS7316 is a low-power, single-supply 3V to 5V, 3-channel integrated video buffer. It incorporates a 5th-order modified Butterworth filter and 6dB gain stage which can be used as a DAC reconstruction filter or an ADC anti-aliasing filter, enabling significant space saving. The 36MHz filter is a perfect choice for HDTV video which includes G'B'R'(R'G'B'), and Y'P'BP'R 720p/1080i and VGA/SVGA/XGA signals.



3.3V single-supply DC-input/DC-output coupled video line driver.

4-Channel, SDTV Video Amplifier with 6th-Order Filters and 6dB Gain

THS7374, THS7375

NEW

Get samples, datasheets, evaluation modules and application reports at: **www.ti.com/sc/device/THS7374**, and **www.ti.com/sc/device/THS7375**

Key Features

- 6th-order 9.5MHz (-3dB) Butterworth filter
- Filter bypass mode in THS7374 allows 150MHz bandwidth
- Flexible input configuration
- Built-in 6dB gain (THS7374), 15dB gain (THS7375)
- Total quiescent current:16mA at 3.3V
- Low differential gain/phase: 0.5%/0.5°
- Rail-to-rail output
- Small TSSOP-14 package

Applications

- Set-top-box output video buffering
- PVR/DVDR output buffering
- Portable/USB low-power video buffering

The THS7374 and THS7475 are The THS7374 and THS7475 are low-power, single-supply +3V to +5V, 4-channel integrated video buffers. The THS7374 features rail-to-rail output stage with 6dB gain, which allows for both ac and dc line driving. The 15dB gain of the THS7375 makes it compatible for use with DaVinci™ processors. Both devices incorporate a 6th-order, 9.5MHz Butterworth filter (with bypass mode in the THS7374) that can be used as a DAC reconstruction filter or an ADC anti-aliasing filter. The filters make them a perfect choice for SDTV video processing which includes Composite (CVBS), S-Video and Y'U'V', G'B'R'(R'G'B'), and Y'P'BP'R 480i/576i and SCART.

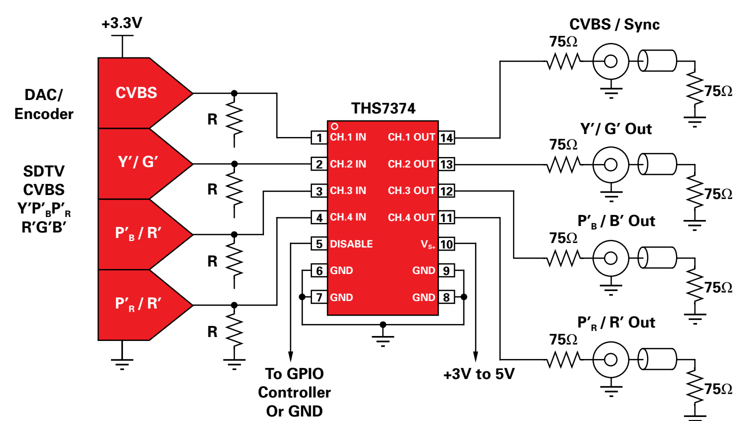


Figure 1. 3.3V Single-Supply DC-Input/DC Output Coupled Video Line Driver

3.3V single-supply DC-Input/DC Output coupled video line driver

Video Amplifiers

Video Amplifiers (Sorted by Ascending G = +2 Bandwidth)

Device	Description	Ch.	SHDN	Supply Voltage (V)	–3dB at G = +2 Bandwidth (MHz)	0.1dB Gain Flatness (MHz)	Diff Gain (%)	Diff Phase (°)	Slew Rate (V/µs)	Offset Voltage (mV) (max)	I_Q Per Ch. (mA) (typ)	Input Range (V)	RRO	Package(s)	Price*
THS7313	I^2C, SD 5th-Order LPF	3	Y	2.7 to 5.5	8	4	0.07	0.12	35	35	6	0 to 2.4	Y	TSSOP-20	$1.20
THS7314	SDTV, 5th-Order Butterworth	3	Y	2.85 to 5.5	8.5	4.2	0.1	0.1	36	390	5.3	0 to 2.4	Y	SOIC	$0.40
THS7315	SDTV, 5th Order Butterworth, 5.2V/V Gain	3	N	2.85 to 5.5	8.5	—	0.2	0.3	37	420	5.2	0 to 0.56	Y	SOIC	$0.50
THS7374	SDTV, 6th-Order Butterworth, 6dB Gain	4	Y	2.85 to 5	9.5	—	0.5	0.5	150	380	4	–0.1 to 1.46	Y	TSSOP-14	$0.55
THS7375	SDTV, 6th Order Butterworth, 5.6V/V Gain	4	Y	2.85 to 5.5	9.5	—	0.5	0.5	150	365	4	–0.1 to 0.9	Y	TSSOP-14	$0.55
OPA360	G = 2, DC-Coupled, LPF, Use with DM270/275/320	1	Y	2.7 to 3.3	9MHz 2-Pole Filter	5	0.5	1	55	80	6	GND to (V+)–1.5	Y	SC-70	$0.49
OPA361	G = 5.2, DC-Coupled, LPF, TV wDetect	1	Y	2.5 to 3.3	9MHz 2-Pole Filter	5	0.5	1	55	55	5.3	GND to 0.55	Y	SC-70	$0.49
THS7318	EDTV/SDTV	3	Y	2.85 to 5	20	11	0.05	0.03	80	200	3.5	0 to 2.4	Y	Wafer Scale	$3.75
THS7316	HDTV, 5th Order	3	N	2.85 to 5.5	36	—	0.1	0.1	—	390	5.8	0 to 2.3	Y	SOIC	$0.55
THS4281	Low Power, High Speed, RRIO	1	N	+2.7, ±5, +15	40	20	0.05	0.08	35	12.5	750	30	Y	SOT, MSOP	$0.95
OPA358	Small Package, Low Cost	1	Y	2.7 to 3.3	40	12	0.3	0.7	55	6	5.2	GND –0.1 to (V+)–1	Y	SC-70	$0.45
OPAy832	VFB, Fixed Gain	1, 2, 3	N	+2.8, ±5	80	—	0.1	0.16	350	7	4.25	–0.5 to 1.5	Y	SOT-23, SOIC	$0.70
OPAy354	VFB, Low Cost	1, 2, 4	N	2.5 to 5.5	100	40	0.02	0.09	150	8	4.9	–0.1 to 5.4	Y	SOT-23, SOIC, MSOP, TSSOP	$0.67
OPAy357	VFB, Low Cost, SHDN	1, 2	Y	2.5 to 5.5	100	40	0.02	0.09	150	8	4.9	–0.1 to 5.4	Y	SOT-23, SOIC, MSOP	$0.67
OPAy830	VFB	1, 2, 4	N	+2.8, ±5.5	110	—	0.07	0.17	600	7	4.25	–0.45 to 1.2	Y	SO-8, SOT-23	$0.75
OPA842	VFB	1	N	±5	150	56	0.003	0.008	400	1.2	20.2	±3.2	N	SOT-23, SOIC	$1.55
OPAy683	CFB	1, 2	Y	±5, +5	150	37	0.06	0.03	540	1.5	0.9	±3.75	N	SOT-23, SOIC, MSOP	$1.20
THS7353	I^2C, Selectable SD/ED/HD/Bypass 5th-Order LPF, 0dB Gain	3	Y	2.7 to 5.5	9/16/35/150	5/9/20/25	0.15	0.3	40/70/150/300	20	5.9	0 to 3.4	Y N	TSSOP-20	$1.65
OPAy684	CFB	1, 2, 3, 4	Y	±5, +5	160	19	0.04	0.02	820	3.5	1.7	±3.75	N	SOT-23, SOIC	$1.35
VCA822	Wideband, Variable Gain, Linear in V/V	1	Y	±5	168	28	—	—	1700	17	36	–2.1 to +1.6	N	MSOP,SOIC	$4.35
THS7303	I^2C, Selectable SD/ED/HD/Bypass, 5th-Order LPF, 6dB	3	Y	2.7 to 5.5	9/16/35/190	5/9.5/22/125	0.13	0.55	40/75/155/320	35	6	0 to 2.4	Y	TSSOP-20	$1.65
OPAy355	VFB, Low Cost, SHDN	1, 2, 3	Y	2.5 to 5.5	200	75	0.02	0.05	300	9	8.3	–0.1 to 3	Y	SOT-23, SOIC, MSOP, TSSOP	$0.69
OPAy356	VFB, Low Cost	1, 2	N	2.5 to 5.5	200	75	0.02	0.05	300	9	8.3	–0.1 to 3	Y	SOT-23, SOIC, MSOP	$0.69
OPA656	VFB, JFET-Input	1	N	±5	200	30	0.02	0.05	290	1.8	14	–4/+2.5	N	SOT-23, SOIC	$3.35
OPAy690	VFB	1, 2, 3	Y	±5, +5	220	30	0.06	0.03	1800	4	5.5	±3.5	N	SOT-23, SOIC	$1.35
OPAy691	CFB	1, 2, 3	Y	±5, +5	225	90	0.07	0.02	2100	2.5	5.1	±3.5	N	SOT-23, SOIC	$1.45
OPAy820	VFB	1, 4	N	±.5, ±5	230	—	0.01	0.03	240	0.75	5.6	0.9 to 4.5	N	SOT-23, SOIC	$0.90
OPAy692	CFB1, Fixed Gain	1, 3	Y	±5, +5	240	120	0.07	0.02	2000	2.5	5.1	±3.5	N	SOT-23, SOIC	$1.15
THS7327	RGBHV Buffer, I^2C, 2:1MUX	3	Y	2.7 to 5.5	9/16/35/75/500	4/7/15/38/56	0.3	0.45	1300	65	33	0 to 2.4	Y	TQFP-48	$3.35
THS7347	RGBHV Buffer, I^2C, 2:1MUX	3	Y	2.7 to 5.5	500	350	0.05	0.1	1300	15	26.8	0 to 2.4	Y	TQFP-48	$2.75
OPAy694	CFB	2	N	±5	690	—	0.03	0.015	1700	4.1	5	±2.5	N	SOT-23, SOIC	$1.25
OPAy693	CFB, Fixed Gain	1, 3	Y	±5, +5	700	200	0.03	0.01	2500	2	13	±3.4	N	SOT-23, SOIC	$1.30
VCA824	Ultra-Wideband, Variable Gain, Linear in V/V	1	Y	±5	710	135	—	—	2500	17	36	2.1 to +1.6	N	MSOP,SOIC	$5.20
OPA695	CFB	1, 2, 3	Y	±5, +5	1400	320	0.04	0.007	4300	3	12.9	±3.3	N	SOT-23, SOIC	$1.35
BUF602	Closed-Loop Buffer A_V = ±1, 1.4GHz	1	N	±5, 3.3	N/A	240	0.15	0.04	8000	30	5.8	±4.0	N	SOT-23, SOIC	$0.85
OPA615	DC Restoration	1	N	±5	N/A	N/A	N/A	N/A	2500	N/A	13	± 3.5	N	SO-14, MSOP	$4.25
OPA861	Transconductance	1	N	±5	N/A	N/A	—	—	900	12	5.4	±4.2	N	SOT-23, SOIC	$0.95
SN10501/2/3	High Speed, Rail-to-Rail	1,2,3	N	3, 5, ±5	230	100	50	0.007	0.007	25	100	±4.0	N	SOIC, HTSSOP, MSOP PowerPAD™	$0.85
Video Multiplexers															
OPA4872	4:1 MUX	1	Y	±3.5, ±6	500	120	0.035	0.005	2300	5	10.6	±2.8	N	SOIC	$2.15
OPAy875	2:1 MUX	1, 3	Y	±3, ±6	700	200	0.025	0.025	3100	7	11	±2.8	N	MSOP,SOIC SSOP, QSOP	$1.20

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.***

Amplifiers for Line Driver Applications

Line driver is a generic term that covers large subsets of applications that typically require high bandwidth, large slew rate, and high output current, combined with sufficient output voltage swing. The load can be inductive, resistive, or capacitive, and the circuit configuration can vary from single-ended to fully differential. Once the minimum requirement to driving the load to the adequate frequency with the adequate distortion is achieved, each individual end-application will have its own important specifications. These specifications generally include differential gain and differential phase (for a broadcast video line driver), quiescent power and noise (for xDSL applications), or load stability (for ARB generators or a high cap load driver).

For wireline communications, the two latest introductions are the THS6204 for the xDSL market and the OPA2673 for the PLC market. Although specified for the VDSL market, THS6204 can be used in any fully differential application that requires a combination of high slew rate, high bandwidth and high output current. It is intended to drive heavy loads (25Ω) and yet maintain a large output swing. Its large slew rate (2600V/µs) allows the bandwidth to be maintained independently of the output voltage swing and the frequency. The OPA2673 is a +12V high output current operational amplifier with an active off-line control.

The OPA2673 is the first amplifier to combine active off-line control with a current-feedback amplifier. The active off-line control ensures that the amplifier is maintained into the off-mode when a large signal is driven directly on its output, a feature not offered by standard current-feedback architecture. This feature of the OPA2673 allows simplification of the control circuitry for TDMA and reduces both the complexity and the cost of the system.

Dual-Port, Differential VDSL2 Line Driver
THS6204

NEW

Get samples, datasheets, evaluation modeules and application reportst: **www.ti.com/sc/device/THS6204**

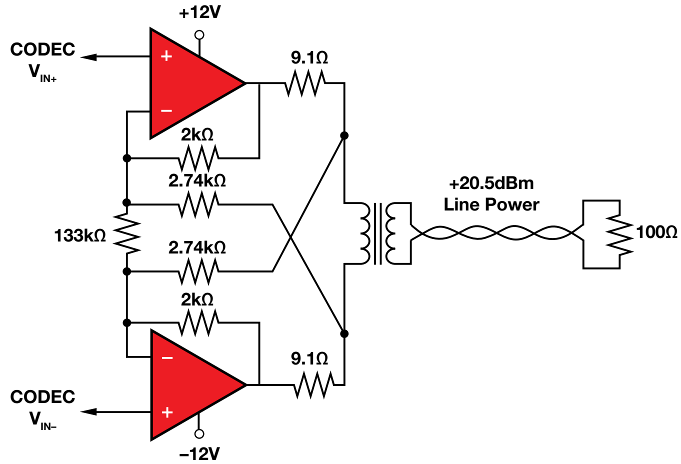
Key Features

- Wide power supply range: 10V to 28V
- High output current: >425mA (25Ω load)
- Output voltage swing: 43.2Vpp (100Ω differential)
- Wide bandwidth: 150MHz (G= +10V/V)
- Low noise: 2.5nV/√Hz
- Low supply current: 20mA/port full bias mode
- Low-power shutdown mode
- Low MTPR distortion
- Packaging: TSSOP-24 PowerPAD™ or QFN-24

Applications

- VDSL2 Systems
- Backward-compatible with ADSL/ ADSL2+/ADSL2++ systems

The THS6204 is a dual-port, current-feedback architecture, differential line driver amplifier system targeted for use in VDSL2 line driver systems supporting the G.993.2 VDSL2 8b profile. The unique architecture of the THS6204 allows quiescent current to be reduced while still achieving very high linearity. Fixed multiple bias settings enable power savings for line lengths where the full performance of the amplifier is not required. The wide output swing of 43.2Vpp (100Ω differential) on ±12V power supplies, coupled with over 425mA current drive (25Ω) provides for wide dynamic headroom, keeping distortion low.



THS6204 functional block diagram.

High-Speed Line Drivers

Dual, Wideband, High Output Current Op Amp with Active Off-Line Control

OPA2673

NEW

Get samples, datasheets and application reports at: **www.ti.com/sc/device/OPA2673**

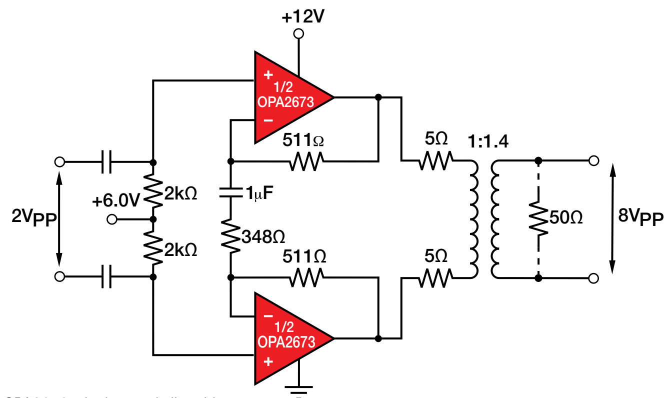
Key Features

- Single +12V supply operation
- High output current: 700mA
- Output voltage swing: 9.8Vpp
- Wide bandwidth: 350MHz (G= +4V/V)
- Low supply current: 15mA/channel
- Flexible power control
- Active off-line for TDMA
- Packaging: MSOP-10 PowerPAD™ or QFN-16

Applications

- Power line modems
- xDSL line drivers
- Cable modem drivers
- Matched I/Q channel amplifiers
- Broadband video line drivers
- ARB line drivers
- High cap load drivers

The OPA2673 offers the low distortion and high output current required in emerging xDSL and power-line modem driver applications. Operating from a single +12V supply, the OPA2673 consumes a low 15mA/channel quiescent current to deliver a very high 700mA output current. The output current can also drive up to 10 parallel video loads (15Ω) with less than 0.1%/0.1° dG/dP nonlinearity.



OPA2673, single-supply line driver.

Line Drivers Selection Guide

Device	Description	BW Gain = 1 (MHz)	BW Gain = +2 (MHz)	Slew Rate (V/µs)	V_N f > 1MHz (nV/√Hz)	V_{OUT} Swing ($R_{LOAD\Omega}$) (min) (V)	Power Supply Range (V)	I_Q/ Amplifier (mA) (max)	I_{OUT} (mA) (min)	Disable /Power Control	Package(s)	Price*
THS6204	Dual Port, Differential VDSL2 Line Driver	—	114	3800	2.5	±4.9(100)	±5 to ±14	21.5/port	±416	Y	QFN, HTSSOP	$1.40
OPA2691	Dual, Wideband, CFB Amp w/Disable	280	225	2100	1.7	±3.7 (100)	+5 to ±6.0	5.3	±190	Y	SOIC	$2.30
OPA2690	Dual, Wideband, VFB Amp w/Disable	500	220	1800	5.5	±3.7 (100)	+5 to ±6.0	5.8	±190	Y	SOIC	$2.15
THS6093	ADSL CPE Line Driver w/ Shutdown	90	—	400	2.1	1.3 to 3.7 (100)	±2.25 to ±7	9.5	±240	Y	SOIC, HTSSOP	$2.15
THS6092	ADSL CPE Line Driver	90	—	400	2.1	1.3 to 3.7 (100)	±2.25 to ±7	12	±240	N	SOIC, SOIC PowerPAD	$2.15
THS6042	ADSL CPE Line Driver	120	95	600	2.2	±4.1(25)	±5 to ±15	9.5	±300	N	SOIC, SOIC PowerPAD	$2.65
THS6043	ADSL CPE Line Driver w/ Shutdown	120	95	600	2.2	±4.1(25)	±5 to ±15	9.5	±300	Y	SOIC, HTSSOP	$2.70
OPA2614	Dual, High IO w/Current Limit	—	180	145	1.8	±4.9 (100)	+5 to ±6.3	6	±350	N	SOIC, SOIC PowerPAD	$1.55
OPA2613	Dual, High IO w/Current Limit	230	110	70	1.8	±4.9 (100)	+5 to ±6.3	6	±350	N	SOIC, SOIC PowerPAD	$1.55
OPA2677	Dual, Wideband, High IO	220	200	2000	2	±5.0 (100)	+5 to ±6.3	12	±380	N	SOIC, SOIC PowerPAD, QFN	$1,40
OPA2674	Dual Wideband, High IO w/Current Limit	250	225	2000	2	±5.0 (100)	+5 to ±6.3	9.3	±380	Y	SOIC	$1.60
THS6184	Dual Port, Low Power Diff. xDSL Line Driver	50	40	340	3	±4.1(100)	±4 to ±12	4.2	±400	Y	QFN, HTSSOP	$3.75
THS6132	High Efficiency Class-G ADSL Line Driver	80	70	300	3.5	±9.9 (30)	±3.0 to ±16.5	3	±400	Y	SOIC, SOIC PowerPAD, QFN	$2.65
THS6182	Low Power ADSL Line Driver	100	80	450	3.2	3.7 (25)	4 to 16.5	12.5	±450	Y	SOIC, SOIC PowerPAD, QFN	$2.95
OPA2673	Dual, High IO w/Active Off-Line Control	600	450	3000	2.4	±4.8 (100)	3.5 to 6.5	19	±700	Y	QFN, MSOP	$1.65
OPA4684	Quad low Power CFB Amp	250	170	750	3.7	±3.9 (1000)	+5 to ±6.0	1.8	–100/+120	N	SOIC, TSSOP	$3.65
OPA2683	Dual Very Low Power CFB Amp	200	150	400	4.4	±4.1(1000)	+5 to ±6.0	2.06	–100/+120	Y	SOIC, MSOP, SOT23-8	$1.85
OPA2684	Dual Low Power CFB Amp	250	170	750	3.7	±3.9 (1000)	+5 to ±6.0	1.8	–100/+130	N	SOIC, SOT23-8	$2.10

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.***

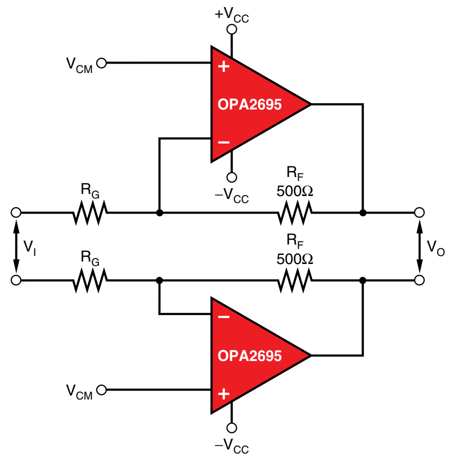
Industrial High-Speed Amplifiers

Amplifiers for Industrial Applications

Key segments in the industrial market requiring high-speed amplifiers include, but are not limited to; test and measurement, aerospace/ military, telecommunications and medical (particularly medical imaging). In these applications, high-speed amplifiers are typically used for filtering, transimpedance, voltage limiting and as drivers for data converters. Each of these applications has its own key specifications required to meet the challenges for achieving the desired system performance. For high-speed amplifiers these specifications range from low offset voltage, high bandwidth at high gain, high output current, fast slew rate and low power dissipation.

Texas Instruments offers a broad portfolio of high-speed amplifiers that are very well suited for a wide array of industrial applications requiring high speed. The OPA695 family, which includes the OPA695 (single), the new OPA2695 (dual) and OPA3695 (triple) are good examples of high-speed amplifiers that can be used for both filtering and ADC driver applications. The OPA2695 is an excellent choice for differential applications requiring high input impedance.

The low-power OPA890 (single) and OPA2890 (dual) are unity gain stable, voltage-feedback operational amplifiers that feature a new internal architecture that provides slew rate and full-power bandwidth previously found only in wideband current-feedback (CFB) op amps. The ±4.1V (V_S = ±5V) output voltage swing minimizes distortion when used as an ADC driver and the low 1.1mA/channel quiescent current supports power sensitive applications. And for applications requiring a dual with even lower power savings, the OPA2889 features a very low quiescent current of only 460µA/channel.



Single, Dual and Quad Fully Differential Amplifiers

THS4521,THS4522,THS4524

Get samples, datasheets and application reports at: www.ti.com/sc/device/**PARTnumber**
(Replace **PARTnumber** with **THS4521**,**THS4522** or **THS4524**)

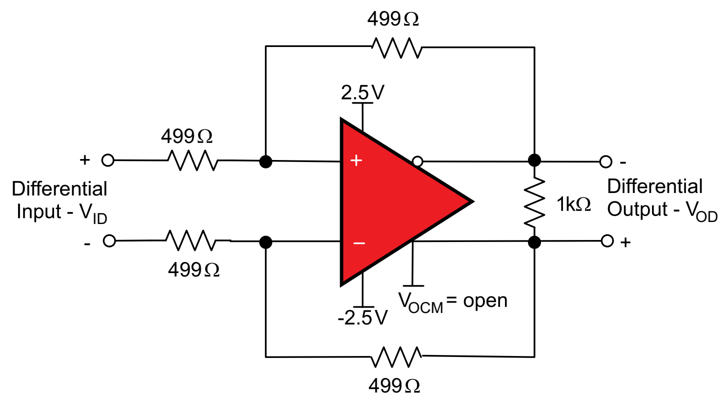
Features:

- Power supply: +2.7V (±1.35) to +5V (±2.5V)
- Quiescent current: 1mA
- Input voltage noise: 5nV/√Hz
- Slew rate: 490 V/µs
- Negative rail-input and rail-to-rail output
- Common mode control
- Bandwidth: 150MHz
- Packages: SO-8 and MSOP-8 (single), TSSOP-16 (dual) and TSSOP-38 (quad)

Applications:

- ADC drivers
- Low-power data acquisition systems
- High density MRI/CAT front ent
- Portable instruments

The THS4521(single),THS4522 (dual), and THS4524 (quad) are negative rail input, rail-to-rail output, fully differential amplifiers operating from a single +2.7 to +5V supply. The low 1mA/channel quiescent current and power down capability to 1µA make is a good choice for low power applications. The output common-mode control with low offset and drift allows for dc-coupling in high accuracy data acquisition systems.



THS452x functional block diagram.

Industrial High-Speed Amplifiers

Single, Dual, Triple Wideband, Current-Feedback Op Amp with Disable
OPA695, OPA2695, OPA3695

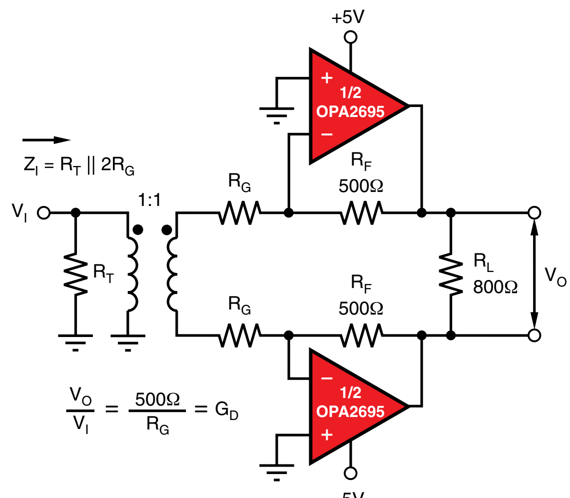
NEW

Get samples, datasheets, evaluation modules and app reports at:
www.ti.com/sc/device/PARTnumber (Replace **PARTnumber** with **OPA695, OPA2695,** or **OPA3695**)

Key Features
- Gain = +2V/V bandwidth (850MHz)
- Gain = +8V/V bandwidth (450MHz)
- Slew rate: 2900V/µs
- Output voltage swing: 4.1V
- Low quiescent current: 12.9mA/ch
- Low disable current: 200µA/ch
- Single (OPA695) and triple (OPA3695)
- Packages: SO-8 (without disable) or QFN-16 (with disable)

Applications
- Very wideband ADC drivers
- Portable instruments
- Active filters
- Low-cost precision IF amplifiers

The OPA2695 is a wide-bandwidth, current-feedback amplifier with disable that features an exceptional 2900V/µs slew rate and low 1.8nV/√Hz input voltage noise. The device has been optimized for high gain operation. The pin-out provides symmetrical input and output paths making the OPA2695 well suited as a differential ADC driver. The low 12.9mA/channel supply current is precisely trimmed at +25°C. This trim, along with a low temperature drift, gives low system power over temperature.



OPA695 functional block diagram.

Dual, Low-Power, Wideband, Voltage-Feedback Op Amp with Disable
OPA2889

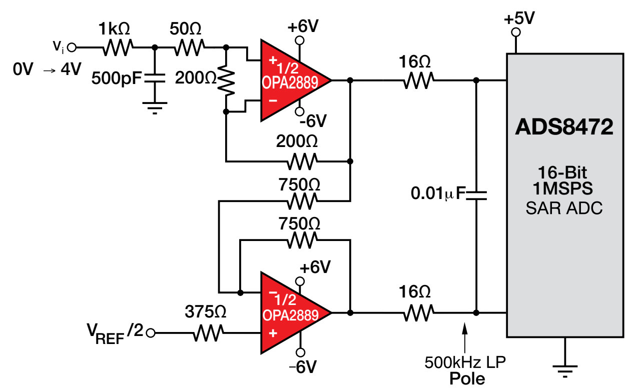
NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/OPA2889**

Features
- Flexible supply range:
  +2.6V to +12V single supply
  ±1.3V to ±6V dual supply
- Slew rate: 250V/µs
- Output voltage swing: ±4V
- Wideband ±5V operation: 60MHz (G = +2V/V)
- Low quiescent current: 460µA/ch
- Low disable current: 18µA
- Packages: SO-8 or MSOP-10

Applications
- Video line drivers
- xDSL line receivers
- High-speed imaging channels
- ADC buffer
- Portable instruments
- Active filters

The OPA2889 is a dual, wideband, low-power amplifier with disable. The new internal architecture offers slew rate and full-power bandwidth previously only found in wideband current-feedback amplifiers. These capabilities coupled with a very low quiescent current of only 460µA per channel makes it very well-suited for portable instrumentation. Operating from ±5V supply, the OPA2889 can deliver a ±4V output swing with over 40mA drive current and 60MHz bandwidth, which make it ideal as an RGB line driver, single-supply ADC input driver or low-power, twisted-pair line receiver.



Low-power, DC-coupled, single-to-differential driver for ≤100kHz inputs.

High-Speed Amplifiers

High-Speed Amplifiers Selection Guide

Device	Ch.	SHDN	Supply Voltage (V)	A_{CL} (min)	BW at A_{CL} (MHz) (typ)	BW G = +2 (MHz) (typ)	GBW Product (MHz) (typ)	Slew Rate (V/µs)	Settling Time 0.10% (ns) (typ)	Distortion 1VPP, G = 2 5MHz HD_2 (dBc) (typ)	Distortion 1VPP, G = 2 5MHz HD_3 (dBc) (typ)	V_N (nV/√Hz) (typ)	V_{OS} (mV) (max)	I_B (µA) (max)	I_Q Per Ch. (mA) (typ)	I_{OUT} (mA) (typ)	Package(s)	Price*
Voltage Feedback (Sorted by Ascending Gain Bandwidth Product)																		
THS4051/52	1, 2	N	±5, ±15	1	70	38	—	240	60	–72, G=2	–90, G=2	14	10	6	8.5	100	SOIC, MSOP PowerPAD™	$0.95
THS4281	1	N	+2.7, ±5, +15	1	90	40	—	35	78	–69, 1MHz	–76, 1MHz	12.5	30	0.5	750	30	SOT23-5, MSOP, SOIC	$0.95
OPA2889	2	Y	5, ±5	1	115	60	75, G > 20	250	25	–80	–82	8.4	5	0.75	0.46	40	MSOP, SOIC	$1.20
THS4011/12	1, 2	N	±5, ±15	1	290	50	—	310	37	–84, G=2	–96, G=2	7.5	6	6	7.8	110	SOIC, MSOP PowerPAD	$1.45
THS4081/82	1, 2	N	±5, ±15	1	175	70	—	230	43	–63, G=2	–73, G=2	10	7	6	3.4	85	SOIC, MSOP PowerPAD	$1.20
OPAy354/57	1, 2, 4	Y	2.5 to 5.5	1	250	90	100, G = 10	150	30	–75, 1MHz, 2Vpp	–83, 1MHz, 2Vpp	6.5	8	50pA	4.9	100	SOT23, SOIC PowerPAD	$0.75
OPAy890	1, 2	Y	5, ±5	1	275	92	130, G > 20	400	10	–102	–94	8	6	1.6	2.25	40	MSOP, SOIC	$0.80
OPAy830	1, 2 ,4	N	+3, +5, ±5	1	310	120	110, G ≥ 10	600	42	–71	–77	9.5	1.5	10	4.25	150	SOT23, SOIC	$0.75
THS4221/22	1, 2	N	3, 5, ±5, 15	1	230	100	120, G > 10	975	25	–90	–100	13	10	3	14	100	SOIC, MSOP PowerPAD	$1.90
OPA2613	2	N	5, ±6	1	230	110	125, G ≥ 20	70	40	–95	–97	1.8	1	10	6	350	SOIC, SOIC PowerPAD	$1.55
OPAy300/301	1	Y	2.7 to 5.5	1	400	80	150	80	30	–74, 1MHz, G = 2	–79, 1MHz, G = 2	3	5	0.5	12	40	SOT23, SOIC	$1.25
OPA842	1	N	±5	1	350	150	200	400	15	–94	–93	2.6	1.2	35	20.2	100	SOT23, SOIC	$1.55
OPA2652	2	N	±5	1	700	200	200, G ≥ 10	335	—	–76	–66	8	7	15	5.5	140	SOT23, SOIC	$1.15
OPAy356	1, 2	N	2.5 to 5.5	1	450	100	200, G = 1	300	30	–81, 1MHz, G = 2	–93, 1MHz, G = 2	5.8	9	50pA	8.3	60	SOT23, SOIC, MSOP	$0.70
OPAy355	1, 2, 3	Y	2.5 to 5.5	1	450	100	200, G ≥ 10	300	30	–81, 1MHz, G = 2	–93, 1MHz, G = 2	5.8	9	50pA	8.3	60	SOT23, SOIC, MSOP, TSSOP	$0.70
THS4631	1	N	±15	1	325	105	210, G > 20	1000	40	–76	–94	7	0.26	100pA	11.5	98	SOIC, SOIC, MSOP PowerPAD	$3.75
THS4031/32	1, 2	N	±5, ±15	1	275	100	220	100	60	–81, THD	—	1.6	2	6	8.5	90	SOIC, MSOP PowerPAD	$1.65
OPA2822	2	N	5, ±5	1	400	200	240, G ≥ 20	170	32	–95	–105	2	1.2	12	4.8	150	SOIC, MSOP	$1.35
OPA656	1	N	±5	1	400	185	230, G > 10	290	8	–74	–100	6	2	20pA	25	60	SOT23, SOIC	$3.35
OPA698	1	N	5, ±5	1	450	215	250, G ≥ 5	1100	—	–74, 2Vpp	–87, 2Vpp	5.6	5	10	15.5	120	SOIC	$1.90
OPAy820	1, 4	N	5 to ±5	1	800	240	280, G ≥ 20	240	18	–90	–110	2.5	0.75	17	5.6	110	SOIC, SOIC PowerPAD	$0.90
OPA2614	2	N	5, ±6	2	180	180	290, G ≥ 20	145	35	–92, 1MHz	–110, 1MHz	1.8	1	14.5	6.5	350	SOIC, SOIC PowerPAD	$1.55
OPAy690	1, 2, 3	Y	5, ±5	1	500	220	300, G > 10	1800	8	–77	–81	5.5	4	8	5.5	190	SOT23, SOIC, SSOP	$1.35
THS4271/75	1	Y	5, ±5, 15	1	1400	390	400, G > 10	1000	25	–70, 30MHz	–90	3	10	15	22	160	SOIC, MSOP PowerPAD	$2.25
OPA843	1	N	±5	3	500	—	800, G = 5	1000	7.5	–96, G = 5	–110, G = 5	2	1.2	35	20.2	100	SOT23, SOIC	$1.60
THS4304	1	N	3 to ±5	1	3000	1000	870, G > 10	1000	5	–100	–100	2.4	4	6	18	100	SOT23, SOIC, MSOP	$1.75
OPA699	1	N	5, ±5	4	260	—	1000, G = 6	1400	7	–67, 2Vpp	–87, 2Vpp	4.1	5	10	15.5	120	SOIC	$1.95
OPA657	1	N	±5	7	350	—	1600, G > 40	700	10	–74, G = 10	–106, G = 10	4.8	1.8	20pA	14	70	SOT23, SOIC	$3.80
OPAy846	1, 2	N	±5	7	500	—	1750, G ≥ 40	625	10	–100, G = 10	–112, G = 10	1.2	0.6	19	12.6	80	SOT23, SOIC	$1.70
OPA847	1	Y	±5	12	600	—	3800, G ≥ 50	950	10	–105, G = 20	–105, G = 20	0.85	0.5	39	18.1	75	SOT23, SOIC	$2.00
Current Feedback (Sorted by Ascending Gain of +2 Bandwidth)																		
THS3110/11	1	Y	±5, ±15	1	100	90	—	1300	27	–53, 10MHz, ±15V	–62, 10MHz, ±15V	3	6	20	4.8	260	SOIC, MSOP PowerPAD	$1.30
THS3112/15	2	Y	±5, ±15	1	110	110	—	1550	63	–70, ±15V	–61, ±15V	2.2	8	23	4.9	270	SOIC, SOIC PowerPAD	$2.00
THS3120/1	1	Y	±5, ±15	1	130	120	—	1500	11	–53, ±15V	–65, ±15V	2.5	6	3	7	475	SOIC, MSOP PowerPAD	$1.85
THS3122/25	2	Y	±5, ±15	1	160	128	—	1550	64	–69, ±15V	–70, ±15V	2.2	6	23	8.4	440	SOIC, SOIC PowerPAD	$2.95
OPAy683	1, 2	Y	5, ±5	1	200	150	—	540	—	–65, R_L = 1k	–74, R_L = 1k	4.4	3.5	4	0.94	110	SOT23, SOIC	$1.20
OPAy684	1, 2, 3, 4	Y	5, ±5	1	210	160	—	820	—	–66, R_L = 1k	–89, R_L = 1k	3.7	3.5	35	1.7	120	SOT23, SOIC, TSSOP	$1.35
OPA2677	2	N	5, ±6	1	220	200	—	2000	—	–82, G = 4	–93, G = 4	2	4.54	30	9	500	SOIC, SOIC PowerPAD, QFN	$1.65
THS6204	4	Y	±5, ±12	5	180	—	—	2300	—	–100, 1MHz, G = 10	–89, 1MHz, G = 10	2.5	15	40	21	404	TSSOP, QFN	$1.40
THS3091/5	1	Y	±5, ±15	1	235	210	—	5000	42	–77, ±15V R_L = 1kΩ	–69, ±15V R_L = 1kΩ	2	3	15	9.5	280	SOIC, SOIC PowerPAD	$2.45

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**.*

High-Speed Amplifiers

High-Speed Amplifiers Selection Guide (continued)

Device	Ch.	SHDN	Supply Voltage (V)	A_{CL} (min)	BW at A_{CL} (MHz) (typ)	BW G = +2 (MHz) (typ)	GBW Product (MHz) (typ)	Slew Rate (V/µs)	Settling Time 0.10% (ns) (typ)	Distortion $1V_{PP}$, G = 2 5MHz: HD_2 (dBc) (typ)	Distortion: HD_3 (dBc) (typ)	V_N (nV/√Hz) (typ)	V_{OS} (mV) (max)	I_B (µA) (max)	I_Q Per Ch. (mA) (typ)	I_{OUT} (mA) (typ)	Package(s)	Price*
Current Feedback (Sorted by Ascending Gain of +2 Bandwidth) (Continued)																		
THS3092/6	2	Y	±5, ±15	1	235	210	—	5000	42	–66, ±15V R_L = 1kΩ	–78, ±15V R_L = 1kΩ	2	4	15	9.5	280	SOIC, SOIC PowerPAD™	$3.90
OPA2674	2	Y	5, ±6	1	250	225	—	2000	—	–82, G = 4	–93, G = 4	2	4.5	30	9	500	SOIC, SOIC PowerPAD	$1.70
OPAy691	1, 2, 3	Y	5, ±5	1	280	225	—	2100	8	–79	–93	1.7	2.5	35	5.1	190	SOT-23, SOIC, SSOP	$1.45
OPA2673	2	Y	±6	1	300	300	—	2800	—	–68, 20MHz, G = 4	–72, 20MHz, G = 4	1.9	TBD	10	28	700	QFN, MSOP PowerPAD	$1.65
OPAy694	1, 2	N	±5	1	1500	690	—	1700	13	–92	–93	2.1	4.1	18	5.8	80	SOT-23, SOIC	$1.25
OPAy695	1, 2, 3	Y	5, ±5	1	1700	1400	—	4300	—	–78, G = 8	–86, G = 8	1.8	3	30	12.9	120	SOT23, SOIC	$1.35
Fully Differential Amplifiers (Sorted by Ascending Gain Bandwidth Product)																		
THS4130/31	1	Y	5, ±5, ±15	1	150	90	180	52	78	–72, G = 1, ±15V	–53, G = 1, ±15V	1.3	2	6	12.3	85	SOIC, MSOP PowerPAD	$2.80
THS4502/03	1	Y	5, ±5	1	370	175	300, G > 10	2800	6.3	–83, 8MHz, G = 1	–97, 8MHz, G = 1	6	7	4.6	23	120	SOIC, MSOP PowerPAD	$4.00
THS4520	1	Y	3 to 5	1	600	400	1200	520	7	–101, 1MHz, G = 1	–101, 1MHz, G = 1	2	25	11	13	105	QFN	$2.45
THS4511	1	Y	3, 5	1	1600	1400	2000	4900	3.3	–117, 10MHz	–106, 10MHz	2	5.2	15.5	39.2	61	QFN	$3.45
THS4513	1	Y	3, 5	1	1600	1400	2800	5100	16	–110, 10MHz,	–108, 10MHz	2.2	5.2	13	37.7	96	QFN	$3.25
THS4508	1	Y	3, 5	2	2000	2000	3000	6400	2	–104, 10MHz	–105, 10MHz	2.3	5	15.5	39.2	61	QFN	$3.95
THS4509	1	Y	3, 5	2	2000	2000	3000	6600	2	–104, 10MHz	–109, 10MHz	1.9	5	13	37.7	96	QFN	$3.75
THS6204	4	Y	±5, ±12	5	180	—	—	2300	—	–100, 1MHz, G = 10	–89, 1MHz, G = 10	2.5	15	40	21	404	TSSOP, QFN	$1.40
Fixed and Variable Gain (Sorted by Ascending ACL Bandwidth)																		
VCA810	1	N	±5	0.01	30	30	—	350	30	–56, G = +40dB	–53, G = +40dB	2.4	0.25	10	20	60	SOIC	$5.75
THS7001/02	1, 2	Y	±4.6, ±16	2	70	85	—	85	70	–65	–80	1.7	—	8	5.5	70	HTSSOP	$4.70
OPAy832	1, 2	N	2.8 to ±5	1	90	80	—	350	45	–66	–73	9.2	7	10	4.25	120	SOT23, SOIC	$0.70
VCA820/22	1	N	±5	2	168	168	—	1700	11	–62, f=20MHz	–68	8.2	17	25	34	160	SOIC, MSOP	$4.35
BUF634	1	N	5, ±5, ±15	1	180	—	—	2000	200	—	—	4	100	20	15	250	SOIC	$3.05
OPAy692	1, 3	Y	5, ±5	1	280	225	—	2000	8	–79	–94	1.7	2.5	35	5.1	190	SOT23, SOIC, SSOP	$1.15
THS7530	1	Y	5	4	300	—	300, G >4	1750	—	–65. 32MHz	–61, 32MHz	1.27	—	30	35	20	TSSOP PowerPAD	$3.85
VCA821/24	1	N	±5	2	710	710	—	2500	11	–66, f=20MHz	–63	6	17	25	34	90	SOIC, MSOP	$5.20
BUF602	1	N	3.3, 5, ±5	1	1200	—	—	8000	—	–76	–98	5.1	30	7	5.8	60	SOT23,SOIC	$0.85
OPAy693	1	Y	5, ±5	1	1400	700	—	2500	12	–82, 10MHz	–96, 10MHz	1.8	2	35	13	120	SOT23, SOIC	$1.30
THS4303	1	Y	3, 5	10	1800	—	18000	5500	—	–75, 70MHz, G = 10	–80, 70MHz, G = 10	2.5	4.25	10	34	180	MSOP PowerPAD	$2.10
THS4302	1	Y	3, 5	5	2400	—	12000	5500	—	–75, 70MHz, G = 5	–85, 70MHz, G = 5	2.8	4.25	10	37	180	MSOP PowerPAD	$2.10
JFET-Input and CMOS Amplifiers																		
OPA358	1	Y	2.7 to 3.3	1	100	10	80	55	35	—	—	6.4	6	50pA	7.5	50	SC70	$0.45
OPAy380	1, 2	N	2.7 to 5.5	1	100	10	90	80	—	—	—	67	0.025	50pA	7.5	50	MSOP, SOIC	$1.95
OPAy354	1, 2, 4	N	2.5 to 5.5	1	250	90	100, G = 10	150	30	–75, 1MHz	–83, 1MHz	6.5	8	50pA	4.9	100	SOT23, SOIC PowerPAD	$0.67
OPAy357	1, 2	Y	2.5 to 5.5	1	250	90	100, G = 10	150	30	–75, 1MHz	–83, 1MHz	6.5	8	50pA	4.9	100	SOT23, SOIC PowerPAD	$0.67
OPAy300/301	1, 2	Y	2.7 to 5.5	1	—	80	150	80	30	–72, 1MHz	–79, 1MHz	3	5	5pA	12	40	SOT-23, SOIC	$1.25
OPAy355	1, 2, 3	Y	2.5 to 5.5	1	450	100	200, G = 10	300	30	–81, 1MHz	–93, 1MHz	5.8	9	50pA	8.3	60	MSOP	$0.69
OPAy356	1, 2	N	2.5 to 5.5	1	450	100	200, G = 10	300	30	–81, 1MHz	–93, 1MHz	5.8	9	50pA	8.3	60	SOT23, SOIC	$0.69
THS4631	1	N	±15	1	325	105	210, G > 20	1000	40	–76	–94	7	0.26	100pA	11.5	98	SOIC, SOIC & MSOP PowerPAD	$3.75
OPA656	1	N	±5	1	400	185	230, G > 10	290	8	–74	–100	6	2	2pA	25	60	SOT23, SOIC	$3.35
OPA657	1	N	±5	7	350	—	1600, G > 40	700	10	–74, G = 10	–106, G = 10	4.8	1.8	2pA	14	70	SOT23, SOIC	$3.80

*Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red**. Preview products are listed in **bold blue**.*

High-Speed Amplifiers Selection Guide (continued)

Device	Ch.	SHDN	Supply Voltage (V)	A_{CL} (min)	BW at A_{CL} (MHz) (typ)	BW G = +2 (MHz) (typ)	GBW Product (MHz) (typ)	Slew Rate (V/µs)	Settling Time 0.10% (ns) (typ)	Distortion $1V_{PP}$, G = 2 5MHz HD2 (dBc) (typ)	HD3 (dBc) (typ)	V_N (nV/√Hz) (typ)	V_{OS} (mV) (max)	I_B (µA) (max)	I_Q Per Ch. (mA) (typ)	I_{OUT} (mA) (typ)	Package(s)	Price*
Transconductance Amplifiers																		
OPA860	1	N	±5	1	470	—	470	3500	—	–77	–79	2.4	—	5	11.2	15	SOIC	$2.25
OPA861	1	N	±5	1	80	—	400	900	—	–68	–57	2.4	—	1	5.4	15	SOT23, SOIC	$0.95
xDSL Drivers and Receivers (Sorted by Ascending Output Current)																		
THS4032	2	N	±5, ±15	1	275	100	—	100	60	–77	–67	1.6	2	6	8.5	90	SOIC, MSOP PowerPAD™	$2.60
OPA4684	4	N	+5, ±6	1	250	170	—	750	—	–82	–84	3.7	3.5	35	1.7	120	TSSOP, SOIC	$3.30
OPA2822	2	N	5, ±5	1	400	200	240, G ≥ 20	170	32	–95, 1MHz, G = 2	–105, 1MHz, G = 2	2	1.2	12	4.8	150	SOIC, MSOP	$1.35
OPA2613	2	N	5, ±6	1	230	110	125, G ≥ 20	70	40	–95, 1MHz, G = 2	–84, 1MHz, G = 2	1.8	1	10	6	350	SOIC, SOIC PowerPAD™	$1.55
OPA2614	2	N	5, ±6	2	180	180	290, G ≥ 20	145	35	–92, 1MHz. G = 4	–110, 1MHz, G = 4	1.8	1	14.5	6.5	350	QFN, SOIC, SOIC PowerPAD	$1.55
THS6184	4	Y	±5, ±16	1	50	—	—	400	—	–89, 1MHz, G = 5	–85, 1MHz, G = 5	2.9	15	15	4.2	400	QFN, TSSOP	$3.75
THS6204	4	Y	±5, ±12	5	180	—	—	2300	—	–100, 1MHz, G = 10	–89, 1MHz, G = 10	2.5	15	40	21	404	QFN, MSOP PowerPAD	$1.40
OPA2674	2	Y	5, ±6	1	260	—	—	2000	—	–82, G = 4	–93, G = 4	2	2	10	9	500	SOIC	$1.70
OPA2677	2	N	5, ±6	1	220	200	—	2000	—	–82, G = 4	–93, G = 4	2	4.5	30	9	500	SOIC, SOIC PowerPAD	$1.65
THS6132	2	Y	±5, ±15	1	80	70	—	300	—	–84, 1MHz, G =10	–92, 1MHz, G = 10	3.5	1	1	6.4	500	QFN TQFP PowerPAD	$3.95
THS6182	2	Y	±5, ±16	1	100	80	—	450	—	–88, 1MHz, G = 5	–107, 1MHz, G = 5	3.2	20	15	11.5	600	QFN, SOIC PowerPAD	$2.95
OPA2673	2	Y	±6	1	300	300	—	2800	—	–68, 20MHz, G = 4	–72, 20MHz, G = 4	1.9	TBD	10	28	700	QFN, MSOP PowerPAD	$1.65
Transimpedance Amplifiers (Sorted by Ascending Gain Bandwidth Product)																		
OPAy380	1, 2	N	2.7, 5.0	1	90	45	90	80	2000	—	—	5.8	0.025	50pA	6.5	50	MSOP, SOIC	$1.95
THS4631	1	N	±15	1	325	105	210, G > 20	1000	40	–76	–94	7	0.26	100pA	11.5	98	SOIC, SOIC and MSOP PowerPAD	$3.75
OPA656	1	N	±5	1	400	185	230, G > 10	290	8	–74	–100	6	2	20pA	25	60	SOT23, SOIC	$3.35
OPA657	1	N	±5	7	350	—	1600, G > 40	700	10	–74, G = 10	–106, G = 10	4.8	1.8	20pA	14	70	SOT23, SOIC	$3.80
OPAy846	1, 2	N	±5	7	500	—	1750, G ≥ 40	625	10	–100, G = 10	–112, G = 10	1.2	0.6	19	12.6	80	SOT23, SOIC	$1.70
OPA847	1	Y	±5	12	600	—	3800, G ≥ 50	950	10	–105, G = 20	–105, G = 20	0.85	0.5	39	18.1	75	SOT23, SOIC	$2.00
Multiplexers																		
MPA4609	4	N	5	190	90	—	—	150	—	—	—	0.65	0.2	—	12.5	—	TQFP	$3.95
OPAy875	1, 3	Y	±3 to ±6	2	700	700	—	3100	3	–71	–90	6.7	7	±18	11	±70	MSOP, SOIC	$1.45
OPA4872	1	Y	±3.5 to ±6	1	1100	500	—	2300	14	–60, 10MHz	–78, 10MHz	4.5	5	18	10.6	±75	SOIC	$2.15
Voltage-Limiting Amplifiers																		
OPA698	1	N	5, ±5	1	450	215	250	1100	—	–82	–88	5.6	5	10	15.5	120	SOIC	$1.90
OPA699	1	N	5, ±5	4	260	—	1000	1400	—	—	—	4.1	5	10	15.5	120	SOIC	$1.95
RF/IF Amplifiers																		
THS9000/1	1	N	3, 5	5.8	500	—	—	—	—	—	—	0.6	—	—	Var	—	MicroMLP, SOT23	$1.05
DC Restoration (Sample/Hold Amplifier)																		
OPA615	1	N	±5	1	710	—	—	2500	—	–62	–47	4.6	4	1	13	5	SOIC, MSOP	$4.25
Filtered Amplifiers																		
THS7303	3	Y	2.7 to 5.5	—	—	9/16/ 35/190	—	40/75/ 155/320	—	—	—	—	35	—	6	70	TSSOP	$1.65
THS7313	3	Y	2.7 to 5.5	—	—	8	—	35	—	—	—	—	35	—	6	70	TSSOP	$1.20
THS7314	3	N	2.85 to 5.5	—	—	8.5	—	36	—	—	—	—	390	—	5.3	80	SOIC	$0.40
THS7315	3	Y	2.85 to 5.5	—	—	8.5	—	37	—	—	—	—	420	—	5.2	90	SOIC	$0.50
THS7316	3	N	2.85 to 5.5	—	—	36	—	80	—	—	—	—	390	—	5.8	80	SOIC	$0.55
THS7318	3	Y	2.85 to 5	—	—	20	—	80	—	—	—	—	—	—	3.5	—	NanoFree™ Wafer Scale	$3.75
THS7327	3	Y	2.7 to 5.5	—	—	500	—	1300	—	—	—	—	65	—	33	80	TQFP	$3.35
THS7347	3	Y	2.7 to 5.5	—	—	500	—	1300	—	—	—	—	15	—	26.8	80	TQFP	$2.75
THS7353	3	Y	2.7 to 5.5	—	—	9/16/35/	—	40/70/ 150/300	—	—	—	—	20	—	5.9	70	TSSOP	$1.65
THS7374	4	Y	2.85 to 5.5	—	—	150	—	160	—	—	—	—	TBD	TBD	4	90	TSSOP	$0.55
THS7375	4	Y	2.85 to 5.5	—	—	150	—	160	—	—	—	—	TBD	TBD	4	90	TSSOP	$0.55

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue**.*

Voltage-Controlled Gain Amplifiers

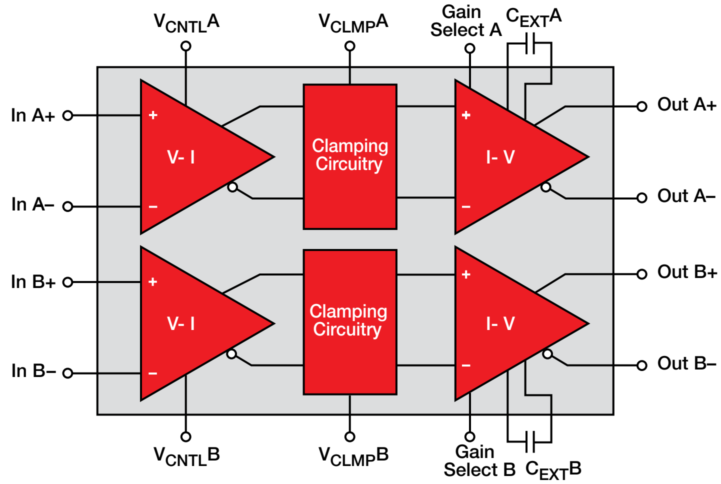
The voltage-controlled gain amplifier (VCA) provides linear dB gain and gain-range control with high impedance inputs. Available in single, dual and octal configurations, the VCA series is designed to be used as a flexible gain-control element in a variety of electronic systems. With a broad gain-control range, both gain and attenuation control are provided for maximum flexibility.

Design Considerations
Primary
- Input frequency
- Noise (nV/√Hz)
- Variable gain range

Secondary
- Number of channels
- Distortion—low second harmonic and third harmonic distortion
- Level of integration
- Per channel power consumption

Technical Information
The broad attenuation range can be used for gradual or controlled channel turn-on or turn-off where abrupt gain changes can create artifacts and other errors.

Typical Applications
- Ultrasound systems
- Medical and industrial
- Test equipment



VCA2617 functional block diagram.

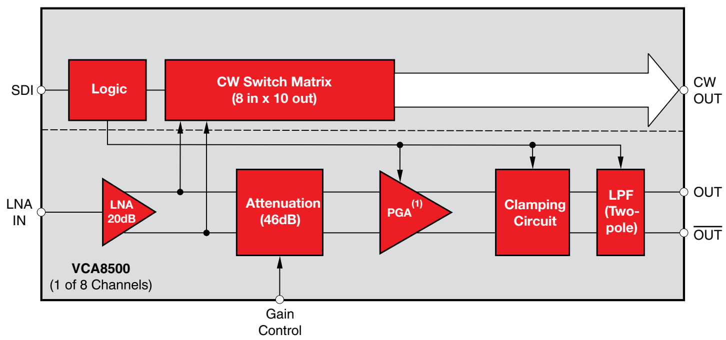
8-Channel Variable-Gain Amplifier for Imaging Applications
VCA8500

Get samples, datasheets, evaluation moodules and app reports at: **www.ti.com/sc/device/VCA8500**

Key Features
- Ultra low power: 65mW/channel
- Low noise: 0.8nV/√Hz
- Low-noise pre-amp (LNP):
  - 20dB fixed gain
  - 250mV_{PP} linear input range
- Variable gain amplifier:
  - Gain control range: 46dB
  - Selectable PGA gain: 20dB, 25dB, 27dB, 30dB
- Integrated low-pass filter:
  - Second-order, linear phase
- Excellent channel matching: ±0.25dB
- Distortion, HD_2: –50dBc at 5MHz
- Serial control interface
- Small package: QFN-64, 9x9mm

Applications
- Medical imaging, ultrasound systems
- Portable systems
- Low- and mid-range systems

The VCA8500 is an 8-channel, variable-gain amplifier consisting of a low-noise pre-amplifier (LNP) and a variable-gain amplifier (VGA). This combination, along with the device features, makes it ideal for a variety of ultrasound systems. The VCA8500 is built on TI's BiCOM process and is available in a small QFN-64 PowerPAD™ package.



NOTE (1): 20dB, 25dB, 27dB, or 30dB gain setting.

VCA8500 functional block diagram.

Voltage-Controlled Gain Amplifiers

Wideband, >40dB Gain Adjust Range Variable Gain Amplifiers

VCA820, VCA821, VCA822, VCA824

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/PARTnumber** (Replace **PARTnumber** with **VCA820**, **VCA821**, **VCA822** or **VCA824**)

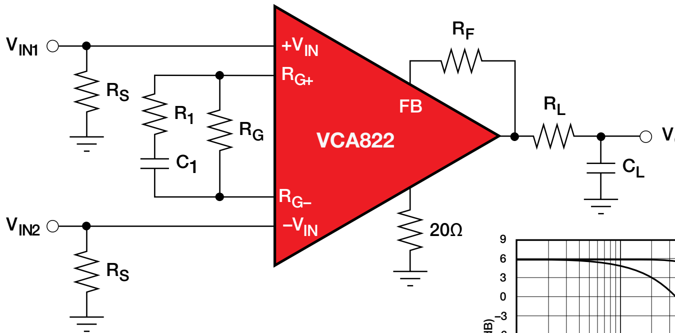
Key Features

- Gain adjust range: >40dB
- High gain accuracy: 20dB ±0.4dB
- Small signal bandwidth (G=+2): 710MHz (VCA821/824), 150MHz (VCA820/822)
- Slew rate: 2500V/µs (VCA821/824), 1700V/µs (VCA820/822)
- Output current; ±160mA (VCA820/822), ±90mA (VCA821/824)
- Voltage noise: 8.2nV/√Hz (VCA820/822), 6nV/√Hz (VCA821/824)
- Packages: MSOP-10 or SO-14

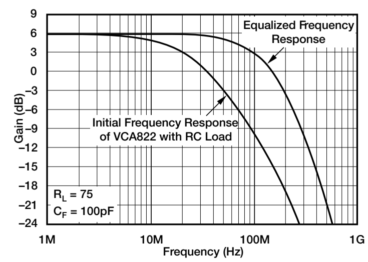
Applications

- Differential line receivers
- Differential equalizers (VCA822/824)
- Voltage-tunable active filters
- Pulse amplitude compensation
- Variable attenuators
- AGC receivers with RSSI (VCA820/821)

The VCA820, VCA821, VCA822 and VCA824 are dc-coupled, wideband, variable gain amplifiers with linear gain adjustment control for >40dB gain range. These amplifiers provide a differential input to single-ended conversion with a high-impedance gain control input used to vary the gain where the VCA820/821 feature linear in dB gain control and the VCA822/824 linear in V/V gain control.



VCA822 as differential equalizer.



Differential equalization of an RC load.

Voltage-Controlled Gain Amplifiers Selection Guide

Device	V_N (nV/√Hz)	Bandwidth (MHz) (typ)	Specified at V_S (V)	Number of Channels	Variable Gain Range (dB)	Package(s)	Price*
THS7530	1.27	300	5	1	46	HTSSOP-14	$3.65
VCA2612	1.25	40	5	2	45	TQFP-48	$12.50
VCA2613	1	40	5	2	45	TQFP-48	$10.25
VCA2614	4.8	40	5	2	40	TQFP-32	$8.35
VCA2615	0.7	42	5	2	52	QFN-48	$10.25
VCA2616/2611	0.95	40	5	2	40	TQFP-48	$10.25
VCA2617	3.8	50	5	2	48	QFN-32	$8.40
VCA2618	5.4	30	5	2	43	TQFP-32	$8.40
VCA2619	5.9	40	5	2	50	TQFP-32	$8.40
VCA810	2.4	30	±5	1	80	SO-8	$5.75
VCA820	6	150	±5	1	40	MSOP-10, SO-14	$4.35
VCA821	8.2	420	±5	1	40	MSOP-10, SO-14	$5.20
VCA822	6	150	±5	1	40V/V	MSOP-10, SO-14	$4.35
VCA824	8.2	420	±5	1	40V/V	MSOP-10, SO-14	$5.20
VCA8500	0.8	15	3.3	8	45	QFN-64	$32.00
VCA8613	1.2	14	3	8	40	TQFP-64	$25.40
VCA8617	1	15	3	8	40	TQFP-64	$24.00

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.***

Comparators

Comparator ICs are specialized op amps designed to compare two input voltages and provide a logic state output. They can be considered one-bit analog-to-digital converters.

The TI comparator portfolio consists of a variety of products with various performance characteristics, including: fast ns response time, wide input voltage ranges, extremely low quiescent current consumption and op amp and comparator combination ICs.

Comparator vs. Op Amp

	Comparator	Op Amp
Speed (Response time)	Yes	No
Logic Output	Yes	No
Wide Diff. Input Range	Yes	Yes
Low Offset Drift	No	Yes

In general, if a fast response time is required, use a comparator.

Design Considerations

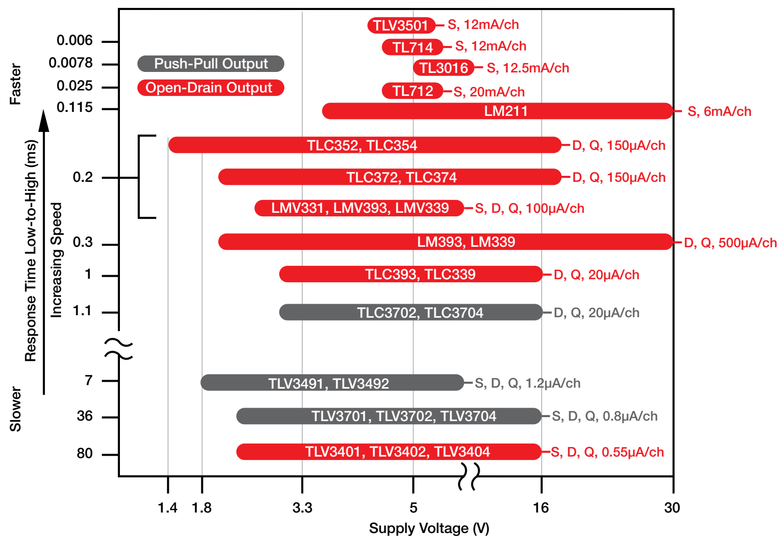
Output topology

- Open collector—connects to the logic supply through a pull-up resistor and allows comparators to interface to a variety of logic families.
- Push-pull—does not require a pull-up resistor. Because the output swings rail-to-rail, the logic level is dependent on the voltage supplies of the comparator.

Response time (propagation delay)—applications requiring "near real-time" signal response should consider comparators with nanosecond (ns) propagation delay. Note that as propagation delay decreases, supply current increases. Evaluate what mix of performance and power can be afforded. The TLV349x family offers a unique combination of speed/power with 5µs propagation delay on only 1µA of quiescent current.

Combination comparator and op amp—for input signals requiring DC level shifting and/or gain prior to the comparator, consider the TLV230x (open drain) or TLV270x (push-pull) op amp and comparator combinations. These dual function devices save space and cost.

Comparator and voltage reference—comparators typically require a reference voltage to compare against. The TLV3011 is an integrated comparator and voltage reference combination in a space-saving SC70 package.



Comparators functional block diagram.

High-Speed Comparator in SOT23
TLV3501

Get samples and datasheets at: **www.ti.com/sc/device/TLV3501**

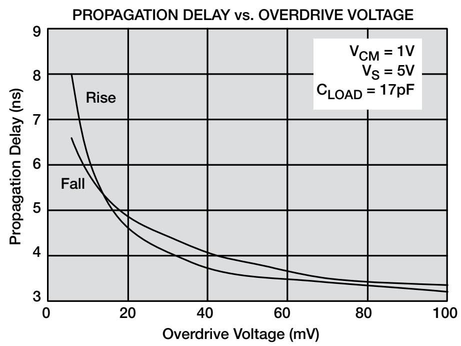
Key Features

- High speed: 4.5ns response at 20mV overdrive
- Beyond-the-rail common-mode input range
- Rail-to-rail, push-pull output
- Single-supply operation: 2.7V to 5.5V
- Packaging: SOT23

Applications

- Test and measurement
- Power supply monitoring
- Base stations

The TLV3501 is a high-speed comparator in a small SOT23 package. Designed for a variety of applications, TLV3501 offers very fast response relative to power consumption. It is specified over the extended temperature range of –40°C to +125°C.



TLV3501 performance characteristics.

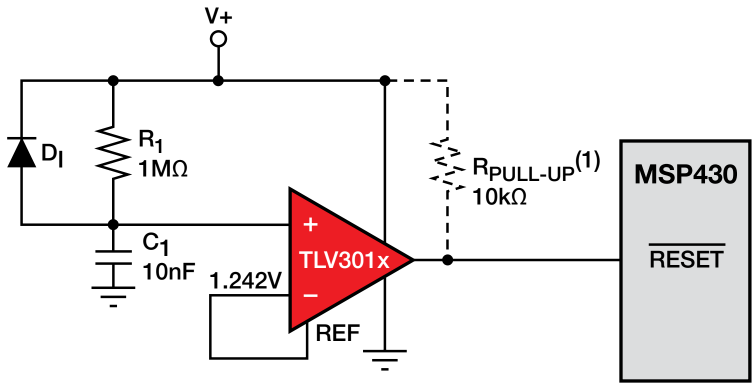
Low-Power Comparators with Integrated Voltage Reference
TLV3011, TLV3012

Get samples and datasheets at: **www.ti.com/sc/device/TLV3011** and **www.ti.com/sc/device/TLV3012**

Key Features
- Comparator and voltage reference:
  TLV3011: open-drain output
  TLV3012: push-pull output
- Integrated voltage reference: 1.2V, 1% initial accuracy, 40ppm/°C drift
- Low quiescent current: 5µA max
- Wide input common-mode range: 200mV beyond rails
- Propagation delay: 6µs
- Very-low voltage operation: 1.8V to 5.5V
- Packaging: SC-70 and SOT23

Applications
- Battery voltage monitoring
- Power good function
- Low signal/voltage detection
- Relaxation oscillator

The TLV3011 is a low-power, open-drain output comparator; the TLV3012 is a push-pull output comparator. The integrated 1.242V series voltage reference offers low 100ppm/°C (max) drift, is stable with up to 10nF capacitive load and can provide up to 0.5mA (typ) of output current.



TLV3011 or TLV3012 configured to power-up reset for MSP430.
Note: (1) Use $R_{PULL-UP}$ with the TLV3011 only.

Comparators Selection Guide

Device	Description	Ch.	I_Q Per Ch. (mA) (max)	Output Current (mA) (min)	t_{RESP} Low-to-High (µs)	V_S (V) (min)	V_S (V) (max)	V_{OS} (25°C) (mV) (max)	Output Type	Package(s)	Price*
High Speed, $t_{RESP} \le 0.1\mu s$											
TLV3501	Ultra-High Speed, Low Power	1, 2	5	20	0.004	2.7	5.5	5	Push-Pull	SOT23	$1.50
TL714	High Speed, 10mV (typ) Hysteresis	1	12	16	0.006	4.75	5.25	10	Push-Pull	PDIP, SOIC	$2.16
TL3016	High Speed, Low Offset	1	12.5	5	0.0078	5	10	3	Push-Pull	SOIC, TSSOP	$0.95
TL3116	Ultra Fast, Low Power, Precision	1	14.7	5	0.0099	5	10	3	Push-Pull	SOIC, TSSOP	$0.95
TL712	Single, High Speed	1	20	16	0.025	4.75	5.25	5	Push-Pull	PDIP, SOIC, SOP	$0.83
LM306	Single, Strobed, General Purpose	1	10	100	0.028	15	24	5	Push-Pull	PDIP, SOIC	$0.77
LM211	Single, High Speed, Strobed	1	6	25	0.115	3.5	30	3	Open-Collector/ Emitter	PDIP, SOIC	$0.20
LM311	Single, High Speed, Strobed, Differential	1	7.5	25	0.115	3.5	30	7.5	Open-Collector/ Emitter	PDIP, SOIC, SOP, TSSOP	$0.18
LM111	Single, Strobed, Differential	1	6	25	0.165	3.5	30	3	Open-Collector/ Emitter	CDIP, LCCC	$1.57
Low Power, $I_Q < 0.5mA$											
TLV3401	Nanopower, Open-Drain, RRIO	1, 2, 4	0.00055	1.6	80	2.5	16	3.6	Open-Drain	MSOP, PDIP, SOIC, SOT23, TSSOP	$0.60
TLV3701	Nanopower, Push-Pull, RRIO	1, 2, 4	0.0008	1.6	36	2.5	16	5	Push-Pull	MSOP, PDIP, SOIC, SOT23, TSSOP	$0.60
TLV3491	Low Voltage, Excellent Speed/Power	1, 2, 4	0.0012	5	6	1.8	5.5	15	Push-Pull	SOT23, SOIC, TSSOP	$0.42
TLV2302	Sub-µPower, Op Amp and Comparator, RRIO	2, 4	0.0017	0.2	55	2.5	16	5	Open-Collector	MSOP, PDIP, SOIC, TSSOP	$0.70
TLV2702	Sub-µPower, Op Amp and Comparator, RRIO	2, 4	0.0019	0.2	36	2.5	16	5	Push-Pull	MSOP, PDIP, SOIC, TSSOP	$0.90
TLC3702	Dual and Quad, µPower	2, 4	0.02	4	1.1	3	16	5	Push-Pull	PDIP, SOIC, TSSOP	$0.34

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Comparators

Comparators Selection Guide (continued)

Device	Description	Ch.	I_Q Per Ch. (mA) (max)	Output Current (mA) (min)	t_{RESP} Low-to-High (µs)	V_S (V) (min)	V_S (V) (max)	V_{OS} (25°C) (mV) (max)	Output Type	Package(s)	Price*
Low Power, I_Q < 0.5mA (Continued)											
TLC393	Low Power, LM393 Replacement	2	0.02	6	1.1	3	16	5	Open-Drain	PDIP, SOIC, SOP, TSSOP	$0.37
TLC339	Quad, Low Power	4	0.02	6	1	3	16	5	Open-Drain	PDIP, SOIC, TSSOP	$0.44
LP2901	Quad, Low Power, General Purpose	4	0.025	30	1.3	5	30	5	Open-Collector	PDIP, SOIC	$0.68
LP339	Quad, Low Power, General Purpose	4	0.025	30	1.3	5	30	5	Open-Collector	PDIP, SOIC	$0.27
LMV393	Dual, Low Voltage	2	0.1	10	0.2	2.7	5.5	7	Open-Collector	SOIC, TSSOP	$0.30
LMV339	Quad, Low Voltage	4	0.1	10	0.2	2.7	5.5	7	Open-Collector	SOIC, TSSOP	$0.36
LMV331	Single, Low Voltage	1	0.12	10	0.2	2.7	5.5	7	Open-Collector	SC70, SOT23	$0.36
TLC372	Fast, Low Power	2, 4	0.15	6	0.2	2	18	5	Open-Drain	PDIP, SOIC, TSSOP	$0.33
LM3302	Quad, General Purpose	4	0.2	6	0.3	2	28	20	Open-Drain/Emitter	PDIP, SOIC	$0.36
LP211	Single, Strobed, Low Power	1	0.3	25	1.2	3.5	30	7.5	Open-Drain/Emitter	SOIC	$0.61
LP311	Single, Strobed, Low Power	1	0.3	25	1.2	3.5	30	7.5	Open-Drain/Emitter	PDIP, SOIC, SOP	$0.68
Low Voltage, $V_S \leq 2.7V$ (min)											
TLC352	1.4V	2, 4	0.15	6	0.2	1.4	18	5	Open-Drain	PDIP, SOIC, TSSOP	$0.40
TLV3491	Low Voltage, Excellent Speed/Power	1, 2, 4	0.0012	5	6	1.8	5.5	15	Push-Pull	SOT23, SOIC, TSSOP	$0.42
TLV2352	Low Voltage	2, 4	0.125	6	0.2	2	8	5	Open-Drain	PDIP, SOIC, TSSOP	$0.80
TLC372	Fast, Low Power	2, 4	0.15	6	0.2	2	18	5	Open-Drain	PDIP, SOIC, TSSOP	$0.33
LM3302	Quad, Differential	4	0.2	6	0.3	2	28	20	Open-Collector	PDIP, SOIC	$0.36
LM2903	Dual, Differential	2	0.5	6	0.3	2	30	7	Open-Collector	PDIP, SOIC, SOP, TSSOP	$0.18
LM293	Dual, Differential	2	0.5	6	0.3	2	30	5	Open-Collector	PDIP, SOIC	$0.20
LM293A	Dual, Differential	2	0.5	6	0.3	2	30	3	Open-Collector	SOIC	$0.22
LM393	Dual, Differential	2	0.5	6	0.3	2	30	5	Open-Collector	PDIP, SOIC, SOP, TSSOP	$0.16
LM393A	Dual, Differential	2	0.5	6	0.3	2	30	3	Open-Collector	PDIP, SOIC, SOP, TSSOP	$0.18
LM239	Quad, Differential	4	0.5	6	0.3	2	30	5	Open-Collector	PDIP, SOIC	$0.22
LM239A	Quad, Differential	4	0.5	6	0.3	2	30	2	Open-Collector	SOIC	$0.27
LM2901	Quad, Differential	4	0.625	6	0.3	2	30	3	Open-Collector	PDIP, SOIC, SOP, TSSOP	$0.18
LM339	Quad, Differential	4	0.5	6	0.3	2	30	5	Open-Collector	PDIP, SOIC, SOP, SSOP, TSSOP	$0.16
LM339A	Quad, Differential	4	0.5	6	0.3	2	30	3	Open-Collector	PDIP, SOIC, SOP	$0.18
TL331	Single, Differential	1	0.7	6	0.3	2	36	5	Open-Collector	SOT23	$0.18
LM139	Quad, Differential	4	0.5	6	0.3	2	36	5	Open-Collector	SOIC	$0.54
LM139A	Quad, Differential	4	0.5	6	0.3	2	36	2	Open-Collector	SOIC	$0.94
LM193	Dual, Differential	2	0.5	6	0.3	2	36	5	Open-Collector	SOIC	$0.30
TLV3401	Nanopower, Open- Drain, RRIO	1, 2, 4	0.00055	1.6	80	2.5	16	3.6	Open-Drain	MSOP, PDIP, SOIC, SOT23, TSSOP	$0.60
TLV3701	Nanopower, Push-Pull, RRIO	1, 2, 4	0.0008	1.6	36	2.5	16	5	Push-Pull	MSOP, PDIP, SOIC, SOT23, TSSOP	$0.60
LMV331	Single, Low Voltage	1	0.12	10	0.2	2.7	5.5	7	Open-Collector	SC70, SOT23	$0.36
LMV393	Dual, Low Voltage	2	0.1	5	0.2	2.7	5.5	7	Open-Collector	SOIC, TSSOP	$0.30
LMV339	Quad, Low Voltage	4	0.075	10	0.2	2.7	5.5	7	Open-Collector	SOIC, TSSOP	$0.36
Combination Comparator and Op Amp											
TLV2302	Sub-µPower, Op Amp and Comparator, RRIO	2	0.0017	0.2	55	2.5	16	5	Open-Collector	MSOP, PDIP, SOIC, TSSOP	$0.70
TLV2702	Sub-µPower, Op Amp and Comparator, RRIO	2, 4	0.0019	0.2	36	2.5	16	5	Push-Pull	MSOP, PDIP, SOIC, TSSOP	$0.90
Comparator and Voltage Reference											
TLV3011	µPower, Comparator with 1.242V Reference	1	0.003	5	6	1.8	5.5	15	Open-Drain	SC-70, SOT23	$0.75
TLV3012	µPower, Comparator with 1.242V Reference	1	0.003	5	6	1.8	5.5	15	Push-Pull	SC-70, SOT23	$0.75

**Suggested resale price in U.S. dollars in quantities of 1,000.*

The difference amplifier is a moderate input impedance, closed-loop, fixed-gain block that allows the acquisition of signals in the presence of ground loops and noise. These devices can be used in a variety of precision, general-purpose, audio, low-power, high-speed and high-common-mode voltage applications.

Difference Amplifier

The basic difference amplifier employs an op amp and four on-chip, precision, laser trimmed resistors. The INA132, for example, operates on 2.7V to 36V supplies and consumes only 160µA. It has a differential gain of 1 and high common-mode rejection. The output signal can be offset by applying a voltage to the Ref pin. The output sense pin can be connected directly at the load to reduce gain error. Because the resistor network divides down the input voltages, difference amplifiers can operate with input signals that exceed the power supplies.

High Common-Mode Voltage Difference Amplifier Topology

A five-resistor version of the simple difference amplifier results in a device that can operate with very high levels of common-mode voltage—far beyond its power supply rails. For example, the INA117 can sense differential signals in the presence of common-mode voltages as high as ±200V while being powered from ±15V. This device is very useful in measuring current from a high-voltage power supply through a high-side shunt resistor.

Design Considerations

Power supply—common-mode voltage is always a function of the supply voltage. The INA103 instrumentation amplifier is designed to operate on voltage supplies up to ±25V, while the INA122 difference amp can be operated from a 2.2V supply.

Output voltage swing—lower supply voltage often drives the need to maximize dynamic range by swinging close to the rails.

Common-mode input voltage range—selection of the most suitable difference amp begins with an understanding of the input voltage range. Some offer resistor networks that divide down the input voltages, allowing operation with input signals that exceed the power supplies. A five-resistor version of the simple difference amplifier results in a device that can operate with very high levels of common-mode voltage—far beyond the supply rails.

Gain—signal amplification needed for the desired circuit function must be considered. With the uncommitted on-chip op amp, the INA145 and the INA146 can be configured for gains of 0.1 to 1000.

Sensor impedance—should be <0.001 of difference amp input impedance to retain CMR and gain accuracy. In other words, the amp input impedance should be 1,000 times higher than the source impedance.

Offset voltage drift (µV/°C)—input offset voltage changes over temperature. This is more critical in applications with changing ambient temperature.

Quiescent current—often of high importance in battery-powered applications, where amplifier power consumption can greatly influence battery life.

Slew rate—if the signal is reporting a temperature, force or pressure, slew rate is not generally of great concern. If the signal is for an electronic event, (e.g., current, power output) a fast transition may be needed.

Common-mode rejection—a measure of unwanted signal rejection and the amp's ability to extract a signal from surrounding DC, power line or other electrical noise.

Should I Use a Difference Amplifier or Instrumentation Amplifier?

Difference amplifiers excel when measuring signals with common-mode voltages greater than the power supply rails, when there is a low power requirement, when a small package is needed, when the source impedance is low or when a low-cost differential amp is required. The difference amp is a building block of the instrumentation amp.

Instrumentation amplifiers are designed to amplify low-level differential signals where the maximum common-mode voltage is within the supply rails. Generally, using an adjustable gain block, they are well-suited to single-supply applications. The three-op-amp topology works well down to Gain = 1, with a performance advantage in AC CMR. The two-op-amp topology is appropriate for tasks requiring a small package footprint and a gain of 5 or greater. It is the best choice for low-voltage, single-supply applications.

Difference Amplifiers

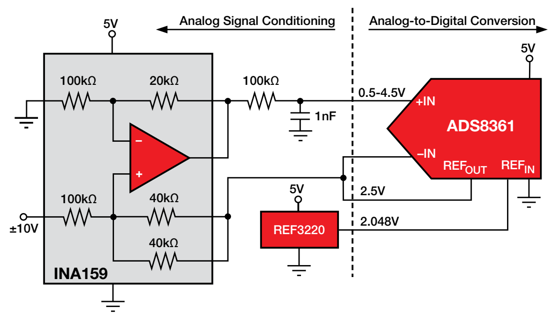
High-Speed, Precision, Level Translation Difference Amplifier
INA159

Get samples, datasheets and app reports at: **www.ti.com/sc/device/INA159**

Key Features
- Gain of 0.2 interface between ±10V signals and low-voltage, single-supply ADCs
- Wide bandwidth: 1.5MHz
- High slew rate: 15V/µs
- Low offset voltage: ±100µV
- Low offset drift: ±1.5µV/°C
- Linearity: 0.01% FSR
- Single supply: +1.8V to +5.5V
- Packaging: MSOP-8

Applications
- Industrial process control
- Instrumentation
- Audio line receiver

The INA159 is a level translation difference amplifier. It acts as a translator between ±10V levels and the input of single-supply ADCs typically operating at 5V. The INA159 accomplishes this with a gain of 0.2 along with a convenient voltage-divider reference input simplifying the biasing of the INA159's quiescent output to the optimum point for the ADC. The INA159 has a robust output stage, excellent frequency response and high slew rate.



INA159 simplifies level translation of ±10V input to single-supply ADC.

Difference Amplifiers Selection Guide

Device	Description	Ch.	Gain	Offset (µV) (max)	Drift (µV/°C) (max)	Offset CMRR (dB) (min)	BW (MHz) (typ)	Output Voltage Swing (V) (min)	Power Supply (V)	I_Q Per Ch. (mA) (max)	Package(s)	Price*
INA105	Precision, Unity-Gain	1	1	500	10	72	1	(V+) –5 to (V–) +5	±5 to ±18	2	SOIC-8	$3.20
INA106	Precision, Fixed G = 10	1	10	200	0.2	86	5	(V+) –5 to (V–) +5	±5 to ±18	2	DIP, SOIC-8	$5.00
INA132	µPower, Single Supply, High Precision	1	1	250	5	76	0.3	(V+) –1 to (V–) +0.5	+2.7 to +36	0.185	DIP, SO	$1.15
INA2132	Dual INA132	2	1	250	5	80	0.3	(V+) –1 to (V–) +0.5	+2.7 to +36	0.185	SO	$1.80
INA133	High Speed, Precision	1	1	450	5	80	1.5	(V+) –1.5 to (V–) +1	±2.25 to ±18	1.2	SOIC-8	$1.15
INA2133	Dual INA133	2	1	450	5	80	1.5	(V+) –1.5 to (V–) +1	±2.25 to ±18	1.2	SOIC-14	$1.80
INA143	High Speed, Precision, G = 10 or 1/10	1	10, 0.1	250	3	86	0.15	(V+) –1.5 to (V–) +1	±2.25 to ±18	1.2	SOIC-8	$1.05
INA2143	Dual INA143	2	10, 0.1	250	3	86	0.15	(V+) –1.5 to (V–) +1	±2.25 to ±18	1.2	SOIC-14	$1.70
INA145	Resistor Programmable Gain	1	1 to 1000	1000	10	76	0.5	(V+) –1 to (V–) +0.25	±2.25 to ±18	0.7	SOIC-8	$1.50
INA152	µPower, High Precision	1	1	1500	15	80	0.8	(V+) –0.35 to (V–) +0.3	+2.7 to +20	0.65	MSOP-8	$1.20
INA154	High Speed, Precision	1	1	750	20	80	3.1	(V+) –2 to (V–) +2	±4 to ±18	2.9	SOIC-8	$1.05
INA157	High Speed, Precision, G = 2 or 1/2	1	2, 0.5	500	20	86	4	(V+) –2 to (V–) +2	±4 to ±18	2.9	SOIC-8	$1.05
INA159	High Speed, Precision, Level Shift, G = 0.2	1	0.2	500	1.5	80	1.5	(V+)–0.1 to (V–) +0.048	+1.8 to +5.5	1.5	MSOP-8	$1.75
Audio												
INA134	Low Distortion, Audio Line Receiver, 0dB	1	1	1000	2	74	3.1	(V+) –2 to (V–) +2	±4 to ±18	2.9	DIP, SOIC-8	$1.05
INA2134	Dual INA134	2	1	1000	2	74	3.1	(V+) –2 to (V–) +2	±4 to ±18	2.9	DIP, SOIC-14	$1.70
INA137	Low Distortion, Audio Line Receiver, 6dB	1	2, 0.5	1000	2	74	4	(V+) –2 to (V–) +2	±4 to ±18	2.9	DIP, SOIC-8	$1.05
INA2137	Dual INA137	2	2, 0.5	1000	2	74	4	(V+) –2 to (V–) +2	±4 to ±18	2.9	DIP, SOIC-14	$1.70
DRV134	Audio Balanced Line Driver	1	2	250000	150	46	1.5	(V+) –3 to (V–) +2	±4.5 to ±18	5.5	DIP, SOIC-16	$1.95
DRV135	Audio Balanced Line Driver	1	2	250000	150	46	1.5	(V+) –3 to (V–) +2	±4.5 to ±18	5.5	SOIC-8	$1.95
High Common-Mode Voltage												
INA117	±200V CM Range	1	1	1000	40	86	0.2	(V+) –5 to (V–) +5	±5 to ±18	2	DIP, SOIC-8	$2.70
INA146	±100V CM Range, Prog. Gain	1	0.1 to 100	5000	600	70	0.55	(V+) –1 to (V–) +0.15	±2.25 to ±18	0.70	SOIC-8	$1.70
INA148	±200V CM Range, 1MΩ Input	1	1	5000	10	70	0.1	(V+) –1 to (V–) +0.25	±1.35 to ±18	0.3	SOIC-8	$2.10

Suggested resale price in U.S. dollars in quantities of 1,000.

Analog Current Shunt Monitors

Current shunt monitors are a unique class of high common-mode voltage difference amplifiers that have the ability to operate on single, low-voltage supplies.

Current shunt monitors have a common-mode voltage range that is independent of power supply (as opposed to classical difference amplifiers where the common-mode voltage range is proportional to power supply voltage). Unlike most high common-mode voltage difference amplifiers, current sense shunt monitors have gains for sensing low differential voltages (50 to 100mV).

Current sensing can be done on either the low-side (ground) or high-side (power supply). Low-side sensing is simple and requires no special components, but it often cannot be used because it either disturbs ground or requires additional wiring. Current shunt monitors are intended to make it easy to implement high-side current sensing. Discrete solutions to high-side sensing are difficult and costly to implement.

Common-Mode Voltage

The common-mode voltage range is typically the first parameter to be considered and this breaks down into two basic categories of current shunt monitors: families that handle only positive common-mode voltages above +2.7V (with a choice of upper limits up to +60V); and a family that handles –16V to +80V. The ability to sense common-mode voltages at ground and below is required when the power supply that the current is being sensed from could get shorted out, or if the shunt resistor is in an inductive load that could be exposed to inductive kickback. In addition, a common-mode range to –16V allows the current shunt monitor to be used to sense current in –12V to –15V power supplies. Lastly, it easily withstands battery reversals in 12V automotive applications.

Current Output vs. Voltage Output

Another broad category is the type of output. The current output families enable the gain to be set by selecting the value of an external load resistor. The fastest current shunt monitor is the INA139 or INA169. Current output INA170, and current output devices have a minimum common-mode voltage of +2.7V, with a maximum up to +60V.

Voltage output current shunt monitors have the advantage of a buffered voltage output which eliminates the need for an additional op amp in many applications. These devices are available in fixed gains of 14, 20, 50 and 100. The voltage output current shunt monitors all have a common-mode range of –16V to +80V.

See Page 92 for a complete selection of digital output current shunt monitors.

High-Side Measurement, Bi-Directional, Zero-Drift Current Shunt Monitor

INA21x Series

NEW

Get samples, datasheets, evaluation modules and app reports at: www.ti.com/sc/device/**PARTnumber** (Replace **PARTnumber** with **INA210**, **INA211**, **INA212**, **INA213** or **INA214**)

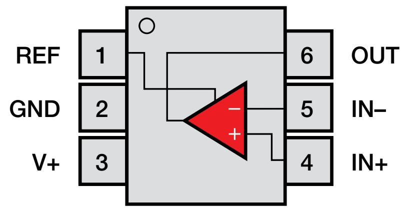
Key Features

- Wide common-mode range: –0.3V to +26V
- Offset voltage: ±35μV (max) (Enables shunt drops of 10mV full-scale)
- Accurate:
  - Gain: ±1% (max)
  - Offset drift: 0.5μV/°C (max)
  - Gain drift: 25ppm/°C (max)
- Gain range: 50V/V to 1000V/V
- Supply voltage: +2.7V to +18V
- Quiescent current: 100μA (max)
- Package: SC70

Applications

- Welding equipment
- Notebook computers
- Cell phones
- Telecom equipment
- Automotive
- Battery chargers

The INA21x devices are voltage-output, current shunt monitors that can sense drops across shunts at common-mode voltages from –1V to +26V, independent of the supply voltage. Five gains are available: 50V/V, 100V/V, 200V/V, 500V/V or 1000V/V. The low offset of the zero-drift architecture enables current sensing with maximum drops across the shunt as low as 10mV full-scale.



INA210 pin-out diagram.

Analog Current Shunt Monitors

Bi-Directional, Voltage-Output Current Shunt Monitors

INA28x Series

Get samples and datasheets at:
www.ti.com/sc/device/PARTnumber (Replace PARTnumber with INA282, INA283, INA284 or INA285)

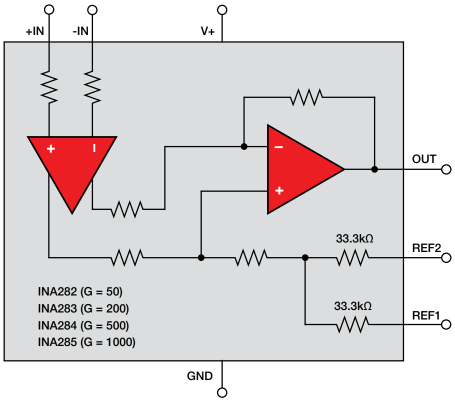
Key Features

- Wide common-mode range: –16V to +80V
- Offset voltage: ±10µV (max)
- Accurate:
  - Gain: ±1% (max)
  - Offset drift: 0.05µV/°C (max)
  - Gain drift: 25ppm/°C (max)
- Choice of gain range: 50V/V, 200V/V, 500V/V, 1000V/V
- Supply voltage: +2.7V to +18V
- Quiescent current: 900µA (max)
- Package: SOIC-8, DFN-10

Applications

- Welding equipment
- Notebook computers
- Cell phones
- Telecom equipment
- Automotive
- Battery chargers

The INA28x devices are voltage-output current shunt monitors that can sense drops across shunts at common-mode voltages from –16V to +80V, independent of the supply voltage. Four gains are available: 50V/V, 200V/V, 500V/V or 1000V/V. The low offset of the zero-drift architecture enables current sensing with maximum drops across the shunt as low as 10mV full-scale.



INA28x functional block diagram.

Current Shunt Monitors Selection Guide

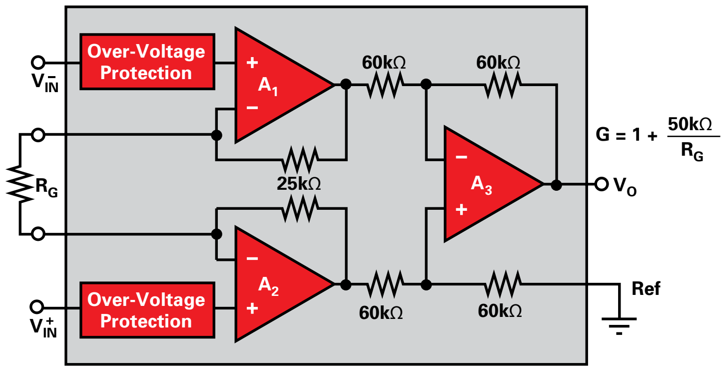
Device	Description	Ch.	Gain	Offset (µV) (max)	Offset Drift (µV/°C) (max)	CMRR (dB) (typ)	BW (MHz) (typ)	Output Voltage Swing (V) (min)	Power Supply (V)	I_Q Per Ch. (mA) (max)	Package(s)	Price*
Voltage-Output, High-Side Current Shunt Monitors												
INA19x	–16V to +80V CMV	1	20, 50, 100	2000	2.5	120	0.5, 0.3, 0.2	V(+) –0.2	+2.7 to 18	0.9	SOT23-5	$0.80
INA20x	Single/Dual Comparator, V_{REF}	1	20, 50, 100	2500	3.5	123	0.5, 0.3, 0.2	V(+) –0.25	+2.7 to 18	2.2	SO-14, TSSOP-14, MSOP-10, MSOP/SO/DFN-8	$1.25
INA27x	–16V to +18V CMV, Filtering Provision	1	14, 20	2000	2.5	120	0.13	V(+) –0.2	+2.7 to 18	0.9	SO-8	$0.80
INA21x	Zero Drift, Bi-Directional, –0.3V to +26V CMV	1	50, 100, 200, 500, 1000	35	0.5	140	0.014	V(+) –0.1	+2.7 to 26	0.1	SC-70	$0.65
INA28x	Zero Drift, Bi-Directional, –16V to +80V CMV	1	50, 200, 500, 1000	10	0.05	100	0.014	V(+) –0.1	+2.7 to 18	0.9	SO-8, DFN-10	$0.95
Current-Output, High-Side Current Shunt Monitors												
INA138	36V (max)	1	1 to 100	1000	1	120	0.8	0 to (V+) –0.8	+2.7 to 36	0.045	SOT23-5	$0.99
INA168	60V (max)	1	1 to 100	1000	1	120	0.8	0 to (V+) –0.8	+2.7 to 60	0.045	SOT23-5	$1.55
INA139	High Speed, 40V (max)	1	1 to 100	1000	1	115	0.44	0 to (V+) –1.2	+2.7 to 40	0.125	SOT23-5	$0.99
INA169	High Speed, 60V (max)	1	1 to 100	1000	1	120	0.44	0 to (V+) –1.2	+2.7 to 60	0.125	SOT23-5	$1.35
Bidirectional Current Shunt Monitors												
INA170	60V (max)	1	1 to 100	1000	1	120	0.4	0 to V(+) –1.2	+2.7 to 40	0.125	MSOP-8	$1.45
INA209	Voltage Current, Power Over I^2C	1	—	100	0.1	120	—	—	3 to 5.5	1.5	TSSOP-16	$3.50
INA219	Low Cost, Voltage Current, Power Over I^2C	1	—	100	0.1	120	—	—	3 to 5.5V	1.5	SOT23-8	$1.85
INA21x	Zero Drift, Bi-Directional, –0.3V to +26V CMV	1	50, 100, 200, 500, 1000	35	0.5	140	0.014	V(+) –0.1	+2.7 to 26	0.1	SC-70	$0.65
INA28x	Zero Drift, Bi-Directional, –16V to +80V CMV	1	50, 200, 500, 1000	10	0.05	100	0.014	V(+) –0.1	+2.7 to 18	0.9	SO-8, DFN-10	$0.95

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue***

Instrumentation Amplifiers

The instrumentation amplifier (IA) is a high input impedance, closed-loop, fixed- or adjustable-gain block that allows for the amplification of low-level signals in the presence of common-mode errors and noise. TI offers many types of instrumentation amplifiers including single-supply, low-power, high-speed and low-noise devices. These instrumentation amplifiers are available in either the traditional three-op-amp or in the cost-effective two-op-amp topology.



The three-op-amp topology is the benchmark for instrumentation amplifier performance.

Three-Op-Amp Version

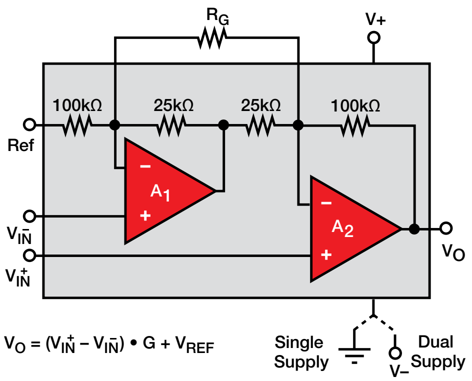
The three-op-amp topology is the benchmark for instrumentation amplifier performance. These devices provide a wide gain range (down to G = 1) and generally offer the highest performance. Symmetrical inverting and non-inverting gain paths provide better common-mode rejection at high frequencies. Some types use current-feedback-type input op amps which maintain excellent bandwidth in high gain.

Two-Op-Amp Version

The two-op-amp topology can provide wider common-mode voltage range, especially in low-voltage, single-supply applications. Their simpler internal circuitry allows lower cost, lower quiescent current and smaller package sizes. This topology, however, does not lend itself to gains less than four (INA125) or five (all others).

Design Considerations

Supply voltage—TI has developed a series of low-voltage, single-supply,



$V_O = (V_{IN}^{+} - V_{IN}^{-}) \cdot G + V_{REF}$

Two-op-amp topology provides wider common-mode range in low-voltage, single-supply applications.

rail-to-rail instrumentation amps suitable for a wide variety of applications requiring maximum dynamic signal range.

Gain requirement—for high-gain applications consider a low total noise device, because drift, input bias current and voltage offset all contribute to error.

Common-mode voltage range—the voltage input range over which the amplifier can operate and the differential pair behaves as a linear amplifier for differential signals.

Input bias current—can be an important factor in many applications, especially those sensing a low current or where the sensor impedance is very high. The INA116 requires only 3fA typical of input bias current.

Offset voltage and drift—IAs are generally used in high-gain applications, where any amp errors are amplified by the circuit gain. These errors can become significant unless V_{OS} and drift performance are considered in the device selection. Bipolar input stage INAs generally have smaller error contribution from offset and drift in low source inpedance applications.

Current-feedback vs. voltage-feedback input stage—appropriate for designers needing higher bandwidth or a more consistent 3dB rolloff frequency over various gain settings. The INA128 and INA129 provide a significantly higher 3dB rolloff frequency than voltage-feedback input stage instrumentation amps and have a 3dB rolloff at essentially the same frequency in both G = 1 and G = 10 configurations.

Technical Information

IAs output the difference accurately between the input signals providing Common-Mode Rejection (CMR). It is the key parameter and main purpose for using this type of device. CMR measures the device's ability to reject signals that are common to both inputs.

IAs are often used to amplify the differential output of a bridge sensor, amplifying the tiny bridge output signals while rejecting the large common-mode voltage. They provide excellent accuracy and performance, yet require minimal quiescent current. Gain is usually set with a single external resistor.

In some applications unwanted common-mode signals may be less conspicuous. Real-world ground interconnections are not perfect. What may, at first, seem to be a viable single-ended amplifier application can become an accumulation of errors. Error voltages caused by currents flowing in ground loops sum with the desired input signal and are amplified by a single-ended input amp. Even very low impedance grounds can have induced voltages from stray magnetic fields. As accuracy requirements increase, it becomes more difficult to design accurate circuits with a single-ended input amplifier. The differential input instrumentation amplifier is the answer.

Instrumentation Amplifiers

Lowest Power, Zero-Drift Instrumentation Amplifier
INA333

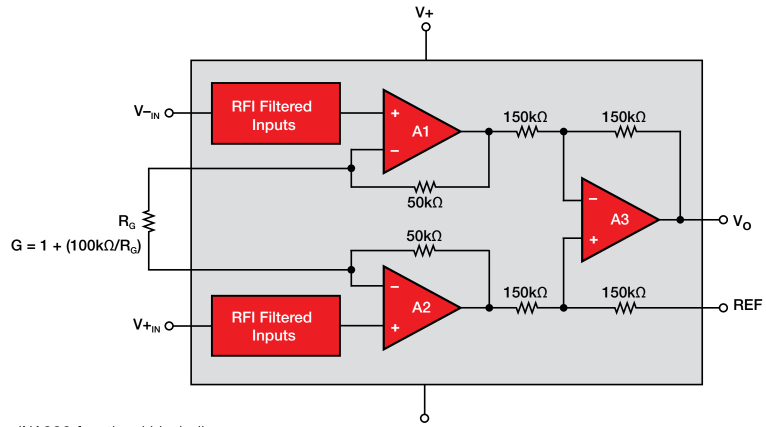
NEW

Get samples, datasheets and app reports at: **www.ti.com/sc/device/INA333**

Key Features
- Low offset voltage: 25µV (max)
- Low drift: 0.1µVV/°C
- Low input bias current: 200pA (max)
- Low noise: 50nV/√Hz
- Supply voltage: +1.8V to +5.5V
- Quiescent current: 75µA (max)
- RFI-filtered inputs
- Package: MSOP-8, DFN-10

Applications
- Bridge amplifiers
- Weigh scales
- Thermocouple amplifiers
- RTD sensor amplifiers
- Medical instrumentation
- Data acquisition

The INA333 is a low-power, precision instrumentation amplifier offering excellent accuracy. A single external resistor sets any gain from 1 to 10,000 and provides as industry-standard equation ($G = 1+(100k\Omega/R_G)$). With its 3-op-amp design, low quiescent current and operation with power supplies as low as +0.9V, it is ideal for a wide range of portable applications.



INA333 functional block diagram.

Precision, Low-Power Instrumenation Amplifier
INA821

PREVIEW*

Get samples and datasheets at: **www.ti.com/sc/device/INA821**

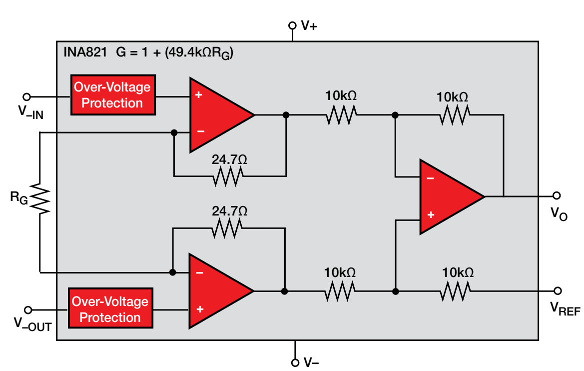
Key Features
- Voltage offset : 25µV (max) with 0.3µV/°C drift
- Input bias current: 10nA (max)
- High CMR vs. frequency: 80dB at 10kHz
- ±40V input protection
- Supply voltage: ±2.25V to ±18V
- Temperature range: –40°C to +125°C
- Packaging: MSOP, SO, and DFN 3x3mm

Applications
- Bridge amplifiers
- Weigh scales
- Thermocouple amplifiers
- RTD sensor amplifiers
- Medical instrumentaiton
- Data aquisition

The INA821 is a low-power, precision instrumentation amplifier offering excellent accuracy. The versatile 3-op-amp design and small size make it ideal for a wide range of applications. Current-feedback input circuitry provides wide bandwidth, even at high gain (200kHz at G = 100).

A single external resistor sets any gain from 1 to 10,000. The INA821 provides an industry-standard gain equation: $G = 1 + (49.4k\Omega/R_G)$. It is laser trimmed for very low offset voltage (25µV) and high common-mode rejection (130dB at G = 100). It operates with supplies as low as ±2.25V. Internal input protection can withstand up to ±40V without damage.

The INA821 will be available in SO-8, MSOP-8, and 3x3mm DFN-8 and is specified for the –40°C to +125°C temperature range.



INA821 functional block diagram. Estimated release date 3Q 2009.

Single-Supply Instrumentation Amplifiers

Single-Supply Instrumentation Amplifiers Selection Guide

Device	Description	Gain	Non Linear-ity (%) (max)	Input Bias Current (nA) (max)	Offset at G = 100 (µV) (max)	Offset Drift (µV/°C) (max)	CMRR at G = 100 (dB) (min)	BW at G = 100 (kHz) (min)	Noise 1kHz (nV/√Hz) (typ)	Power Supply (V)	I_Q Per Amp (mA) (max)	Package(s)	Price*
Single-Supply, Low-Power, I_Q < 525µA per Instrumentation Amp													
INA333	Zero Drift, Low Power, Precision	1 to 10000	0.00001	0.2	25	0.1	100	3.5	50	1.8 to 5.5	0.075	MSOP-8, DFN-8	$1.80
INA321	RRO, SHDN, Low Offset, Gain Error, Wide Temp	5 to1000	0.01	0.01	500	7	90	50	100	2.7 to 5.5	0.06	MSOP-8	$1.10
INA2321	Dual INA321	5 to1000	0.01	0.01	500	7	90	50	100	2.7 to 5.5	0.06	TSSOP-14	$1.75
INA322	RRO, SHDN, Wide Temp, Low Cost	5 to 1000	0.01	0.01	10,000	7	60	50	100	2.7 to 5.5	0.06	MSOP-8	$0.95
INA2322	Dual INA322	5 to 1000	0.01	0.01	10,000	7	60	50	100	2.7 to 5.5	0.06	TSSOP-14	$1.65
INA122	µPower, RRO, CM to GND	5 to 10000	0.012	25	250	3	83	5	60	2.2 to 36	0.085	DIP-8, SOIC-8	$2.45
INA332	RRO, Wide BW, SHDN, Wide Temp, Low Cost	5 to 1000	0.01	0.01	8,000	5	60	500	46	2.7 to 5.5	0.49	MSOP-8	$0.90
INA2332	Dual INA332	5 to 1000	0.01	0.01	8,000	5	60	500	46	2.7 to 5.5	0.49	TSSOP	$1.45
INA126	µPower, < 1V V_{SAT}, Low Cost	5 to 10000	0.012	25	250	3	83	9	35	2.7 to 36	0.2	DIP/SO/MSOP-8	$1.15
INA2126	Dual INA126	5 to 10000	0.012	25	250	3	83	9	35	2.7 to 36	0.2	DIP/SO/MSOP-16	$1.85
INA118	Precision, Low Drift, Low Power[2]	1 to 10000	0.002	5	55	0.7	107	70	10	2.7 to 36	0.385	DIP-8, SOIC-8	$4.80
INA331	RRO, Wide BW, SHDN, Wide Temp	5 to 1000	0.01	0.01	500	5	90	2000	46	2.7 to 5.5	0.49	MSOP-8	$1.10
INA2331	Dual INA331	5 to 1000	0.01	0.01	1000	5	80	2000	46	2.7 to 5.5	0.49	TSSOP-14	$1.80
INA125	Internal Ref, Sleep Mode[2]	4 to 10000	0.01	25	250	2	100	4.5	38	2.7 to 36	0.525	DIP-16, SOIC-16	$2.05
Single-Supply, Low Input Bias Current, I_B < 50pA													
INA155	Low Offset, RRO, Wide Temp, SR = 6.5V/µs	10, 50	0.015	0.01	1000	5	92	110	40	2.7 to 5.5	2.1	SO-8, MSOP-8	$1.10
INA156	Low Offset, RRO, Low Cost, Wide Temp, SR = 6.5V/µs	10, 50	0.015	0.01	8000	5	74	110	40	2.7 to 5.5	2.5	MSOP-8	$0.95
INA321	RRO, SHDN, Low Offset, Gain Error, Wide Temp	5 to 1000	0.01	0.01	500	7	90	50	100	2.7 to 5.5	0.06	MSOP-8	$1.10
INA2321	Dual INA321	5 to 1000	0.01	0.01	500	7	90	50	100	2.7 to 5.5	0.06	TSSOP-14	$1.75
INA322	RRO, SHDN, Wide Temp, Low Cost	5 to 1000	0.01	0.01	10000	7	60	50	100	2.7 to 5.5	0.06	MSOP-8	$0.95
INA2322	Dual INA322	5 to 1000	0.01	0.01	10000	7	60	50	100	2.7 to 5.5	0.06	TSSOP-14	$1.65
INA331	RRO, Wide BW, SHDN, Wide Temp	5 to 1000	0.01	0.01	500	5	90	2000	46	2.7 to 5.5	0.49	MSOP-8	$1.10
INA2331	Dual INA331	5 to 1000	0.01	0.01	1000	5	80	2000	46	2.7 to 5.5	0.49	TSSOP-14	$1.80
INA332	RRO, Wide BW, SHDN, Wide Temp, Low Cost	5 to 1000	0.01	0.01	8,000	7	60	500	46	2.7 to 5.5	0.49	MSOP-8	$0.90
INA2332	Dual INA332	5 to 1000	0.01	0.01	8,000	7	60	500	46	2.7 to 5.5	0.49	TSSOP-14	$1.45
Single-Supply, Precision, V_{OS} < 300µV, Low V_{OS} Drift													
INA118	Precision, Low Drift, Low Power[2]	1 to 10000	0.002	5	55	0.7	107	70	10	2.7 to 36	0.385	DIP-8, SOIC-8	$4.80
INA333	Zero Drift, Low Power, Precision	1 to 10000	0.00001	0.2	25	0.1	100	3.5	50	1.8 to 5.5	0.075	MSOP-8, DFN-8	$1.80
INA326	RRIO, Auto-Zero, CM > Supply, Low Drift	0.1 to 10000	0.01	2	100	0.4	100	1	33	2.7 to 5.5	3.4	MSOP-8	$1.95
INA327	RRIO, Auto-Zero, SHDN, CM > Supply, Low Drift	0.1 to 10000	0.01	2	100	0.4	100	1	33	2.7 to 5.5	3.4	MSOP-10	$2.10
INA337	RRIO, Auto-Zero, Low Drift, CM > Supply, Wide Temp	0.1 to 10000	0.01	2	100	0.4	106	1	33	2.7 to 5.5	3.4	MSOP-8	$1.95
INA338	RRIO, Auto-Zero, Low Drift, CM > Supply, SHDN, Wide Temp	0.1 to 10000	0.01	2	100	0.4	106	1	33	2.7 to 5.5	3.4	MSOP-10	$2.10
INA122	µPower, RRO, CM to GND	5 to 10000	0.012	25	250	3	85	5	60	2.2 to 36	0.085	DIP-8, SOIC-8	$2.45
INA125	Internal Ref, Sleep Mode[2]	4 to 10000	0.01	25	250	2	100	4.5	38	2.7 to 36	0.525	DIP-16, SOIC-16	$2.05
INA126	µPower, < 1V V_{SAT}, Low Cost	5 to 10000	0.012	25	250	3	83	9	35	2.7 to 36	0.2	DIP/SO/MSOP-8	$1.15
INA2126	Dual INA126	5 to 10000	0.012	25	250	3	83	9	35	2.7 to 36	0.2	DIP/SO/MSOP-16	$1.85
Signal Amplifiers for Temperature Control I_B (nA) Temp Error[3] 1/F Noise													
INA330	Optimized for Precision 10kΩ Thermistor Applications	—	—	0.23	—	0.009°C[1]	—	1	0.0001°C pp[1]	2.7 to 5.5	3.6	MSOP-10	$1.65

[1]Typical [2]Internal +40V input protection [3] –40°C to +85°C

*Suggested resale price in U.S. dollars in quantities of 1,000.

New products are listed in **bold red.**

Dual-Supply Instrumentation Amplifiers

Dual-Supply Instrumentation Amplifiers Selection Guide

Device	Description	Gain	Non Linearity (%) (max)	Input Bias Current (nA) (max)	Offset at G = 100 (µV) (max)	Offset Drift (µV/°C) (max)	CMRR at G = 100 (dB) (min)	BW at G = 100 (kHz) (min)	Noise 1kHz (nV/√Hz) (typ)	Power Supply (V)	I_Q Per Amp (mA) (max)	Package(s)	Price*
Dual-Supply, Low-Power, I_Q < 850µA per Instrumentation Amp													
INA122	µPower, RRO, CM to GND	5 to 10000	0.012	25	250	3	83	5	60	±1.3 to ±18	0.085	DIP-8, SOIC-8	$2.45
INA126[2]	µPower, < 1V V_{SAT}, Low Cost	5 to 10000	0.012	25	250	3	83	9	35	±1.35 to ±18	0.2	DIP/SO/MSOP-8	$1.15
INA118	Precision, Low Drift, Low Power[1]	1 to 10000	0.002	5	55	0.7	107	70	10	±1.35 to ±18	0.385	DIP-8, SOIC-8	$4.80
INA121	Low Bias, Precision, Low Power[1]	1 to 10000	0.005	0.05	500	5	96	50	20	±2.25 to ±18	0.525	DIP-8, SO-8	$2.50
INA125	Internal Ref, Sleep Mode[1]	4 to 10000	0.01	25	250	2	100	4.5	38	±1.35 to ±18	0.525	DIP-16, SOIC-16	$2.05
INA128[2]	Precision, Low Noise, Low Drift[1]	1 to 10000	0.002	5	60	0.7	120	200	8	±2.25 to ±18	0.75	DIP-8, SOIC-8	$3.05
INA129	Precision, Low Noise, Low Drift,[1] AD620 Second Source	1 to 10000	0.002	5	60	0.7	120	200	8	±2.25 to +18	0.75	DIP-8, SOIC-8	$4.45
INA141[2]	Precision, Low Noise, Low Power, Pin Compatible with AD62121	10, 100	0.002	5	50	0.5	117	200	8	±2.25 to +18	0.8	DIP-8, SOIC-8	$3.55
INA821	Precision, Low Power in MSOP-8	1 to 10000	0.00001	10	25	0.3	120	200	8	±2.25 to ±18	0.6	MSOP-8, SO-8, DFN-8	$2.00
Dual-Supply, Low Input Bias Current, I_B < 50pA													
INA110	Fast Settle, Low Noise, Wide BW	1, 10, 100, 200, 500	0.01	0.05	1000	2.5	106	470	10	±6 to ±18	4.5	DIP-16, SOIC-16	$7.00
INA121	Precision, Low Power[1]	1 to 10000	0.005	0.05	500	5	96	50	20	±2.25 to ±18	0.525	DIP-8, SO-8	$2.50
INA111	Fast Settle, Low Noise, Wide BW	1 to 1000	0.005	0.02	520	6	106	450	10	±6 to ±18	4.5	DIP-8, SO-16	$4.20
INA116	Ultra-Low I_B 3fA (typ), with Buffered Guard Drive Pins[1]	1 to 1000	0.005	0.0001	5000	40	86	70	28	±4.5 to ±18	1.4	DIP-16, SO-16	$4.20
Dual-Supply, Precision V_{OS} < 300µV, Low V_{OS} Drift													
INA821	Precision, Low Power in MSOP-8	1 to 10000	0.00001	10	25	0.3	120	200	8	±2.25 to ±18	0.6	MSOP-8, SO-8, DFN-8	$2.00
INA114	Precision, Low Drift[1]	1 to 10000	0.002	2	50	0.25	110	10	11	±2.25 to ±18	3	DIP-8, SO-16	$4.80
INA115	Precision, Low Drift, w/Gain Sense Pins[1]	1 to 10000	0.002	2	50	0.25	110	10	11	±2.25 to ±18	3	SO-16	$4.20
INA131	Low Noise, Low Drift[1]	100	0.002	2	50	0.25	110	70	12	±2.25 to ±18	3	DIP-8	$3.80
INA141[2]	Precision, Low Noise, Low Power, Pin Compatible with AD62121	10, 100	0.002	5	50	0.5	117	200	8	±2.25 to ±18	0.8	DIP-8, SOIC-8	$3.55
INA118	Precision, Low Drift, Low Power[1]	1 to 10000	0.002	5	55	0.7	107	70	10	±1.35 to ±18	0.385	DIP-8, SOIC-8	$4.80
INA128[2]	Precision, Low Noise, Low Drift[1]	1 to 10000	0.002	5	60	0.7	120	200	8	±2.25 to ±18	0.75	DIP-8, SOIC-8	$3.05
INA129	Precision, Low Noise, Low Drift, AD620 Second Source[1]	1 to 10000	0.002	5	60	0.7	120	200	8	±2.25 to ±18	0.75	DIP-8, SOIC-8	$4.45
INA122	µPower, RRO, CM to GND	5 to 10000	0.012	25	250	3	83	5	60	±1.3 to ±18	0.085	DIP-8, SOIC-8	$2.45
INA125	Internal Ref, Sleep Mode[1]	4 to 10000	0.01	25	250	2	100	4.5	38	±1.35 to ±18	0.525	DIP-16, SOIC-16	$2.05
INA126[2]	µPower, < 1V V_{SAT}, Low Cost	5 to 10000	0.012	25	250	3	83	9	35	±1.35 to ±18	0.2	DIP/SO/MSOP-8	$1.15
INA101	Low Noise, Wide BW, Gain Sense Pins, Wide Temp	1 to 1000	0.002	20	250	0.25	100	25	13	±5 to ±20	8.5	PDIP-14, SO-16	$7.95
INA110	Fast Settle, Low Noise, Low Bias, Wide BW	1, 10, 100, 200, 500	0.01	0.05	1000	2.5	106	470	10	±6 to ±18	4.5	CDIP-16	$7.00
Dual-Supply, Lowest Noise													
INA103	Precision, Fast Settle, Low Drift, Audio, Mic Pre Amp, THD+N = 0.0009%	1 to 1000	0.00061	12000	255	1.23	100	800	1	±9 to ±25	12.5	DIP-16, SO-16	$5.00
INA163	Precision, Fast Settle, Low Drift, Audio, Mic Pre Amp, THD+N = 0.002%	1 to 10000	0.0006	12000	300	1.23	100	800	1	±4.5 to ±18	12	SOIC-14	$2.90
INA166	Precision, Fast Settle, Low Drift, Audio, Mic Pre Amp, THD+N = 0.09%	2000	0.005	12000	300	2.53	100	450	1.3	±4.5 to ±18	12	SO-14	$5.95
INA217	Precision, Low Drift, Audio, Mic PreAmp, THD+N = 0.09%, SSM2017 Replacement	1 to 10000	0.00061	12000	300	1.23	100	800	1.3	±4.5 to ±18	12	DIP-8, SO-16	$2.50

[1] Internal +40V input protection. [2] Parts also available in dual version.

*Preview products are listed in **bold blue.***

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Programmable Gain Amplifiers

Programmable gain instrumentation amplifiers (PGAs) are extremely versatile data acquisition input amplifiers that provide digital control of gain for improved accuracy and extended dynamic range. Many have inputs that are protected to ±40V even with the power supply off. A single input amplifier type can be connected to a variety of sensors or signals. Under processor control, the switched gain extends the dynamic range of the system.

All PGA-series amps have TTL- or CMOS-compatible inputs for easy microprocessor interface. Inputs are laser trimmed for low offset voltage and low drift to allow use without the need of external components.

Design Considerations
Primary

Digitally-selected gain required—two pins allow the selection of up to four different gain states. A PGA202 and PGA203 can be put in series for greater gain selection.

Non-linearity (accuracy)—depends heavily on what is being driven. A 16-bit converter will require significantly better accuracy (i.e., lower non-linearity) than a 10-bit converter.

Secondary

Gain error and drift—for higher gain, high-precision applications will require closer attention to drift and gain error.

Input bias current— high source impedance applications often require FET-input amps to minimize bias current errors.

Technical Information

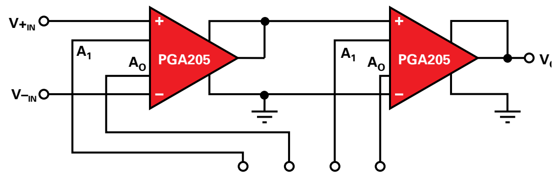
The PGA206 provides binary gain steps of 1, 2, 4 and 8V/V, selected by CMOS- or TTL-compatible inputs. The PGA207 has gains of 1, 2, 5 and 10V/V, adding a full decade to the system dynamic range. The low input bias current, FET-input stage assures that series resistance of the multiplexer does not introduce errors.

Fast settling time (3.5µs to 0.01%) allows fast polling of many channels.

The PGA204 and PGA205 have precision bipolar input stages especially well suited to low-level signals. The PGA205 has gain steps of 1, 2, 4 and 8.

Typical Applications

- Data acquisition
- Auto-ranging circuits
- Remote instrumentation
- Test equipment
- Medical/physiological instrumentation
- General analog interface boards



GAIN	A_3	A_2	A_1	A_0
1	0	0	0	0
2	0	1	0	0
4	1	0	0	0
8	1	1	0	0
16	1	1	0	1
32	1	1	1	0
64	1	1	1	1

Connecting two programmable gain amps can provide binary gain steps G = 1 to G = 64.

Digitally Programmable Gain Amplifiers Selection Guide

Device	Description	Gain	Non Linearity at G = 100 (%) (max)	Offset (µV) (max)	Offset Drift (µV/°C) (max)	CMRR at G = 100 (dB) (min)	BW at G = 100 (kHz) (typ)	Noise at—1kHz (nV/√Hz) (typ)	Power Supply (V)	I_Q (mA) (max)	Package(s)	Price*
PGA103	Precision, Single-Ended Input	1, 10, 100	0.01	500	2 (typ)	—	250	11	±4.5 to ±18	3.5	SOIC-8	$4.35
PGA202	High Speed, FET-Input, 50pA I_B	1, 10, 100, 1000	0.012	1000	12	92	1000	12	±6 to ±18	6.5	DIP-14	$7.75
PGA203	High Speed, FET-Input, 50pA I_B	1, 2, 4, 8	0.012	1000	12	92	1000	12	±6 to ±18	6.5	DIP-14	$7.75
PGA204	High Precision, Gain Error: 0.25%	1, 10, 100, 1000	0.002	50	0.25	110	10	13	±4.5 to ±18	6.5	SOIC-16, PDIP-16	$8.35
PGA205	Gain Drift: 0.024ppm/°C	1, 2, 4, 8	0.002	50	0.25	95	100	15	±4.5 to ±18	6.5	SOIC-16, PDIP-16	$8.35
PGA206	High Speed, FET-Input, 100pA I_B	1, 2, 4, 8	0.002	1500	2 (typ)	95	600	18	±4.5 to ±18	13.5	DIP-16, SOIC-16	$10.80
PGA207	High Speed, FET-Input, 100pA I_B	1, 2, 5, 10	0.002	1500	2 (typ)	95	600	18	±4.5 to ±18	13.5	DIP-16, SOIC-16	$11.85
PGA112/3	Zero-Drift, Precision PGA w/2ch MUX	1 to 200	—	100	0.9	—	380	12	+2.2V to +5.5V	0.45	MSOP-10	$1.00
PGA116/7	Zero-Drift, Precision PGA w/10ch MUX	1 to 200	—	100	1.2	—	380	12	+2.2V to +5.5V	0.45	TSSOP-20	$1.83
PGA309	0.1% Digitally Calibrated Bridge Sensor Conditioner, Voltage Output	8 to 1152	0.002	50	0.2	20	60	210	+2.7 to +5.5	1.6	TSSOP-16	$2.95
PGA308	Single Supply, Auto-Zero, Sensor Amplifier w/Programmable Gain and Offset	4 to 1600	—	40	0.2	95	100	50	+2.7 to +5.5	2	MSOP-10, DFN-10	$2.00

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.***

Programmable Gain Amplifiers

Zero-Drift, Programmable Gain Amplifier w/MUX
PGA112, PGA113, PGA116, PGA117

NEW

Get samples, datasheets and app reports at: **www.ti.com/sc/device/PARTnumber** (Replace **PARTnumber** with **PGA112**, **PGA113**, **PGA116**, or **PGA117**)

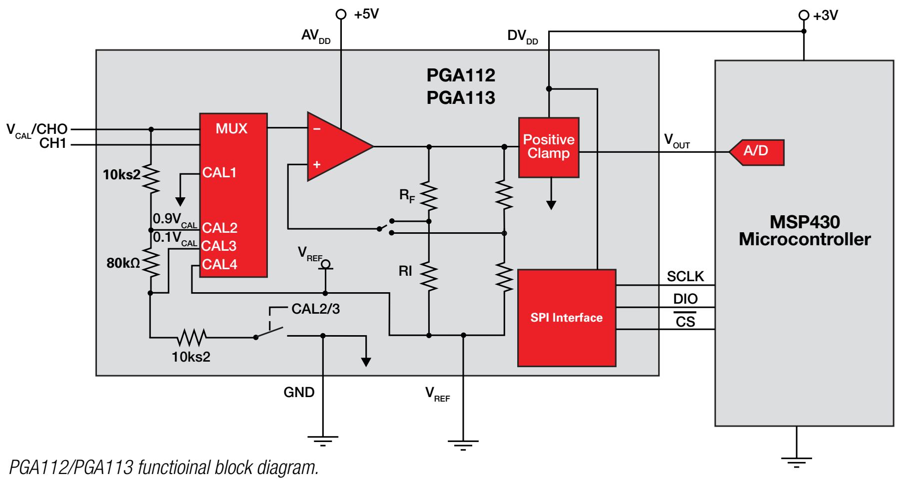
Key Features

- Rail-to-rail input/output
- Offset: 100µV w/0.35µV/°C
- Gain error: 0.05% (typ)
- Binary gains: 1, 2, 4, 8, 16, 32, 64, 128 (PGA112/16)
- Scope gains: 1, 2, 5, 10, 20, 50, 100, 200 (PGA113/17)
- 2- or 10-channel versions
- Supply voltage: +2.2V to +5.5V
- SPI interface (10MHz)
- Package: MSOP-8, DFN-10

Applications

- Portable data acquisition
- PC-based signal acquisition systems
- Test and measurement
- Programmable logic controllers
- Battery powered instruments
- Handheld test equipment
- Remote e-metering
- Automatic gain control

The PGA11x series offers 2-, 6- or 10-channel analog inputs, binary or scope gains, and four internal calibration channels, respectively, tied to V_{REF}, GND, $0.9V_{CAL}$ and $0.1V_{CAL}$, where V_{CAL} is an external voltage connected to Channel 0. The 6- and 10-channel versions offer SPI daisy-chain capability and a hardware shutdown pin.



PGA112/PGA113 functioinal block diagram.

Auto-Zero Sensor Amplifier with Programmable Gain and Offset
PGA308

NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/PGA308**

Key Features

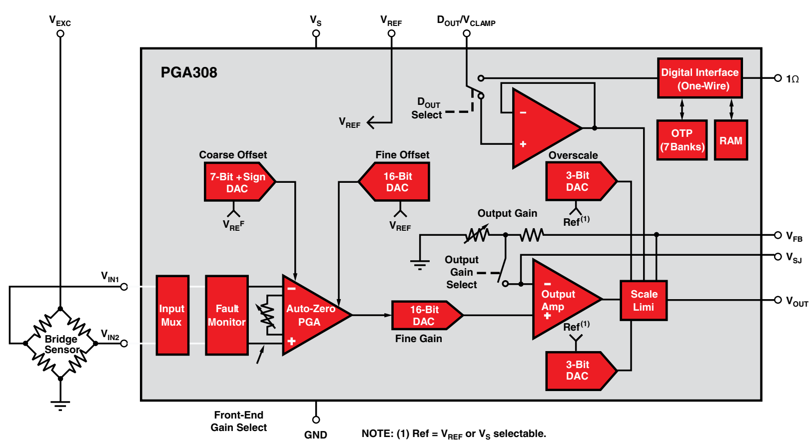
- Digital calibration for bridge sensors
- Offset select: coarse and fine
- Gain select: coarse and fine
- Bridge fault monitor
- Input MUX for lead swap
- Over/under scale limits
- Seven banks OTP memory
- Supply voltage: +2.7V to +5.5V
- Packages: MSOP-10, 3x4mm DFN-10

Applications

- Bridge sensors
- Remote 4-20mA transmitters
- Strain, load, weigh scales
- Automotive sensors

The PGA308 is a programmable analog sensor signal conditioner. The analog signal path amplifies the sensor signal and provides digital calibration for offset and gain. Gain and offset calibration parameters are stored onboard in seven banks of one-time programmable (OTP) memory.

The all-analog signal path contains a 2x2 input multiplexer to allow electronic sensor lead swapping, a coarse offset adjust, an auto-zero programmable gain instrumentation amplifier, a fine gain adjust a fine offset adjust, and a programmable gain output amplifier.



PGA308 functioinal block diagram.

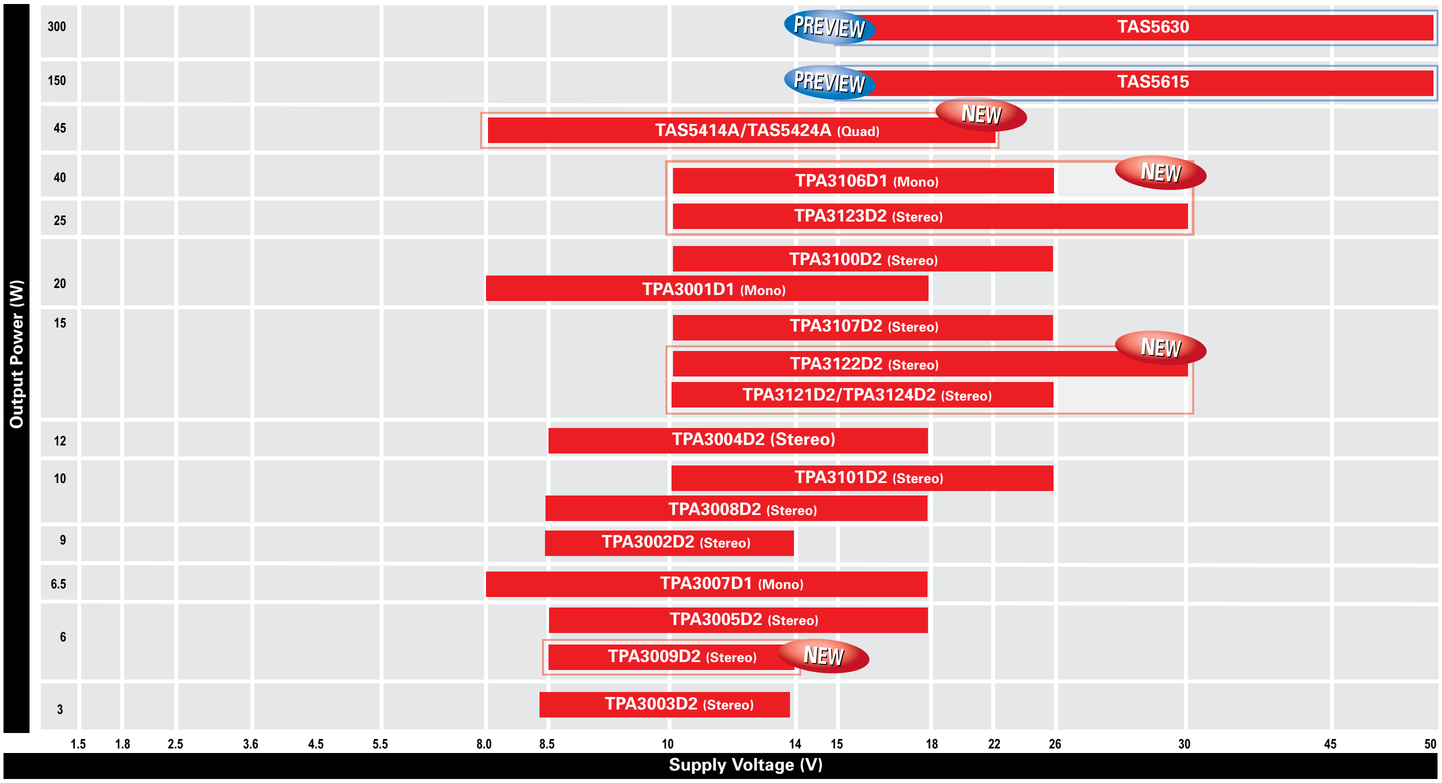
High-Power, Analog-Input Class-D Speaker Amplifiers

Output Power per Channel

- Maximum power is decided primarily by power supply (output voltage and current) and speaker impedance.
- Efficiency of Class-D amplifiers is typically between 80% and 90%, which reduces demands on the power supply design.
- The maximum input signal level dictates the required power amplifier gain to achieve the desired output power.
- For best noise performance, the gain should be as low as possible.

Output Filter Design

- Most of TI's Class-D amplifiers operate without a filter when speaker wires are less than 10cm.
- When speaker wires are long, place a second-order low-pass (LC) filter as close as possible to the amplifier's output pins.
- The filter must be designed specifically for the speaker impedance because the load resistance affects the filter's quality factor, or "Q."
- A ferrite bead may also eliminate very high-frequency interference.
- Place decoupling capacitors and output filters as close as possible to the amplifier IC.
- When using a ferrite bead filter place the LC filter closest to the IC.
- Always connect the PowerPAD™ connection to the power ground.
- When the PowerPAD package serves as a central "star" ground for amplifier systems, use only a single point of connection for the analog ground to the power ground.



Low-Power Analog-Input Class-D Speaker Amplifiers

Output Power per Channel

- Maximum power is decided primarily by power supply and speaker impedance.
- Efficiency of Class-D amplifiers is typically 80 and 90%, which reduces demands on the power supply design.
- The maximum input signal level dictates the required gain to achieve the desired output power.
- For best noise performance, the gain should be as low as possible.
- For louder volume from the speakers, use a TI Class-D amplifier with an integrated boost converter or DRC AGC function.
- An integrated boost converter provides higher volume at low battery levels.
- DRC (Dynamic Range Compression increases the average volume, optimizes the audio to fit the dynamic range of the speaker and protects the speaker from high power damage.

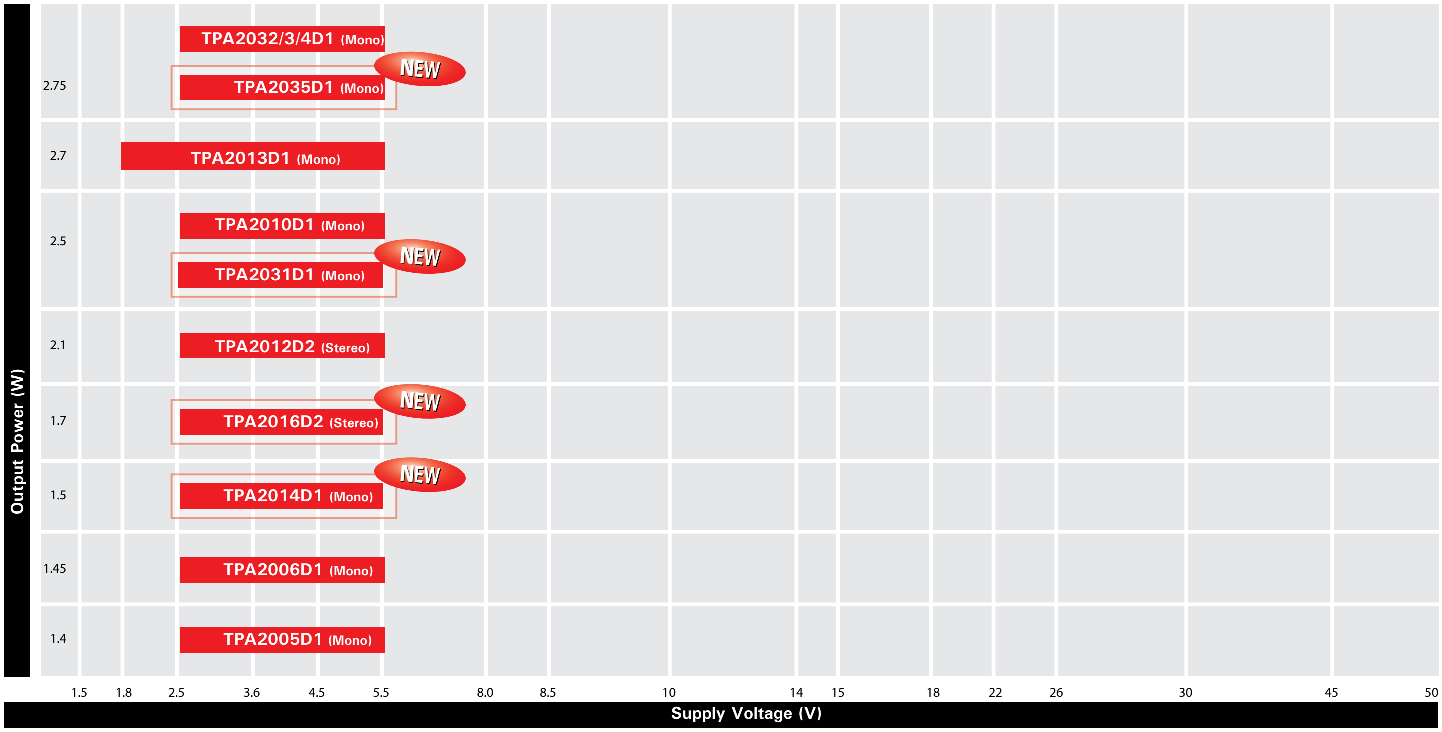
Output Filter Design

- Most of TI's Class-D amplifiers operate without a filter when speaker wires are less than 10cm.
- A ferrite bead filter can also reduce very high-frequency interference.
- For very stringent EMC requirements, place a 2nd-order low-pass LC filter as close as possible to the amplifier's output pins.

PCB Layout

- Place decoupling capacitors and output filters as close as possible to the amplifier IC.
- When using a PowerPAD™, connect to the appropriate signal as per TI datasheet.

Low-Power Analog-Input Class-D Speaker Amplifiers



Digital-Input Class-D Speaker Amplifiers

Output Power per Channel

- After determining the number of speakers in a system, specify the output power for each channel.
- Maximum power is decided primarily by power supply (output voltage and current) and speaker impedance.
- Efficiency of Class-D amplifiers is typically between 80% and 90%, which reduces demands on power-supply designs when compared to Class-AB amplifier requirements.
- The maximum input signal level dictates the required power amplifier gain to achieve the desired output power.
- For best noise performance, the gain should be as low as possible.

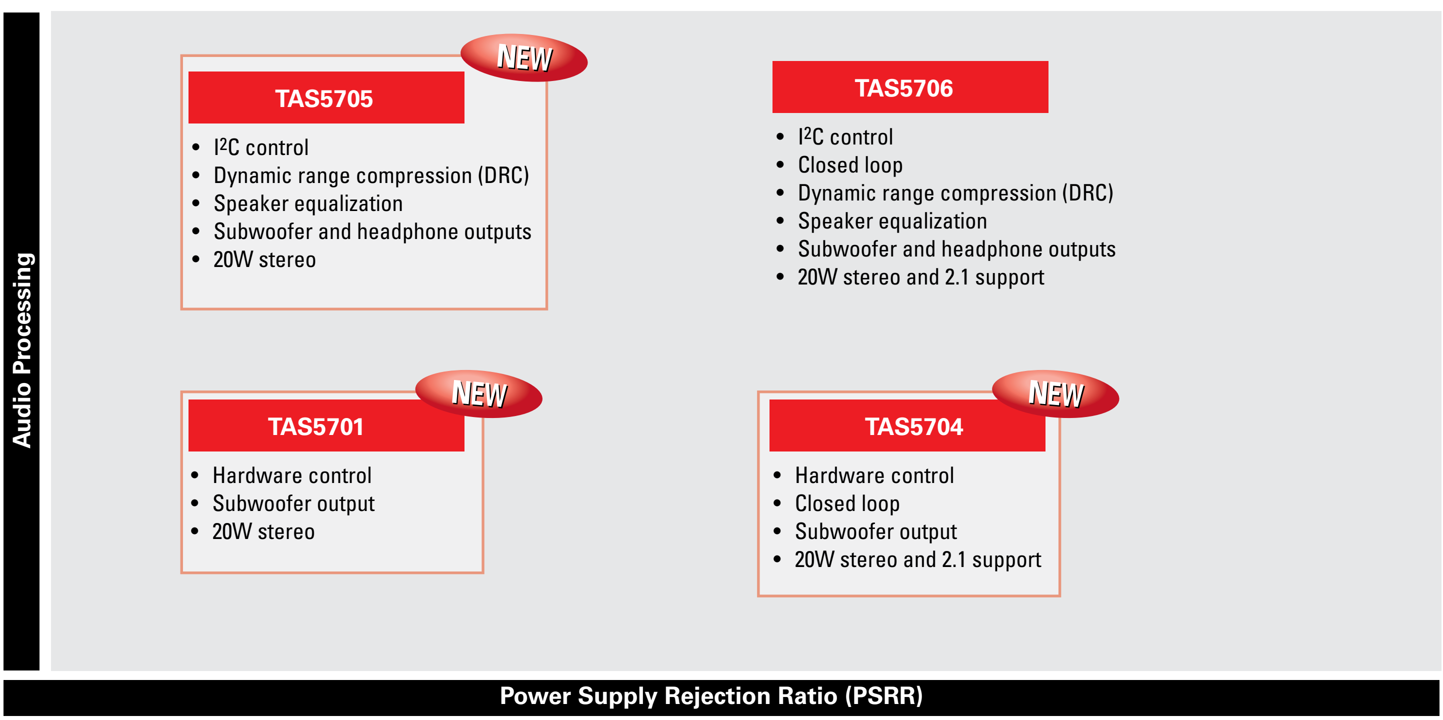
Output Filter Design

- Most of TI's Class-D amplifiers operate without a filter when speaker wires are less than 10cm.
- EMI from high-frequency switching is a major design challenge.
- When speaker wires are long, place a second-order low-pass (LC) filter as close as possible to the amplifier's output pins.
- The filter must be designed specifically for the speaker impedance because the load resistance affects the filter's quality factor, or "Q."
- A ferrite bead may also eliminate very high-frequency interference.

PCB Layout

- Class-D amplifier outputs switch at relatively high frequencies, similar to switch-mode power supplies, and require additional attention to external component placement and trace routing.
- Place decoupling capacitors and output filters as close as possible to the amplifier IC.
- When using a ferrite bead filter place the LC filter closest to the IC.
- Always connect the PowerPAD™ connection to the power ground.
- When the PowerPAD package serves as a central "star" ground for amplifier systems, use only a single point of connection for the digital and analog grounds to the power ground.
- See the application brief "PowerPAD™ Made Easy" for IC package layout and other design considerations at: **http://focus.ti.com/lit/an/slma004b/slma004b.pdf**

Digital-Input Class-D Speaker Amplifiers



PWM-Input Class-D Power Stages

Output Power per Channel

- After determining the number of speakers in a system, specify the output power for each channel.
- Maximum power is decided primarily by power supply (output voltage and current) and speaker impedance.
- Efficiency of Class-D amplifiers is typically between 80% and 90%, which reduces demands on power-supply designs when compared to Class-AB amplifier requirements.

Output Filter Design

- Most of TI's Class-D amplifiers operate without a filter when speaker wires are less than 10cm.
- EMI from high-frequency switching is a major design challenge.
- When speaker wires are long, place a second-order low-pass (LC) filter as close as possible to the amplifier's output pins.
- The filter must be designed specifically for the speaker impedance because the load resistance affects the filter's quality factor, or "Q."
- A ferrite bead may also eliminate very high-frequency interference.

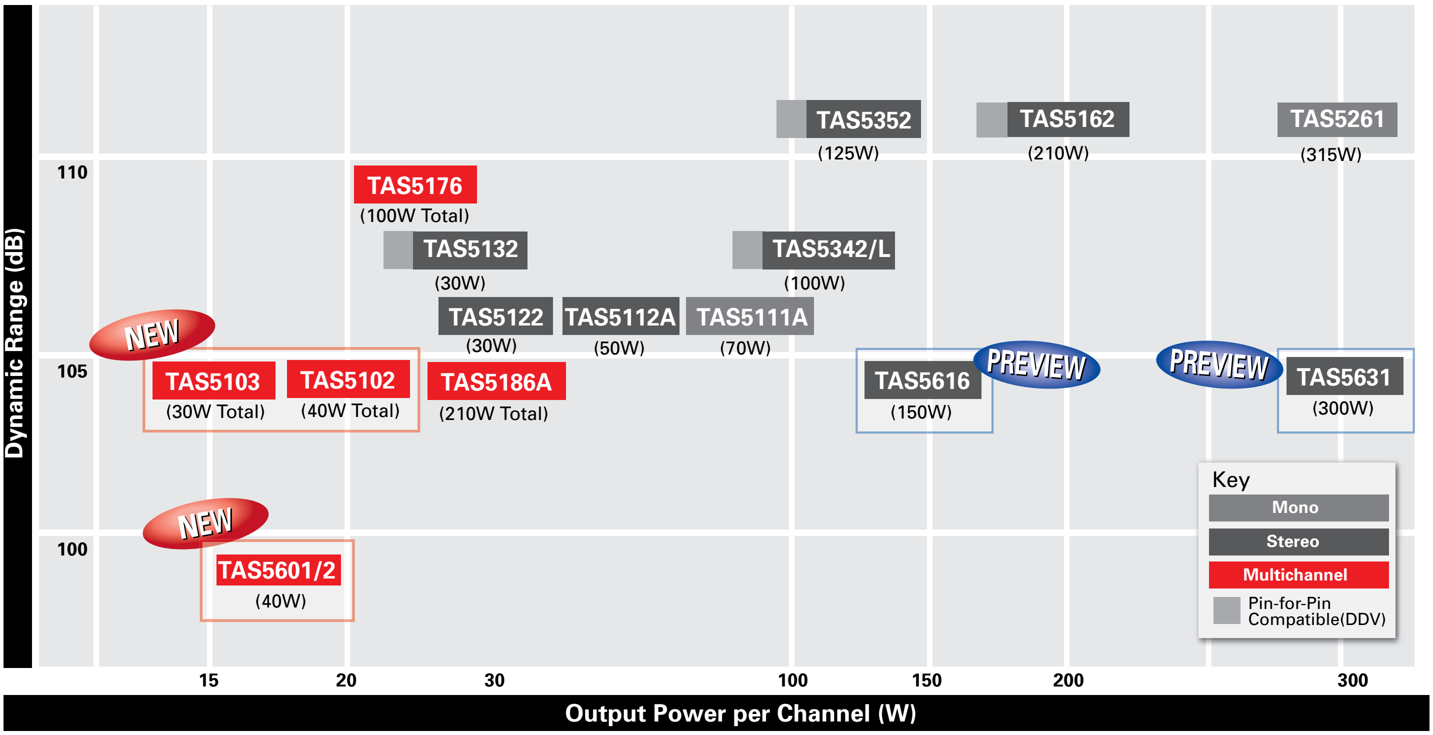
PCB Layout

- Class-D amplifier outputs switch at relatively high frequencies, similar to switch-mode power supplies, and require additional attention to external component placement and trace routing.
- Place decoupling capacitors and output filters as close as possible to the amplifier IC.
- When using a ferrite bead filter in conjunction with an LC filter, place the LC filter closest to the IC.
- See grounding layout guidelines in the application report "System Design Considerations for True Digital Audio Power Amplifiers" (TAS51xx) at: **http://focus.ti.com/lit/an/slaa117a/slaa117a.pdf**
- See the application brief "PowerPAD™ Made Easy" for package layout and other design considerations at: **http://focus.ti.com/lit/an/slma004b/slma004b.pdf**

Heat

- PWM-input Class-D amplifiers operate at high efficiencies.
- PWM-input Class-D amplifiers require significantly less heat-sinking than equivalent Class-AB amplifiers.

PurePath™ PWM-Input Class-D Power Stages



Class-AB Speaker Amplifiers

Output Power per Channel

- After determining the number of speakers in a system, specify the output power for each channel.
- Maximum power is decided primarily by:
  - Power supply (output voltage and current)
  - The amplifier's maximum output voltage
  - Speaker impedance
- Maximum efficiency is ~40% with Class-AB amplifiers.
- The power supply must provide continuous current to support the desired maximum power.
- The maximum input signal level dictates the required power amplifier gain to achieve the desired output power.
- For best noise performance, the gain should be as low as possible.

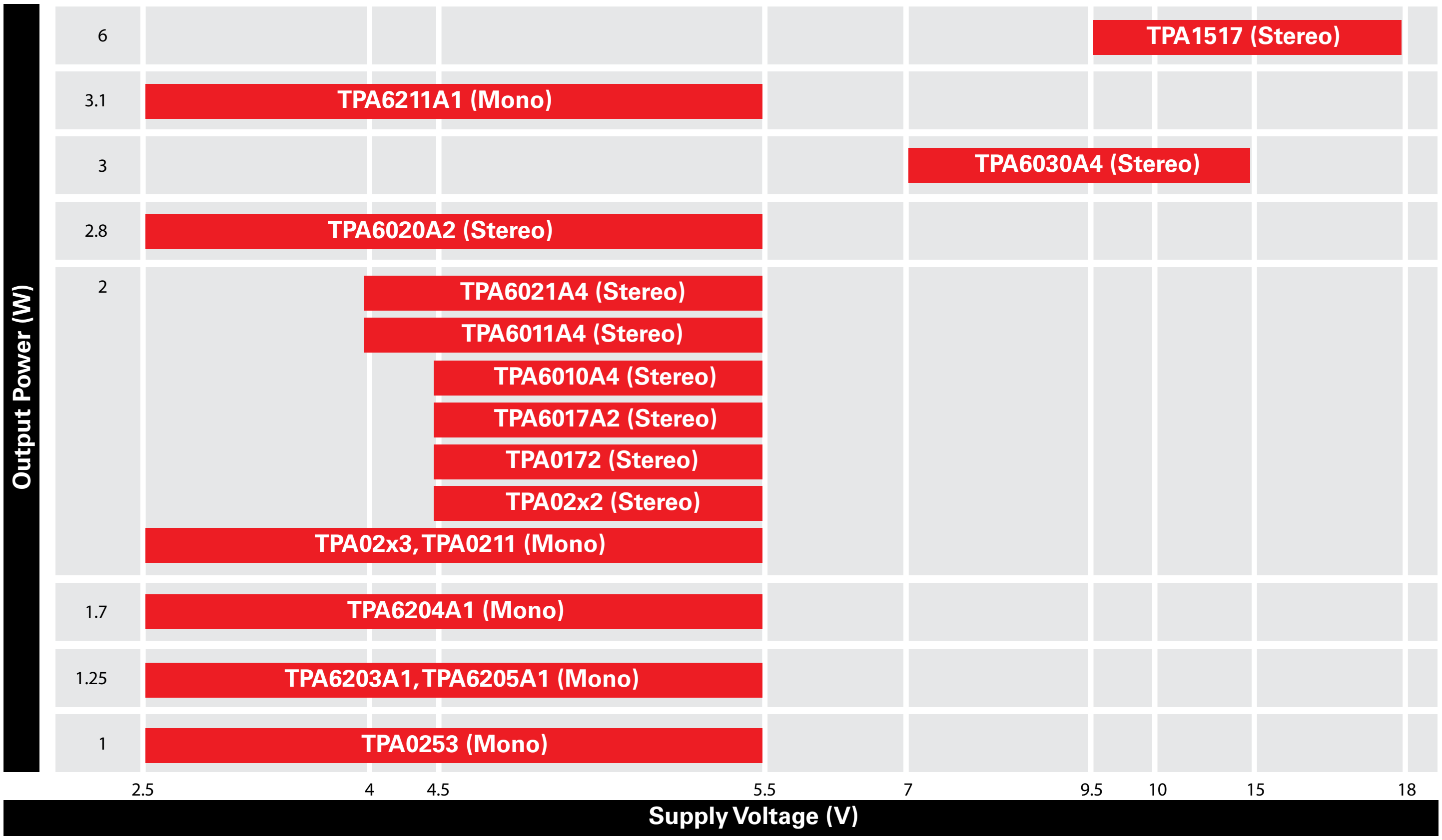
Heat

- Class-AB amplifiers run hotter than equivalent Class-D amplifiers.
- Driving 2W per channel in stereo systems generates 6W of heat with an efficiency of ~40%.
- TI's Class-AB speaker amplifiers feature the PowerPAD™ package, using a PCB as a heatsink.
- See the application brief "PowerPAD™ Made Easy" for package layout and other design considerations at: *http://focus.ti.com/lit/an/slma004b/slma004b.pdf*

Features

- Class-AB amplifiers offer several different ways to control the gain or volume:
  - External resistors (similar to traditional op-amp circuits)
  - Integrated gain-setting resistors
  - DC volume control
  - I^2C volume control
- Most of TI's portfolio provides the three latter control options.
- When a headphone drive is part of the design, most Class-AB amplifiers with TTL-input pins can change outputs from bridge-tied load (BTL) to single-ended (SE) configurations, eliminating the need for an additional amplifier.

Class-AB Speaker Amplifiers



Audio Amplifiers

High-Power Analog-Input Class-D Speaker Amplifiers

Device	Description	Output Power (Ω)	Min Load Impedance (Ωww)	Power Supply (V) (min)	Power Supply (V) (max)	Half Power THD+N at 1kHz (%)	PSRR (dB)	Package(s)	Price*
TAS5630	300W Stereo Audio Input Amplifier with Feedback	300 W	TBD	TBD	50	TBD	80	64-QFP	TBD
TAS5615	150W Stereo Analog Input Amplifier with Feedback	150 W	TBD	TBD	50	TBD	80	64-QFP	TBD
TAS5414A	Quad, Automotive, Single-Ended Analog Inputs	45	2	8	22	0.04	75	SSOP-36	$10.00
TAS5424A	Quad, Automotive, Differential Analog Inputs	45	2	8	22	0.04	75	SSOP-44	$10.75
TPA3106D1	Mono, High Output Power, Internal Gain	40	4	10	26	0.2	70	HLQFP-32	$3.55
TPA3123D2	Stereo, High Output Power, Single-Ended Outputs	25	4	10	30	0.08	55 at 2kHz	HTSSOP-24	$1.75
TPA3100D2	Stereo, High Output Power, Mute, Internal Gain, Auto Re-Start, Wide Supply Voltage	20	4	10	26	0.1	80	HTQFP-48, QFN-48	$3.50
TPA3001D1	Mono, High Output Power, Internal Gain, Differential Input	20	4	8	18	0.06	73	HTSSOP-24	$2.50
TPA3122D2	Stereo, High Output Power, Single-Ended Outputs	15	4	10	30	< 0.15	55 at 2kHz	PDIP-20	$0.99
TPA3107D2	Stereo, Class-D	15	6	10	26	0.08	70	HTQFP-64	$3.35
TPA3124D2	Stereo, Medium Output Power, Single-Ended Outputs, Fast Mute	15	4	10	26	<0.2	55 at 2 kHz	TSSOP-24	$1.45
TPA3121D2	Stereo, Medium Output Power, Single-Ended Outputs	15	4	10	26	< 0.2	55 at 2kHz	TSSOP-24	$1.45
TPA3004D2	Stereo, Volume Control	12	4	8.5	18	0.1	80	HTQFP-48	$3.25
TPA3101D2	Stereo, Mute, Internal Gain, Auto Re-Start, Wide Supply Voltage	10	4	10	26	0.1	80	HTQFP-48, QFN-48	$3.10
TPA3008D2	Stereo, Class-D	10	8	8.5	18	0.1	80	HTQFP-48	$3.10
TPA3002D2	Stereo, Medium Power Class-D with Volume Control	9	8	8.5	14	0.06	80	HTQFP-48	$3.30
TPA3007D1	Mono, Medium Power, Internal Gain	6.5	8	8	18	0.2	73	TSSOP-24	$1.95
TPA3009D2	Stereo, Medium Power Output with Volume Control	6	8	8.5	14	0.045	80	HTQFP-48	$1.60
TPA3005D2	Stereo, Medium Power	6	8	8	18	0.1	80	HTQFP-48	$2.95
TPA3003D2	Stereo, Volume Control, Lower Max Voltage	3	8	8.5	14	0.2	80	TQFP-48	$3.00
TPA2008D2	Stereo, Medium Power, Volume Control, Ideal for Docking Stations	3	3	4.5	5.5	0.05	70	TSSOP	$1.80
Low-Power Analog-Input Class-D Speaker Amplifiers									
TPA2035D1	Mono, Fully Differential, High-Power, Fixed-Gain, with Auto Recovery	2.75	4	2.5	5.5	0.2	75	WCSP	$0.65
TPA2032/3/4D1	Smallest Solution Size, Mono, Fully Differential, Internal Gain 2V/V, 3V/V, 4V/V	2.75	4	2.5	5.5	0.2	75	WCSP	$0.60
TPA2013D1	Mono, Integrated Boost Converter, High and Constant Output Power	2.7	4	1.8	5.5	0.2	95	QFN, WCSP	$1.45
TPA2000D1	Mono, Internal Gain, Cost Effective Solution	2.7	4	2.7	5.5	0.08	77	TSSOP-16, BGA-48	$1.05
TPA2000D2	Stereo, Medium Power, Ideal for Docking Stations	2.5	3	4.5	5.5	0.05	77	TSSOP	$1.40
TPA2010D1	Mono, Fully Differential, 1.45mm x 1.45mm WCSP Package, High Power	2.5	4	2.5	5.5	0.2	75	WCSP	$0.55
TPA2000D4	Stereo with Headphone Amp, Medium Power, Ideal for Docking Stations	2.5	4	3.7	5.5	0.1	70	TSSOP	$1.65
TPA2012D2	Smallest Stereo Amp in 2mm x 2mm WCSP Package	2.1	4	2.5	5.5	0.2	75	WCSP, QFN	$0.95
TPA2016D2	Stereo Amplifier with Dynamic Range Compression and AGC	1.7	8	2.5	5.5	0.2	80	WCSP	$1.60
TPA2014D1	Mono, Integrated Boost Converter, Medium and Constant Power	1.5	8	2.5	5.5	0.1	91	QFN, WCSP	$1.30
TPA2006D1	Mono, Fully Differential, 1.8-V Compatible Shutdown Voltage	1.45	8	2.5	5.5	0.2	75	QFN	$0.49
TPA2005D1	Mono, Fully Differential, Most Package Options	1.4	8	2.5	5.5	0.2	75	BGA, QFN, MSOP	$0.49
TPA2001D2	Stereo, Lower Power, Ideal for Docking Stations	1.25	8	4.5	5.5	0.08	77	TSSOP	$1.20
TPA2031D1	Similar to TPA2010D1 with Slower Start-Up	2.5	4	2.5	5.5	0.2	75	WCSP	$0.60

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Audio Amplifiers

PWM-Input Class-D Power Stages (PurePath™)

Device	Description	PBTL Power	BTL Power	SE Power	Package(s)	Price*
TAS5261	Mono, High Power	—	210	—	SSOP-36	$5.25
TAS5162	Stereo, High Power	331	210	99	SSOP-36, HTSSOP-44	$4.95
TAS5152	High Power, Pin Compatible with TAS5142	240	125	45	SSOP-36	$3.40
TAS5121	Mono, High Power	—	100	—	SSOP-36	$3.00
TAS5142	High Power, Pin Compatible with TAS5152	200	100	40	SSOP-36, HTSSOP-44	$3.10
TAS5182	Controller Only, for Use with External FETs	—	—	—	HTSSOP-56	$5.26
TAS5111A	Mono, Medium Power	—	70	—	HTSSOP-32	$2.40
TAS5112A	Stereo, Medium Power	—	50	—	HTSSOP-56	$3.75
TAS5176	6-Channel, Medium Power	—	2x30 W +1x40 W	5x15 W + 1x25 W	HTSSOP-44	$4.30
TAS5186A	Highest Integration Power	—	—	5x30 W + 1x60 W	HTSSOP-44	$5.10
TAS5122	Stereo, Low Power	—	30	—	HTSSOP-56	$3.00
TAS5132	Stereo, Low Power	—	25	12	HTSSOP-44	$1.95
TAS5342	100W, Stereo, Digital Power	220	117	41	HTSSOP-44	$2.95
TAS5342L	100W, Stereo, Digital Power	214	113	42	HTSSOP-44	$2.75
TAS5352	125W, Stereo, Digital Power	268	138	48	HTSSOP-44	$3.10
TAS5601	Multichannel, Closed Loop	—	20	10	HTSSOP-56	$2.00
TAS5602	Multichannel, Closed Loop, Hi-Z Pin	—	20	10	HTSSOP-56	$2.00
TAS5631	300W Stereo Analog Input Amplifier with Feedback	600	300	140	64-QFP	TBD
TAS5616	150W Stereo Analog Input Amplifier	300	150	70	64-QFP	TBD
TAS5102	Multichannel, Open Loop, Pad Up	—	20	10	HTSSOP-32	$1.80
TAS5103	Multichannel, Open Loop, Pad Down	—	15	7.5	HTSSOP-32	$1.80

[1]*These power indications should be considered a guide, as final power output capability will rely heavily on external factors such as heat dissipation techniques, power supply ripple and speaker load impedance.*

Class-AB Speaker Amplifiers

Device	Description	Output Power (Ω)	Min. Load Imped-ance (Ω)	Power Supply (V) (min)	Power Supply (V) (max)	Half Power THD+N at 1kHz (%)	PSRR (dB)	Package(s)	Price*
TPA6030A4	Stereo with Stereo HP, Wide Supply Voltage, Low Power, Volume Control, Fully Differential	3	16	7	15	0.06	60	HTSSOP-28	$1.40
TPA6017A2	Stereo, Cost Effective, Internal Gain, Fully Differential	2.6	3	4.5	5.5	0.1	77	HTSSOP-20	$0.99
TPA6011A4	Stereo with Stereo HP, Volume Control, Fully Differential	2.6	3	4	5.5	0.06	70	HTSSOP-24	$1.20
TPA6010A4	Stereo with Stereo HP, Volume Control and Bass Boost, Fully Diff	2.6	3	4.5	5.5	0.06	67	HTSSOP-28	$2.25
TPA1517	Stereo, Mute, Medium Power, Low Cost, DIP Package, Single Ended	6	4	9.5	18	0.15	65	PDIP-20, SO-20	$0.85
TPA6021A4	Stereo with Stereo HP, Volume Control, Fully Differential	2	4	4	5.5	0.19	70	PDIP-20	$1.00
TPA6020A2	Stereo, Fully Differential, Low Voltage, Smallest Package	2.8	3	2.5	5.5	0.05	85	QFN-20	$1.15
TPA6211A1	Mono, Fully Differential, Highest Power	3.1	3	2.5	5.5	0.05	85	MSOP, QFN	$0.55
TPA6203A1	Mono, Fully Differential, Lower Cost Solution	1.25	8	2.5	5.5	0.06	90	BGA	$0.45
TPA6204A1	Mono, Fully Differential, High Power	1.7	8	2.5	5.5	0.05	85	QFN	$0.49
TPA6205A1	Mono, Fully Differential, 1.8V Compatible Shutdown Voltage	1.25	8	2.5	5.5	0.06	90	MSOP, QFN, BGA	$0.45
TPA751	Mono, Differential Inputs, Active Low	0.9	8	2.5	5.5	0.15	78	SOIC, MSOP	$0.35
TPA731	Mono, Differential Inputs, Active High	0.9	8	2.5	5.5	0.15	78	SOIC, MSOP	$0.35
TPA721	Mono, Single Ended Inputs, Active High	0.9	8	2.5	5.5	0.15	85	SOIC, MSOP	$0.35
TPA711	Mono, Single Ended Inputs, Active High, Mono Headphone	0.9	8	2.5	5.5	0.15	85	SOIC, MSOP	$0.35
TPA0233	Mono with Stereo Headphone, Summed Inputs	2.7	4	2.5	5.5	0.06	75	MSOP	$1.05
TPA0253	Mono with Stereo Headphone, Summed Inputs	1.25	8	2.5	5.5	0.1	75	MSOP	$0.50
TPA0172	Stereo with Stereo Headphone, Mute Function, I^2C Volume Control	2.0	4	4.5	5.5	0.08	75	TSSOP	$2.45
TPA0212	Stereo w/Stereo Headphone, Internal Gain, Low-Cost Computing Sol.	2.6	3	4.5	5.5	0.15	77	TSSOP	$1.06

[1]*Power output into a 4Ω load with 10% THD and 5V power supply.*

Microphone Preamplifiers

Device	Description	Gain Range (dB)	Noise (EIN), G = 30dB	Half Power THD+N at 1kHz (%)	Power Supply (V)	Package(s)	Price*
PGA2500	Digitally Controlled, Fully Differential, High Performance, Low Noise Wide Dynamic Range, On-Chip DC Servo Loop	0dB, and 10dB to 65dB in 1dB steps	–128dBu	0.0004	±5	SSOP-28	$9.95
Device	**Description**	**Slew Rate (V/µs)**	**GBW (MHz)**	**Half Power THD+N at 1kHz (%)**	**Power Supply (V)**	**Package(s)**	**Price***
INA163	Mono, Low Noise, Low Distortion, Current Feedback, Wide Bandwidth, Wide Range of Gain	15	8	0.0003	±4.5 to ±18	SO-14	$2.90
INA217	Mono, Low Noise, Low Distortion, Current Feedback, Wide Bandwidth, Wide Range of Gain	15	8	0.004	±4.5 to ±18	PDIP-8, SOIC-16	$2.50

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Power Amplifiers and Buffers

TI power amplifiers solve tough high-voltage and high-current design problems in applications requiring up to 100V and 10A output current. Most are internally protected against thermal and current overload, and some offer user-defined current limiting. The unity-gain buffer amplifier series provides slew rates up to 3600V/µs and output current to 250mA.

Design Considerations

Power dissipation—determines the appropriate package type as well as the size of the required heat sink. Always stay within the specified operating range to maintain reliability of the power amps. Some power amps are internally protected against overheating and overcurrent. The thermally-enhanced PowerPAD™ package provides greater design flexibility and increased thermal efficiency in a standard size IC package. PowerPAD provides an extremely low thermal resistance path to a ground plane or special heatsink structure.

Full-power bandwidth—or large-signal bandwidth, high FPBW is achieved by using power amps with high slew rate.

Current limit—be aware of the specified operating area, which defines the relationship between supply voltage and current output. Both power supply and load must be appropriately selected to avoid thermal and current limits.

Thermal shutdown—the incorporation of internal thermal sensing and shut-off will automatically shut-off the amplifier should the internal temperature reach a specified value.

Technical Information Power Amps

Unlike other designs using a power resistor in series with the output current path, the OPA547, OPA548 and OPA549 power amps sense current internally. This allows the current limit to be adjusted from near 0A to the upper limit with a control signal or a low-power resistor. This feature is included in the OPA56x series. The new 2A OPA567 comes in the tiny QFN package.

Buffer

The BUF634 can be used inside the feedback loop to increase output current, eliminate thermal feedback and improve capacitive load drive. When connected inside the feedback loop, the offset voltage and other errors are corrected by the feedback of the op amp.

100V, 25mA High-Voltage/High-Current Op Amp
OPA454

NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/OPA454**

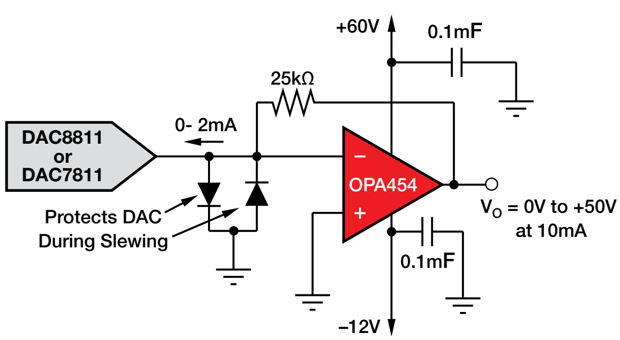
Key Features
- Single or dual supply: ±4V (8V) to ±50V (100V)
- Excellent output voltage swing: 1V to rails
- Enable/Disable pin
- Thermal warning flag and internal protection
- Low quiescent current: 5mA (max)
- Offset voltage: 4mV with 1.6µV/°C drift
- Packages: SO-8, HSOP-20 PowerPAD™

Applications
- Test equipment
- Piezoelectric cells
- Transducer drivers
- Servo drivers
- Audio amplifiers
- High voltage compliance current sources
- General high-voltage regulators/power

The OPA454 is a next-generation OPA445 with high voltage of up to 100V and relatively high current drive up to 25mA. It is unity-gain stable and has a gain bandwidth of 2.5MHz.

It is internally protected against over-temperature and over-current conditions and includes a thermal warning flag. Other features are its excellent accuracy and wide output swing that can reach 1V to the supply rails. The output can also be independently disabled using the Enable/Disable pin.

Packaged in a small, exposed metal pad package, the OPA454 is easy to heat sink over the specified extended industrial temperature range, –40°C to +85°C.



OPA454 functional block diagram.

Power Amplifiers and Buffers

1.5A, High-Current Power Amplifier
OPA564

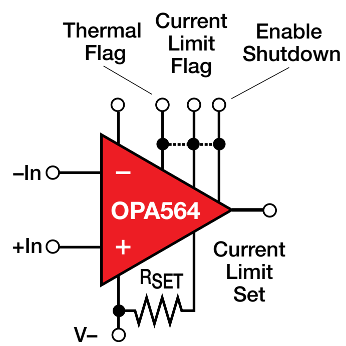
PREVIEW*

Get datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/OPA564**

Key Features
- Single or dual supply: ±3.5V (7V) to ±13V (26V)
- Large output swing: $22V_{PP}$ at 1.5A (24V supply)
- Thermal and over-current warning
- Adjustable current limit
- Output enable/disable control
- Slew rate: 20V/µs
- Packaging: HSOP-20 PowerPAD™

Applications
- Power-line communications
- Valve, actuator drivers
- Synchro, servo drivers
- Motor drivers
- Power supply output amplifiers
- Test equipment
- Transducer excitation
- General-purpose linear power boosters

The OPA564 is a high-current operational amplifier ideal for driving up to 1.5A in reactive loads and provides high reliability in demanding power-line communications and motor control applications. It operates from a single or dual power supply of ±3.5V (7V) to ±13V (26V). In single-supply operation, the input common-mode range extends below ground. The OPA564 is easy to heat sink over the specified extended industrial temperature range, –40°C to +125°C.



OPA564 PowerPAD™-down pinout.
**Expected Release Date 4Q 2008.*

Power Amplifiers Selection Guide

Device	I_{OUT} (A)	V_S (V)	Bandwidth (MHz)	Slew Rate (V/µs)	I_Q (mA) (max)	V_{OS} (mV) (max)	V_{OS} Drift (µV/°C) (max)	I_B (nA) (max)	Package(s)	Price*
OPA445	0.015	20 to 90	2	15	4.7	5	10	0.1	DIP-8, SO-8, SO-8 PowerPAD™	$4.75
OPA452	0.05	20 to 80	1.8	7.2	6.5	3	5	0.1	TO220-7, DDPak-7	$2.55
OPA453	0.05	20 to 80	7.5	23	6.5	3	5	0.1	TO220-7, DDPak-7	$2.55
OPA454	0.025	10 to 100	2.5	13	4	4	10	0.1	SO-8 and HSOP-20 PowerPAD	$2.75
OPA541	10	20 to 70	1.6	10	25	10	40	0.05	TO220-11, TO3-8	$11.10
OPA544	2	20 to 70	1.4	8	15	5	10	0.1	TO220-5, DDPak-5	$7.90
OPA2544	2	20 to 70	1.4	8	15	5	10	0.1	TO220-11	$12.00
OPA547	0.5	8 to 60	1	6	15	5	25	500	TO220-7, DDPak-7	$5.00
OPA548	3	8 to 60	1	10	20	10	30	500	TO220-7, DDPak-7	$6.90
OPA549	8	8 to 60	0.9	9	35	5	20	500	ZIP-11, TO220-11	$12.00
OPA551	0.2	8 to 60	3	15	8.5	3	7	0.1	DIP-8, SO-8, DDPak-7	$1.90
OPA552	0.2	8 to 60	12	24	8.5	3	7	0.1	DIP-8, SO-8, DDPak-7	$1.75
OPA561	1.2	7 to 16	17	50	60	20	50	0.1	HTSSOP-20	$2.80
OPA564	1.5	7 to 28	4	20	35	20	10	0.1	HSOP-20 PowerPAD	$2.75
OPA567	2	2.7 to 5.5	1.2	1.2	6	2	1.3	0.01	QFN-12	$1.85
OPA569	2	2.7 to 5.5	1.2	1.2	6	2	1.3	0.01	SO-20 PowerPAD	$3.10

Buffers Selection Guide (Sorted by Ascending BW at A_{CL})

Device	V_S ±15 (V)	V_S ±5 (V)	V_S 3.3 (V)	V_S 5 (V)	A_{CL} Stable Gain (V/V) (min)	BW at A_{CL} (MHz)	Slew Rate (V/µs)	Settling Time 0.01% (ns) (typ)	I_Q (mA) (typ)	THD (F_C = 1MHz) (dB) (typ)	Diff Gain (%)	Diff Phase (°)	V_N at Flatband (nV/√Hz) (typ)	V_{OS} (mV) (max)	I_B (µA) (max)	Package(s)	Price*
OPA633	Yes	Yes	—	—	1	260	2500	50	21	—	—	0.1	—	15	35	DIP-8	$5.45
OPA692	—	Yes	—	Yes	1	280	2000	12 (0.02%)	5.8	–78	0.07	0.02	1.7	2.5	35	SOT23-6, SOIC-8	$1.15
OPA693	—	Yes	—	Yes	1	1400	2500	12 (0.1%)	13	–84	0.03	0.01	1.8	2	35	SOT23-6, SOIC-8	$1.30
OPA832	—	Yes	Yes	Yes	1	92	350	45 (0.1%)	4.25	–84	0.1	0.16	9.2	7	10	SOT23-5, SOIC-8	$0.32
BUF602	—	Yes	Yes	Yes	1	1000	8000	6 (0.05%)	5.8	—	0.15	0.04	4.8	30	7	SOT23-5, SOIC-8	$0.85
BUF634	Yes	Yes	Yes	Yes	1	30 to 180	2000	200 (0.1%)	15	—	0.4	0.1	4	100	20	DIP-8, SOIC-8 TO220-5, DDPak-5	$3.10

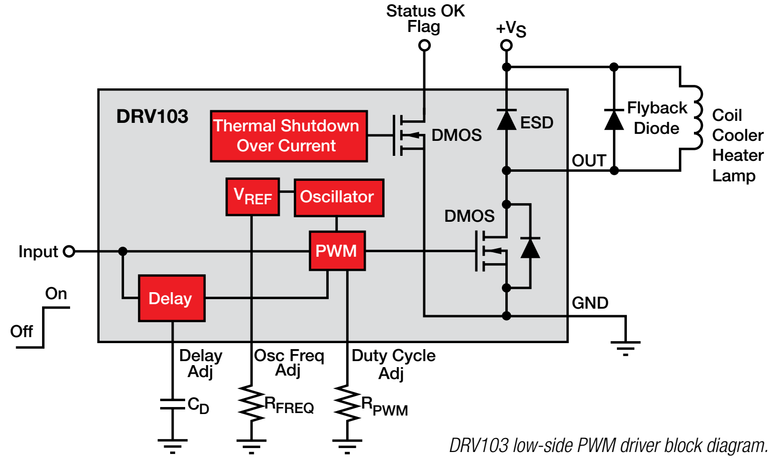
**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue**.*

Pulse Width Modulation Power Drivers

TI's pulse width modulation (PWM) power drivers are specifically designed for applications requiring high current at low to moderately high voltages, ranging from 5V to 60V. Loads include electromechanical loads, such as solenoids, coils, actuators, and relays, as well as heaters, lamps, thermoelectric coolers and laser diode pumps.

These products feature integrated power transistors, which save considerable circuit board area compared to discrete implementations. Unlike the operation of linear drivers, PWM operation offers efficiencies as great as 90%, resulting in less power wasted as heat and reduced demand on the power supply. The DRV10x operates from +8V to +60V and has a single low-side or high-side power switch. The devices in the DRV59x family may be analog or digitally controlled and operate from 0% to 100% duty cycles. The DRV59x operates on +2.8V to +5.5V and has internal H-bridge output switches in series with the load, allowing for bi-directional current flow from a single power supply.



DRV103 low-side PWM driver block diagram.

Design Considerations

Supply voltage—selection begins with the power supply voltages available in the system. TI's families of PWM power drivers operate from 2.8V to 5.5V for the DRV59x family and from 2.8V to 60V for the DRV10x family.

Output current and output voltage—the load to be connected to the power driver will also help determine the proper PWM power driver solution. The maximum output current required by the load should be known. The maximum output voltage capability of the driver may be calculated as follows:

$$V_O\,(max) = V_S - [\, I_O\,(max) \bullet 2 \bullet R_{DS(ON)}\,]$$

Efficiency—a lower on-resistance (R_{ON}) of the output power transistors will yield greater efficiency. Typically, $R_{DS(ON)}$ is specified per transistor. In an H-bridge output configuration, two output transistors are in series with the load. To quickly estimate the efficiency, use the following equation:

$$\text{Efficiency} = R_L / [\, R_L + (\, 2 \bullet R_{DS(ON)}\,)\,]$$

Analog or digital control—TI offers both H-bridge and single-sided drivers. The DRV590, DRV591, DRV593 and DRV594 each accept a DC voltage input signal, either from an analog control loop (i.e., PID controller) or from a DAC, while the DRV592 accepts a PWM input signal.

Output filter—in some applications, a low-pass filter is placed between each output of the PWM driver and the load to remove the switching frequency components. A second-order filter consisting of an inductor and capacitor is commonly used, with the cut-off frequency of the filter typically chosen to be at least an order of magnitude lower than the switching frequency. For example, a DRV593 switching at 500kHz can have a 15.9kHz cut-off frequency. The component values are calculated using the following formula:

$$FC = 1 / [\, 2 \bullet \pi \bullet (\sqrt{(L \bullet C)}\,)\,]$$

The inductor value is typically chosen to be as large as possible, and is then used to calculate the required capacitor value for the desired cut-off frequency.

PWM Power Drivers Selection Guide

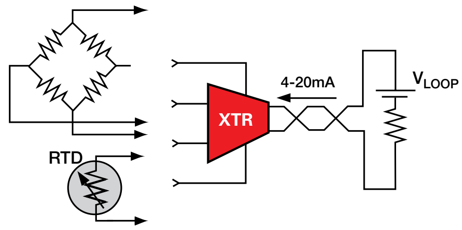
Device	Description	Supply Voltage (V)	Output Current (A) (typ)	Saturation Voltage (V)	R_{ON} (Ω)	Frequency (kHz)	Package(s)	Price*
Single Switch								
DRV101	Low-Side with Internal Monitoring	9 to 60	2.3	1	0.8	24	TO-220, DDPAK	$3.85
DRV102	High-Side with Internal Monitoring	8 to 60	2.7	2.2	0.95	24	TO-220, DDPAK	$3.85
DRV103	Low-Side with Internal Monitoring	8 to 32	1.5/3	0.6	0.9	0.5 to 100	SOIC-8, SOIC-8 PowerPAD™	$2.00
DRV104	High-Side with Internal Monitoring	8 to 32	1.2	0.65	0.45	0.5 to 100	HTSSOP-14 PowerPAD	$1.75
Bridge								
DRV590	1.2A, High-Efficiency PWM Power Driver	2.7 to 5.5	1.2	0.48	0.4	250/500	SOIC-PowerPAD, 4x4mm MicroStar Junior™	$12.00
DRV591	±3A, High-Efficiency PWM Power Driver	2.8 to 5.5	3	0.195	0.065	100/500	9x9 PowerPAD QFP	$11.00
DRV592	±3A, High-Efficiency H-Bridge	2.8 to 5.5	3	0.195	0.065	1000	9x9 PowerPAD QFP	$2.85
DRV593	±3A, High-Efficiency PWM Power Driver	2.8 to 5.5	3	0.195	0.065	100/500	9x9 PowerPAD QFP	$10.80
DRV594	±3A, High-Efficiency PWM Power Driver	2.8 to 5.5	3	0.195	0.065	100/500	9x9 PowerPAD QFP	$10.80
Sensor Signal Conditioning								
DRV401	Signal Cond. for Magnetic Current Sensor	4.5 to 5.5	0.2	0.4	—	2000	QFN-20, SOIC-20	$2.05

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Sensor Conditioners and 4-20mA Transmitters

The PGA309 is a complete voltage output bridge sensor conditioner that eliminates potentiometers and sensor trims. Span and Offset are digitally calibrated with temperature coefficients stored in a low-cost, SOT23-5, external EEPROM. Excitation voltage linearization, internal/external temperature monitoring and selection of internal/external voltage references including supply are provided. Over/Under scale limits are settable and fault detection circuitry is included.

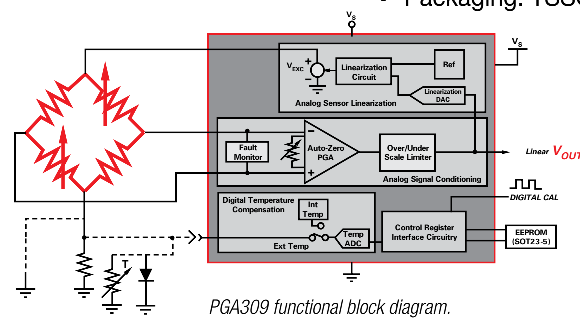
The 4-20mA transmitter provides a versatile instrumentation amplifier (IA) input with a current-loop output, allowing analog signals to be sent over long distances without loss of accuracy. Many of these devices also include scaling, offsetting, sensor excitation and linearization circuitry. The XTR108 provides a digitally controlled analog signal path for RTD signal conditioning. The XTR108 allows for digital calibration of sensor and transmitter errors via a standard digital serial interface, eliminating expensive potentiometers or circuit value changes. Calibration settings can be stored in an inexpensive external EEPROM for easy retrieval during routine operation.



4-20mA transmitter design solutions.

PGA309 Key Features

- Voltage output: ratiometric or absolute
- Digital calibration: no potentiometers, no sensor trim
- Sensor compensation: span and span drift, offset and offset drift
- <0.1% post-cal accuracy
- 2.7V to 5.5V operation
- Packaging: TSSOP-16



PGA309 functional block diagram.

Precision Voltage-to-Current Converter/Transmitter
XTR111

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/XTR111**

Key Features

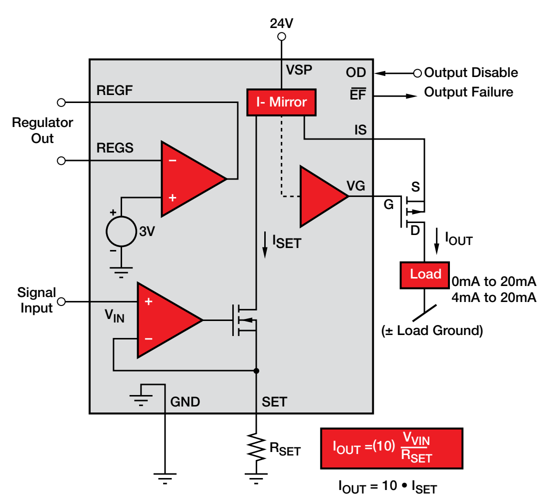
- Wide supply range: 7V to 44V
- Current or voltage output
- Accuracy: 0.015%
- Output error detection and disable
- Adjustable 3V to 15V sub-regulator
- Nonlinearity: 0.002%
- Offset drift: 1µV/°C
- Low supply current: 550µA
- Packaging: DFN-10, MSOP PowerPAD™

Applications

- Universal voltage-controlled current source
- Current or voltage output for 3-wire sensor systems
- PLC output programmable drivers
- Current-mode sensor excitation

The XTR111 is a precision, voltage-to-current converter designed for standard 0-20mA or 4-20mA analog signals and can source up to 36mA. It is ideal for 3-wire sensors and for the analog outputs of control systems like Programmable Logic Controllers (PLCs). Sensor excitation and common voltage-to-current (source) applications will benefit from its high accuracy (0.015%).

The device requires only one precision resistor to set the ratio between input voltage and output current. The circuit can also be modified for voltage output. Other features include an output error flag and output disable capability. The adjustable 3.0V to 15V sub-regulator output provides the supply voltage for additional circuitry.



XTR111 functional block diagram.

Sensor Conditioners and 4-20mA Transmitters

Industrial Analog Voltage or Current Output Driver

XTR300

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/XTR300**

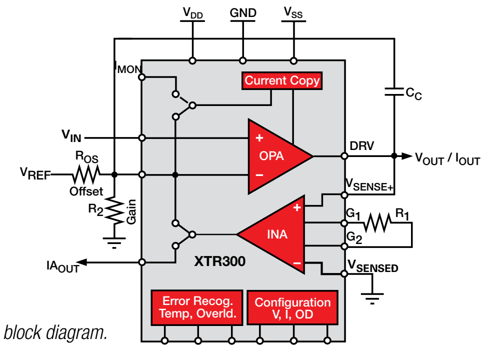
Key Features

- Pin select I or V output or input
- Pin select for output enable/disable (OE)
- Gain or transconductance set by external resistors
- Output voltage swing: ±17.5V at V_S = ±20V
- Output current: ±24mA (linear range)
- Packaging: QFN-20 5mm x 5mm

Applications

- Analog interface between industrial high-voltage and low-voltage signal processing: PLC – I/O, Field Bus I/O

The XTR300 is a complete output driver for industrial and process control applications.The output can be selected as current or voltage by the digital I/V select pin, error flags allow for convenient fault detection. Separate driver and receiver channels are provided for added flexibility. The integrated instrumentation amplifier (INA) can be used for remote voltage sensing or as a high-voltage, high-impedance measurement channel. For additional protection, maximum output current limit and thermal protection is provided.



XTR300 functional block diagram.

4-20mA Transmitters and Receiver Selection Guide

Device	Description	Sensor Excitation	Loop Voltage (V)	Full-Scale Input Range	Output Range (mA)	Additional Power Available (V at mA)	Package(s)	Price*
2-Wire, 4-20mA Transmitters								
XTR105	100Ω RTD Conditioner with Linearization	Two 800µA	7.5 to 36	5mV to 1V	4-20	5.1 at 0.5	DIP-14, SOIC-14	$4.60
XTR106	Bridge Conditioner with Linearization	5V and 2.5V	7.5 to 36	5mV to 1V	4-20	5.1 at 1	DIP-14, SOIC-14	$4.00
XTR108	10Ω to 10kΩ RTD Conditioner, 6-Channel Input MUX, Extra Op Amp Can Convert to Voltage Sensor Excitation, Calibration Stored in External EEPROM	Two 500µA	7.5 to 24	5mV to 320mV	4-20	5.1 at 2.1	SSOP-24	$3.35
XTR112	1kΩ RTD Conditioner with Linearization	Two 250µA	7.5 to 36	5mV to 1V	4-20	5.05 at 1	SOIC-14	$4.00
XTR114	10kΩ RTD Conditioner with Linearization	Two 100µA	7.5 to 36	5mV to 1V	4-20	5.05 at 1	SOIC-14	$4.00
XTR115	I_{IN} to I_{OUT} Converter, External Resistor Scales V_{IN} to I_{IN}	V_{REF} = 2.5V	7.5 to 36	40µA to 250µA	4-20	4.9 at 1	SOIC-8	$1.25
XTR116	I_{IN} to I_{OUT} Converter, External Resistor Scales V_{IN} to I_{IN}	V_{REF} = 4.096V	7.5 to 36	40µA to 250µA	4-20	4.9 at 1	SOIC-8	$1.05
XTR117	Current Loop, 7.5 to 40V, 5V Voltage Regulator	V_{REG}= 5V	7.5 to 40	40µA to 250µA	4-20	4.9 at 1	MSOP-8, DFN-8	$0.90
Bridge Conditioner with Digital Calibration for Linearization, Span and Offset Over Temperature								
PGA309	Complete Digitally Calibrated Bridge Sensor Conditioner, Voltage Output, Calibration Stored in External EEPROM, One-Wire/Two-Wire Interface	V_{EXC} = V_S, 2.5V 4.096V	2.7 to 5.5	1mV/V to 245mV/V	0.05V-4.9V at V_S = +5V	—	TSSOP-16	$2.95
PGA308	Single Supply, Auto-Zero, Sensor Amplifier w/ Programmable Gain and Offset	—	2.7 to 5.5	0.2V to 4.1V	0.03V to 5.44mA at V_S = +5V	—	MSOP-10, DFN-10	$2.00
Industrial Current/Voltage Drivers								
XTR110	Precision V-to-I Converter/Transmitter, Selectable I/O Ranges	V_{REF} = 10V	13.5 to 40	0V to 5V, 0V to 10V	0-20, 4-20 5-20	—	DIP-16, SOL-16	$7.10
XTR111	Precision V-to-I Converter/Transmitter, Adjustable V_{REG} 3V to 15V	V_{REG} = 3 to 15V	8 to 40	0V to 12V	0-20, 4-20, 5-20	3V to 15V	DFN/MSOP-10	$1.10
XTR300	Industrial Analog Current/Voltage Output Driver	—	<34	V(–)+3 to V(+)–3 Dig. selected $V_{O\leq}$	±17V ±24mA	—	5x5 QFN/TSSOP-20	$2.45
4-20mA Current Loop Receiver								
RCV420	4-20mA Input, 0V to 5V Output, 1.5V Loop Drop	V_{REF} = 10V	+11.5/–5 to ±18	4-20mA	0V to 5V	—	DIP-16	$3.55

*Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red.***

Logarithmic Amplifiers

TI has achieved significant advancement in log amp technology. The logarithmic amplifier is a versatile integrated circuit that computes the logarithm of an input current relative to a reference current or the log of the ratio of two input currents. Logarithmic amplifiers can compress an extremely wide input dynamic range (up to 8 decades) into an easily measured output voltage. Accurate matched bipolar transistors provide excellent logarithmic conformity over a wide input current range. On-chip compensation achieves accurate scaling over a wide operating temperature range.

TI log amplifiers are designed for optical networking, photodiode signal compression, analog signal compression and logarithmic computation for instrumentation. Some log amps, such as the LOG102, feature additional uncommitted op amps for use in a variety of functions including gain scaling, inverting, filtering, offsetting and level comparison to detect loss of signal. The LOG2112 is a dual version of the LOG112 and includes two log amps, two uncommitted output amps and a single shared internal voltage reference.

Design Considerations

Output scaling—amplifier output is 0.32V, 0.5V or 1.0V per decade and is the equivalent of the gain setting in a voltage input amp.

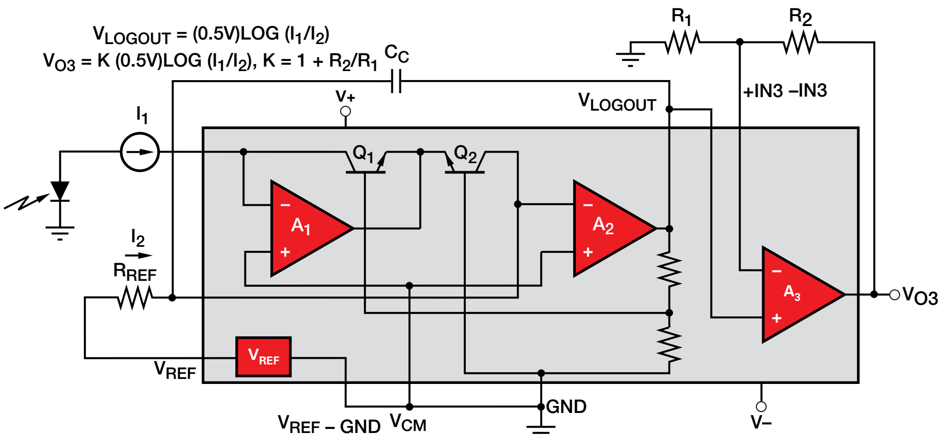
Quiescent current—lowest in LOG101 and LOG104.

Conformity error—measured with 1nA to 1mA input current converted to 5V output. More than 16-bits of dynamic range are achievable.

Auxiliary op amps—some log amps have additional uncommitted op amps that can be used to offset and scale the output signal to suit application requirements.

LOG112 Key Features

- Easy-to-use complete function
- Output scaling amplifier
- On-chip 2.5V voltage reference
- High accuracy: 0.2% FSO over 5 decades
- Wide input dynamic range: 7.5 decades, 100pA to 3.5mA
- Low quiescent current: 1.75mA
- Wide supply range: ±4.5V to ±18V
- Packaging: SO-14 (narrow) and SO-16



NOTE: Internal resistors are used to compensate gain change over temperature.
The V_{CM} pin is internally connected to GND in the LOG2112.

LOG112 functional block diagram.

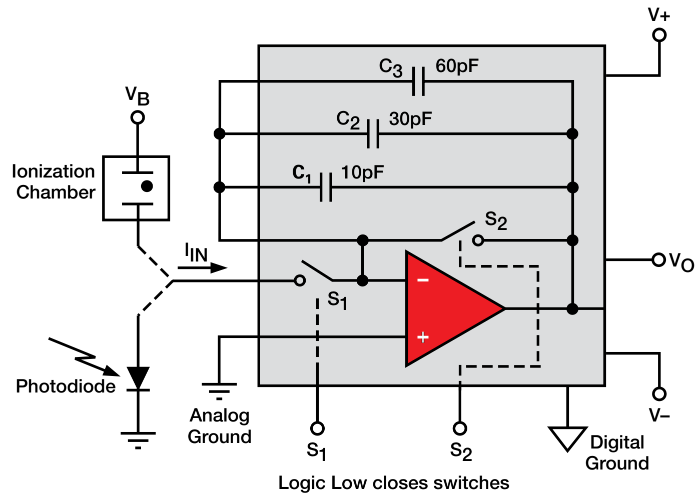
Logarithmic Amplifiers Selection Guide

Device	Scale Factor (V/Decade)	Input Current Range (nA) (min)	Input Current Range (mA) (max)	Conformity Error (Initial 5 Decades) (%) (max)	Conformity Error (Initial 5 Decades) (%/°C) (typ/temp)	Bandwidth (kHz)	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	Reference Type	Auxiliary Op Amps	Package	Price*
LOG101	1	0.1	3.5	0.2	0.0001	38	9	36	1.5	External	—	SO-8	$6.95
LOG102	1	1	1	0.3	0.0002	38	9	36	2	External	2	SO-14	$7.25
LOG104	0.5	0.1	3.5	0.2	0.0001	38	9	36	1.5	External	—	SO-8	$6.95
LOG112	0.5	0.1	3.5	0.2	0.0001	38	9	36	1.75	2.5V Internal	1	SO-14	$7.90
LOG2112	0.5	0.1	3.5	0.2	0.0001	38	9	36	1.75	2.5V Internal	1/Ch	SO-16	$11.35
LOG114	0.375	0.1	10	0.2	0.001	5000	5	10	15	2.5V Internal	2	QFN-16	$7.90

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Integrating Amplifiers

Integrating amplifiers provide a precision, lower noise alternative to conventional transimpedance op amp circuits which require a very high value feedback resistor. Designed to measure input currents over an extremely wide dynamic range, integrating amplifiers incorporate a FET op amp, integrating capacitors, and low-leakage FET switches. Integrating low-level input current for a user-defined period, the resulting voltage is stored on the integrating capacitor, held for accurate measurement and then reset. Input leakage of the IVC102 is only 750fA. It can also measure bipolar input currents.



IVC102 functional block diagram.

The ACF2101 two-channel integrator offers extremely low bias current, low noise, an extremely wide dynamic range and excellent channel isolation. Included on each of the two integrators are precision 100pF integration capacitors, hold and reset switches and output multiplexers. As a complete circuit on a chip, leakage current and noise pickup errors are eliminated. An output capacitor can be used in addition to (or instead of) the internal capacitor depending on design requirements.

Design Considerations

Supply voltage—while single-supply operation is feasible, bipolar-supply operation is most common and will offer the best performance in terms of precision and dynamic range.

Number of channels—IVC102 offers a single integrator, while the ACF2101 is a dual.

Integration direction—either into or out of the device. IVC102 is a bipolar input current integrator and will integrate both positive and negative signals. ACF2101 is a unipolar current integrator, with the output voltage integrating negatively.

Input bias (leakage) current—often sets a lower limit to the minimum detectable signal input current. Leakage can be subtracted from measurements to achieve extremely low-level current detection (<10fA). Circuit board leakage currents can also degrade the minimum detectable signal.

Sampling rate and dynamic range—the switched integrator is a sampled system controlled by the sampling frequency (fs), which is usually dominated by the integration time. Input signals above the Nyquist frequency (fs/2) create errors by being aliased into the sampling frequency bandwidth.

Technical Information

Although these devices use relatively slow op amps, they may be used to measure very fast current pulses. Photodiode or sensor capacitance can store a pulse charge temporarily, the charge is then slowly integrated during the next cycle.

See the OPT101 data sheet for monolithic photodiode and transimpedance amplifier. The OPT101 converts light directly into a voltage output, with low leakage current errors, minimal noise pick-up and low gain peaking due to stray capacitance.

Integrating Amplifiers Selection Guide

Device	Description	Input Bias Current (fA) (max)	Noise at 1kHz (nV/√Hz) (typ)	Switching Time (ns) (typ)	Useful Sampling Rate (kHz)	Input Current Range (μA)	Power Supply (V)	I_Q (mA) (max)	Package(s)	Price*
IVC102	Precision, Low Noise, Bipolar Input Current	±750	10	100	10	0.01 to 100	+4.75 to +18 –10 to –18	5.5	SO-14	$4.55
ACF2101	Low Noise, Dual Switched Integrator	1000	—	200	10	0.01 to 100	+4.5 to +18 –10 to –18	15 5.2	SO-24	$15.55
Monolithic Photodiode and Transimpedance Amplifier										
OPT101	Monolithic Photodiode with On-Chip Transimpedance Amplifier	165 (typ)	—	—	14	—	+2.7 to +36	0.24	PDIP-8, SOP-8	$2.75

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Isolation Amplifiers

There are many applications where it is desirable, even essential, that a sensor not have a direct (galvanic) electrical connection with the system to which it is supplying data in order to avoid either dangerous voltages or currents from one half of the system from damaging the other half. Such a system is said to be "isolated", and the area which passes a signal without galvanic connections is known as an "isolation barrier".

Isolation barrier protection works in both directions, and may be needed in either half of the system, sometimes both. Common applications requiring isolation protection are those where sensors may accidentally encounter high voltages and the system it is driving must be protected. Or a sensor may need to be isolated from accidental high voltages arising downstream in order to protect its environment: examples include prevention of explosive gas ignition caused by sparks at sensor locations or protecting patients from electric shock by ECG, EEG and EMG test and monitoring equipment. The ECG application may require isolation barriers in both directions: the patient must be protected from the very high voltages (>7.5kV) applied by the defibrillator, and the technician handling the device must be protected from unexpected feedback.

Applications for Isolation Amplifiers

- Sensor is at a high potential relative to other circuitry (or may become so under fault conditions)
- Sensor may not carry dangerous voltages, irrespective of faults in other circuitry (e.g. patient monitoring and intrinsically safe equipment for use with explosive gases)
- To break ground loops

Quad, Digital Isolators
ISO7240, ISO7241, ISO7242

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/PARTnumber** (Replace **PARTnumber** with **ISO7240**, **ISO72421** or **ISO7242**)

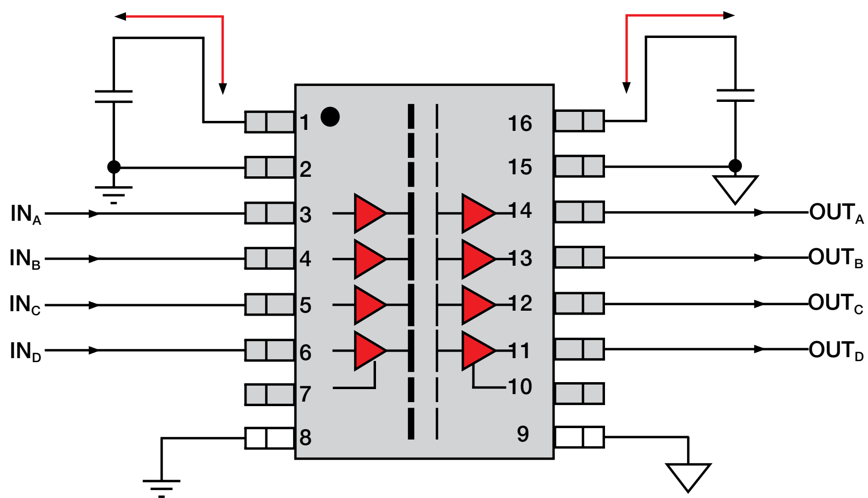
Key Features

- Signaling rate options: 1, 25, 150MSPS
- Low channel-to-channel output skew: 1ns (max)
- Low pulse-width distortion: 2ns (max)
- Typical 25-year life at rated working voltage
- $4000V_{PEAK}$ isolation, $560V_{PEAK}$, V_{IORM}
- 4kV ESD protection
- Supply voltage: 3.3V or 5V
- Package: SOIC-16

Applications

- Industrial fieldbus
- Computer peripheral interface
- Servo control interface
- Data acquisition

The ISO7240, ISO7241 and ISO7242 are quad-channel digital isolators with multiple channel configurations and output enable functions. The logic input and output buffers are separated by a silicon dioxide (SiO2) isolation barrier. When used in conjunction with isolated power supplies, these devices block high voltage, isolate grounds and prevent noise currents from entering the local ground and interfering with or damaging sensitive circuitry. A periodic update pulse is sent across the barrier to ensure the output's proper dc level.



Typical ISO724x application circuit.

Isolation Amplifiers

Isolation Amplifiers Selection Guide

Part Number[1]	Description	Supply Voltage(s) (V)	Number of Channels	Data rate (Mbps)	Insulation Rating (V_{RMS})	Channel Configuration	TTL/ CMOS Input Threshold	Prop Delay (max) (ns)	Input Noise Filter	Package	Price*
ISO150	Dual, Isolated, Bi-Directional Digital Coupler	5	2	80	1500	Programmable	TTL	40	None	SOP-12	$8.10
ISO721	Single, 100Mbps Digital Isolator	3.3, 5	1	100	2500	1/0	TTL	24	Yes	SOIC-8	$1.40
ISO721M	Single, 150Mbps Digital Isolator	3.3, 5	1	150	2500	1/0	CMOS	16	None	SOIC-8	$1.45
ISO722	Single, 100Mbps Digital Isolator with Enable	3.3, 5	1	100	2500	1/0	TTL	24	Yes	SOIC-8	$0.95
ISO7220A	Dual Channel, 2/0, 1Mbps Digital Isolator	3.3, 5	2	1	2500	2/0	TTL	475	Yes	SOIC-8	$0.95
ISO7220B	Dual Channel, 2/0, 5Mbps Digital Isolator	3.3, 5	2	5	2500	2/0	TTL	—	Yes	SOIC-8	$1.20
ISO7220C	Dual Channel, 2/0, 25Mbps Digital Isolator	3.3, 5	2	25	2500	2/0	TTL	42	Yes	SOIC-8	$2.00
ISO7220M	Dual Channel, 2/0, 150Mbps Digital Isolator	3.3, 5	2	150	2500	2/0	CMOS	16	None	SOIC-8	$2.50
ISO7221A	Dual Channel, 1/1, 1Mbps Digital Isolator	3.3, 5	2	1	2500	1/1	TTL	475	Yes	SOIC-8	$0.95
ISO7221B	Dual Channel, 1/1, 5Mbps Digital Isolator	3.3, 5	2	5	2500	2/0	TTL	—	Yes	SOIC-8	$1.20
ISO7221C	Dual Channel, 1/1, 25Mbps Digital Isolator	3.3, 5	2	25	2500	1/1	TTL	42	Yes	SOIC-8	$2.00
ISO7221M	Dual Channel, 1/1, 150Mbps Digital Isolator	3.3, 5	2	150	2500	1/1	CMOS	16	None	SOIC-8	$2.50
ISO722M	Single, 150Mbps Digital Isolator with Enable	3.3, 5	1	150	2500	1/0	CMOS	16	None	SOIC-8	$1.45
ISO7230A	Triple Channel, 3/0, 1Mbps, Digital Isolator	3.3, 5	3	1	2500	3/0	TTL	95	Yes	SOIC-16	$1.50
ISO7230C	Triple Channel, 3/0, 25Mbps, Digital Isolator	3.3, 5	3	25	2500	3/0	TTL	42	Yes	SOIC-16	$2.45
ISO7230M	Triple Channel, 3/0, 150Mbps, Digital Isolator	3.3, 5	3	150	2500	3/0	CMOS	23	None	SOIC-16	$3.50
ISO7231A	Triple Channel, 2/1, 1Mbps, Digital Isolator	3.3, 5	3	1	2500	2/1	TTL	95	Yes	SOIC-16	$1.50
ISO7231C	Triple Channel, 2/1, 25Mbps, Digital Isolator	3.3, 5	3	25	2500	2/1	TTL	42	Yes	SOIC-16	$2.45
ISO7231M	Triple Channel, 2/1, 150Mbps, Digital Isolator	3.3, 5	3	150	2500	2/1	CMOS	23	None	SOIC-16	$3.50
ISO7240A	Quad Channel, 4/0, 1Mbps, Digital Isolator	3.3, 5	4	1	2500	4/0	TTL	95	Yes	SOIC-16	$1.90
ISO7240C	Quad Channel, 4/0, 25Mbps, Digital Isolator	3.3, 5	4	25	2500	4/0	TTL	42	Yes	SOIC-16	$2.90
ISO7240CF	Quad, 4/0.25Mbps, Digital Isolator, Selectable Failsafe	3.3, 5	4	25	2500	4/0	TTL	42	Yes	SOIC-16	$3.00
ISO7240M	Quad Channel, 4/0, 150Mbps, Digital Isolator	3.3, 5	4	150	2500	4/0	CMOS	23	None	SOIC-16	$4.10
ISO7241A	Quad Channel, 3/1, 1Mbps, Digital Isolator	3.3, 5	4	1	2500	3/1	TTL	95	Yes	SOIC-16	$1.90
ISO7241C	Quad Channel, 3/1, 25Mbps, Digital Isolator	3.3, 5	4	25	2500	3/1	TTL	42	Yes	SOIC-16	$2.90
ISO7241M	Quad Channel, 3/1, 150Mbps, Digital Isolator	3.3, 5	4	150	2500	3/1	CMOS	23	None	SOIC-16	$4.10
ISO7242A	Quad Channel, 2/2, 1Mbps, Digital Isolator	3.3, 5	4	1	2500	2/2	TTL	95	Yes	SOIC-16	$1.90
ISO7242C	Quad Channel, 2/2, 25Mbps, Digital Isolator	3.3, 5	4	25	2500	2/2	TTL	42	Yes	SOIC-16	$2.90
ISO7242M	Quad Channel, 2/2, 150Mbps, Digital Isolator	3.3, 5	4	150	2500	2/2	CMOS	23	None	SOIC-16	$4.10

Suggested resale price in U.S. dollars in quantities of 1,000

NOTE: [1]The A and C option devices have TTL input thresholds and a noise-filter at the input that prevents transient pulses from being passed to the output of the device. The M option devices have CMOS Vcc/2 input thresholds and do not have the input noise-filter or the additional propagation delay.

Amplifiers for Driving Analog-to-Digital Converters

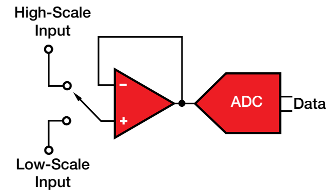
Data acquisition systems generally require an amplifier preceding the ADC to buffer the input signal. Most modern ADCs possess complex input characteristics due to the capacitive charging and switching that occurs during sampling and conversion. This behavior causes transient currents on the ADC's input that can disturb or distort a precision analog input signal. The input amplifier serves to provide a stable, accurate signal in the presence of these current transients. It can also provide gain (or attenuation), level shifting, filtering and other signal conditioning functions.

Selecting the input op amp requires attention to many considerations. DC accuracy may narrow the possible choices of an amplifier. The amplifier must have sufficiently low offset voltage, offset voltage drift, input bias current, noise, and so forth, to meet the required accuracy performance. It is often the dynamic performance characteristics, however, that prove most troublesome in the selection process. The amplifier must preserve the required dynamic signal characteristics.

Design Considerations

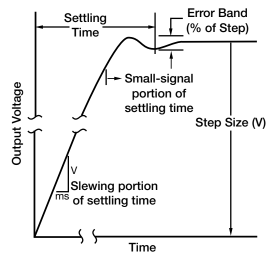
Time domain issues—some applications demand that the amplifier respond accurately to full-scale changes in input voltage. For example, a multiplexed-input system may have input voltages equal to full-scale extremes on two adjacent inputs. The amplifier and ADC must respond to this sudden full-scale change in one sampling period.

Settling time—an all-encompassing specification used to describe the ability of an amplifier to respond to a large change in input voltage. The settling time includes the large-signal period determined by slew rate and the small signal settling period determined primarily by the bandwidth of the amplifier. Slewing time varies with the step size. Though generally specified for a specific step size, the settling time for other step sizes can be inferred from the slewing portion of the step.

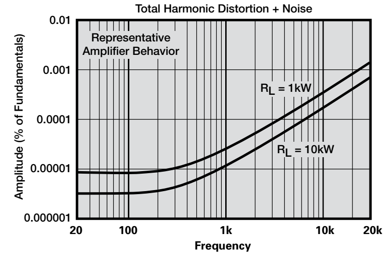


Multiplexed data acquisition systems require excellent dynamic behavior from op amps.

The small-signal portion of the settling waveform is affected by the gain of the input amplifier. If the amplifier is placed in a higher gain, system bandwidth is reduced, proportionally increasing the small-signal portion of the settling waveform.



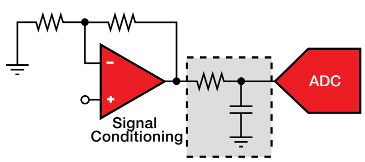
Frequency domain performance—many ADCs are used to digitize dynamic waveforms such as audio. Rapid full-scale signal steps are rarely, if ever, encountered in these systems. For this reason, such systems generally specify spectral purity of the digitized signal. The amplifier must support this application with the required distortion performance. Many amplifiers specify THD+N (total harmonic distortion + noise). Other measures are also used.



All these measures are made by applying a pure sine wave (or combination of sine waves) and measuring the spectral content in the amplifier's output that are not present in its input signal.

Technical Information

The input amplifier is generally connected to the ADC through an R-C network. Though often called a filter, this network actually serves as a "flywheel" in the presence of the current pulses created by the ADC's input circuitry. The circuit values of this circuit depend on both the amplifier and the ADC characteristics and often must be optimized for a particular application. The optimum capacitor value is generally in the range of 10 to 50 times the input capacitance of the ADC. The resistor is chosen to meet the speed or bandwidth requirement of the application.



"Flywheel" conditioning network.

The op amps shown in the following table are among the most likely choices for the indicated conversion speeds and ADC architectures. Depending on specific application requirements, other amplifiers may provide improved performance. For a complete list of op amps, visit: **amplifier.ti.com**

Amplifiers for ADCs Selection Guide

Device	Description	Ch.	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/µs) (typ)	V_{OS} (25°C) (mV) (max)	Offset Drift (µV/°C) (typ)	I_B (pA) (max)	V_N at 1kHz (nV/√Hz) (typ)	Single Supply	Rail-to-Rail	Package(s)	Price*
For Use with Medium-Speed SAR ADCs (<250kSPS)															
INA155	Medium Speed, Precision INA	1	2.7	5.5	2.1	0.55	6.5	1	5	10	40	Y	Out	MSOP	$1.10
INA128	High Precision, 120dB CMRR	1	4.5	36	0.75	1.3	4	0.5	0.2	5000	8	N	N	PDIP, SOIC	$3.05
INA331	High Bandwidth, Single Supply	1, 2	2.7	5.5	0.5	5	5	0.5	5	10	46	Y	Out	MSOP	$1.10
OPA340	CMOS, 0.0007% THD+N	1, 2, 4	2.7	5.5	0.95	5.5	6	0.5	2.5	10	25	Y	I/O	SOT-23, MSOP	$0.80
OPA363	1.8V, High CMRR, SHDN	1, 2	1.8	5.5	0.75	7	5	0.5	2	10	17	Y	I/O	SOT-23, MSOP	$0.60
OPA2613	Dual VFB, Low Noise	2	5	12.6	6	12.5	70	1	3.3	12µA	1.8	Y	N	SOIC, SOIC PowerPAD™	$1.55
OPA211	36V, Bipolar Precision	1,2	5	36	3.6	80	27	0.1	0.2	15000	1.1	Y	Out	DFN, MSOP, SO8	$3.45

**Suggested resale price in U.S. dollars in quantities of 1,000*

Amplifiers for Driving Analog-to-Digital Converters

Amplifiers for ADCs Selection Guide (continued)

Device	Description	Ch.	V_S (V) (min)	V_S (V) (max)	I_Q Per Ch. (mA) (max)	GBW (MHz) (typ)	Slew Rate (V/µs) (typ)	V_{OS} (25°C) (mV) (max)	Offset Drift (µV/°C) (typ)	I_B (pA) (max)	V_N at 1kHz (nV/$\sqrt{Hz}$) (typ)	Single Supply	Rail-to-Rail	Package(s)	Price*
For Use with Medium-Speed SAR ADCs (<250kSPS) (continued)															
OPA381	Precision, High Speed	1, 2	2.7	5.5	1	18	12	0.025	0.03	50	10	Y	Out	DFN, MSOP	$1.45
OPA228	Precision, Low Noise, G ≥ 5	1, 2, 4	5	36	3.8	33	10	0.075	0.1	10000	3	N	N	PDIP, SOIC	$1.10
OPA350	Precision, ADC Driver	1, 2, 4	2.7	5.5	7.5	38	22	0.5	4	10	5	Y	I/O	PDIP, MSOP	$1.30
THS4281	Very Low Power, RRIO	1	2.7	15	1	80	35	3.5	4	10	12.5	Y	I/O	SOT-23, MSOP, SOIC	$0.95
OPAy830	Low Power, RR, VFB	1, 2	3	11	3.9	100	500	5.5	—	10,000	9.2	N	Out	MSOP	$0.80
THS4032	100MHz, Low Noise	2	5	30	8.5	230	100	2	10	6	1.6	N	N	MSOP, SOIC, PowerPAD™	$3.35
THS4520	Rail-to-Rail Output, FDA[1]	1	3	5	13	1200	520	2.5	8	11	2	Y	Out	QFN	$2.45
For Use with High-Resolution, Delta-Sigma (DS) ADCs															
OPA333	1.8V, RRIO, Zero Drift	1,2	1.8	5.5	0.025	0.5	0.16	0.01	0.05	100	—	Y	I/O	SC70, SOT23, SO8	$0.95
OPA735	12V, Precision, Auto-Zero Amp	1	2.7	13.2	0.75	1.6	1.5	0.005	0.05	200	—	Y	Out	SOT-23, MSOP	$1.25
OPA277	Low Offset and Drift	1, 2, 4	4	36	0.825	1	0.8	0.02	0.1	1000	8	N	N	QFN, SOIC, PDIP	$0.85
OPA227	Ultra-Low Noise, Bipolar Input	1, 2, 4	5	36	3.8	8	2.3	0.075	0.1	10000	3	N	N	QFN, PDIP, SOIC	$1.10
INA326	Auto-Zero INA, 110dB CMRR	1	2.5	5.5	3.4	1kHz	—	0.1	0.4	2000	33	Y	I/O	MSOP	$1.80
OPA627	Ultra-Low THD+N, Difet™	1	9	36	7.5	16	55	0.1	0.4	5	5.2	N	N	PDIP, SOIC	$12.25
OPA336	High Precision, µPower Amp	1, 2, 4	2.3	5.5	0.032	0.1	0.03	0.125	1.5	10	40	Y	Out	MSOP, PDIP	$0.40
INA159	Level Translation Amp	1	1.8	5.5	1.4	1.5	15	0.5	2	—	30	Y	I/O	MSOP	$1.50
INA152	Single-Supply Difference Amp	1	2.7	20	0.65	0.8	0.4	1.5	3	—	87	Y	Out	MSOP	$1.20
For Use with High-Speed SAR (>250kSPS) ADCs															
OPA2613	Dual VFB, Low Noise	2	5	12.6	6	12.5	70	1	3.3	12µA	1.8	Y	N	SOIC, SOIC PowerPAD	$1.55
OPA727	CMOS, e-trim™, Low Noise	1, 2, 4	4	12	6.5	20	30	0.15	1.5	100	11	Y	N	MSOP, DFN, TSSOP	$1.45
OPAy365	High-Speed, Zero-Drift CMOS	1, 2	2.2	5.5	5	50	25	0.5	1	10	100	5	IN	SOT23, SO-8	$0.95
OPA358	CMOS, 3V Operation, SC70	1	2.7	3.3	7.5	80	55	6	5	50	6.4	Y	Y	SC70	$0.45
OPAy830	Low Power, Wideband, SS	1,2,4	3	11	3.9	100	500	1.5	27	10	9.5	Y	Out	MSOP, SOIC	$1.20
THS4130/31	Differential In/Out, SHDN	1	5	30	15	135	52	2	4.5	6µA	1.3	Y	N	SOIC, MSOP	$2.75
OPA211	36V, Bipolar, Precision	1,2	5	36	3.6	80	27	0.1	0.2	15000	1.1	Y	Out	DFN, MSOP, SO8	$3.45
OPA355	CMOS, 2.7V Operation, SOT23	1, 2, 3	2.7	5.5	11	200	300	9	7	50	5.8	Y	Out	SOT-23, SOIC	$0.90
OPA842	Low Distortion, VFB	1	8	12.6	20.2	200	400	1.2	4	35	2.6	N	N	SOT-23, SOIC	$1.55
THS4032	100MHz, Low Noise	2	5	30	8.5	230	100	2	10	6	1.6	N	N	MSOP PowerPAD, SOIC	$3.35
OPA2822	Dual Wideband, Low Noise, VFB	2	4	12.6	4.8	240	170	1.2	5	12µA	2	Y	N	SOIC, MSOP	$1.45
THS4520	Rail-to-Rail Output, FDA[1]	1	3	5	13	1200	520	2.5	8	11µA	2	Y	Out	QFN	$2.45
OPAy890	Low Power, VFB	1,2	3	12	1.2	130	500	5	15	1.6µA	8	Y	N	SOT-23, SOIC	$0.75
OPA2889	Dual, Very Low Power, VFB	2	2.6	12	0.46	75	250	5	±20	0.75µA	8.4	Y	N	MSOP, SOIC	$1.20
For Use with High-Speed Data Converters (Pipeline and Flash ADCs)															
OPA2613	Dual VFB, Low Noise	2	5	12.6	6	12.5	70	1	3.3	12µA	1.8	Y	N	SOIC	$1.55
OPA842	Low Distortion, VFB	1	7	12.6	20.2	200	400	1.2	4	35µA	2.6	Y	N	SOT-23, SOIC	$1.55
OPA847	Low Noise, VFB with SHDN	1	7	12.6	18.1	3900	950	0.5	0.25	39µA	0.85	Y	N	SOT-23, SOIC	$2.00
OPA843	Low Distortion, G ≥ +3, VFB	1	7	12.6	20.2	800	1000	1.2	4	35µA	2	Y	N	SOT-23, SOIC	$1.60
OPA698	Wideband, VFB w/Limiting	1	5	12.6	15.5	250	1100	5	15	10µA	5.6	Y	N	SOIC	$1.90
OPA2690	Dual VFB w/Disable Limiting	2	5	12.6	5.5	300	1800	4.5	12	10µA	5.5	Y	N	SOIC	$2.15
THS4502/03	Differential In/Out, SHDN	1	4.5	15	28	370	2800	–4/+2	10	4.6µA	6.8	Y	N	MSOP	$4.00
OPAy695	Ultra-Wideband CFB	1,2,3	5	12.6	12.3	—	4300	3	10	37µA	1.8	Y	N	SOT-23, SOIC	$1.35
THS4511	Wideband, Low Noise, FDA[1]	1	3	5	39.2	2000	4900	5.2	2.6	15.5µA	2	Y	N	QFN	$3.45
THS4513	Wideband, Low Noise, FDA[1]	1	3	5	37.7	2000	5100	5.2	2.6	13µA	2.2	Y	N	QFN	$3.25
THS4508	Wideband, FDA1	1	3	5	39.2	3000	6400	5	2.6	15.5µA	2.3	Y	N	QFN	$3.95
THS4509	Low Distortion, FDA1	1	3	5	37.7	3000	6600	0.8	2.6	13µA	1.9	Y	N	QFN	$3.75
THS4520	Rail-to-Rail Output, FDA1	1	3	5	13	1200	520	2.5	8	11µA	2	Y	Out	QFN	$2.45

*[1]Fully differential amplifier * Suggested resale price in U.S. dollars in quantities of 1,000. *Suggested resale price in U.S. dollars in quantities of 1,000.*

Delta-Sigma (ΔΣ) ADCs

Delta-sigma converters are capable of very high resolution, and are ideal for converting signals over a very wide range of frequencies from DC to several megahertz. In a delta-sigma ADC, the input signal is oversampled by a modulator, then filtered and decimated by a digital filter producing a high-resolution data stream at a lower sampling rate.

The delta-sigma architecture approach allows resolution to be traded for speed and both to be traded for power. This nearly continuous relationship between data rate, resolution and power consumption makes delta-sigma converters extraordinarily flexible. In many delta-sigma converters, this relationship is programmable, allowing a single device to handle multiple measurement requirements.

Because delta-sigma converters oversample their inputs, they can perform most anti-aliasing filtering in the digital domain. Modern VLSI design techniques have brought the cost of complex digital filters far below the cost of their analog equivalents. Formerly unusual functions, such as simultaneous 50Hz and 60Hz notch filtering, are now built into many delta-sigma ADCs.

Typical high-resolution applications for delta-sigma ADCs include audio, industrial process control, analytical and test instrumentation and medical instrumentation.

Recent innovations in ADC architectures have led to a new class of ADC architecture which uses both the pipeline and the oversampling principle. These, very high-speed converters push the data rates into the MSPS range, while maintaining resolutions of 16-bits and higher. These speeds enable a host of new wide bandwidth signal processing applications such as communications and medical imaging.

Most delta-sigma ADCs have inherently differential inputs. They measure the actual difference between two voltages, instead of the difference between one voltage and ground. The differential input structure of a delta-sigma makes it ideal for measuring differential sources such as bridge sensors and thermocouples. Frequently, no input amplifiers are required for these applications.

Delta-sigma converters work differently than SAR converters. A SAR takes a “snapshot” of an input voltage and analyzes it to determine the corresponding digital code. A delta-sigma measures the input signal for a certain period of time and outputs a digital code corresponding to the signal’s average over that time. It is important to remember the way delta-sigma converters operate, particularly for designs incorporating multiplexing and synchronization.

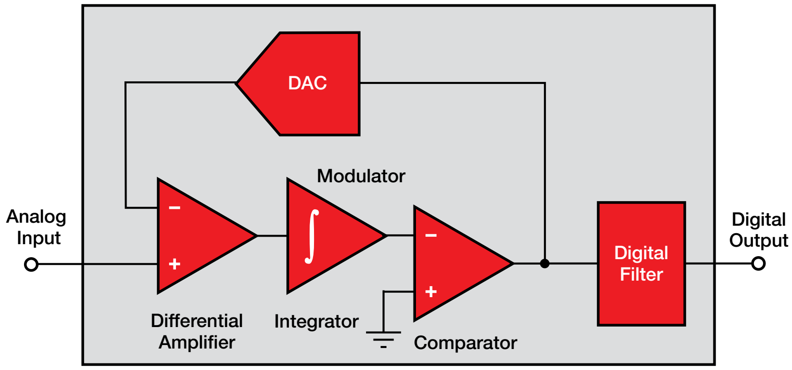
It is very easy to synchronize delta-sigma converters together, so that they sample at the same time but it’s more difficult to synchronize a delta-sigma converter to an external event. Delta-sigma converters are highly resistant to system clock jitter. The action of oversampling effectively averages the jitter, reducing its impact on noise.

Many delta-sigma converters include input buffers and programmable gain amplifiers (PGA). An input buffer increases the input impedance to allow direct connection to high source impedance signals. A PGA increases the converter’s resolution when measuring small signals. Bridge sensors are an example of a signal source that can take advantage of the PGA within the converter.

Every ADC requires a reference, and for high-resolution converters, low-noise, low-drift references are critical. Most delta-sigma converters have differential reference inputs.

The following pages provide a broad range of delta-sigma ADCs available from TI for a wide range of applications.

To help facilitate the selection process, an interactive online data converter parametric search engine is available at ***dataconverter.ti.com*** with links to all data converter specifications.



Delta-sigma ADCs consist of a delta-sigma modulator followed by a digital decimation filter. The modulator incorporates a comparator and integrator in a feedback loop with a DAC. The loop is synchronized by a clock.

Delta-Sigma (ΔΣ) ADCs

31-Bit, 4kSPS, Ultra-High-Performance, Low-Power ADC
ADS1281, ADS1282

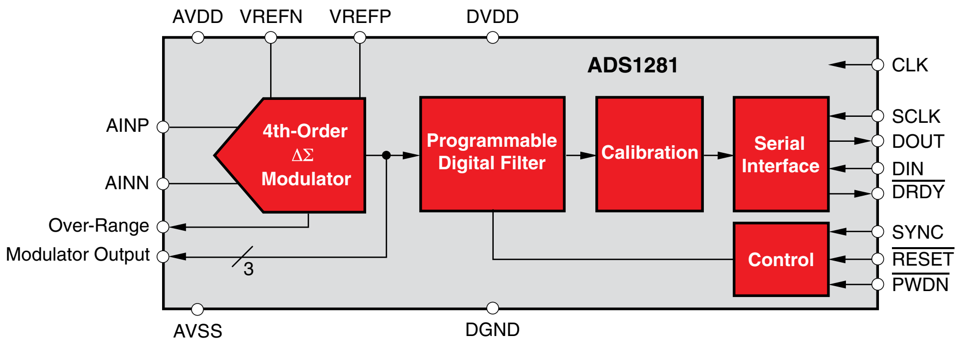
NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/ADS1281; www.ti.com/sc/device/ADS1282**

Key Features
- Output data rate: 4kSPS
- SNR: 130dB (typ, 250SPS)
- High accuracy:
  - THD: –122dB (typ)
  - INL: 0.7ppm (typ, ADS1281)
    0.5 ppm (typ, ADS1282)
- Flexible digital filter:
  - Sinc + FIR + IIR (selectable)
  - Selectable FIR data rates: 50SPS to 4kSPS
  - Filter bypass option
- Low Power:
  - 12mW (ADS1281)
  - 25mW (ADS1282)
- Packaging: TSSOP-24 (ADS1281) and TSSOP-28 (ADS1282)

Applications
- Seismic/energy exploration
- Geophone/hydrophone exploration
- Earthquake building monitoring
- Scientific Instrumentation

The ADS1281 and ADS1282 are 4kSPS, high-resolution ΔΣ ADCs operating from either a +5V unipolar or ±2.5V bipolar analog supply, and have a 1.8V to 3.3V digital supply. They offer high accuracy without sacrificing power. The ADS1282 features an onboard low-noise programmable gain amplifier delivering a gain from 1 to 64, plus a two-channel input multiplexer. Both the ADS1281 and ADS1282 deliver output data through an SPI-compatible interface.



ADS1281 functional block diagram.

16-Channel, Current-Input ADC
DDC316

NEW

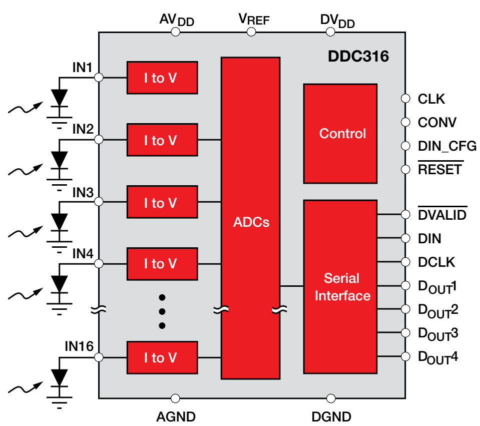
Get samples and datasheets at: **www.ti.com/sc/device/DDC316**

Key Features
- Single-chip solution to measure 16 low-level currents
- Integrating I-to-V conversion front-end
- Programmable full-scale: 3pC to 12pC
- Adjustable speed:
  - Data rate up to 100kSPS
  - Integration time down to 10µs
- Analog supply: +5V
- Digital supply: +3.3V
- Packaging: BGA-64

Applications
- CT scanners
- DAS
- Photodiode sensors
- X-ray detection systems

The DDC316 is a 16-bit, 16-channel, current-input ADC. It combines both current-to-voltage and analog-to-digital conversion so that 16 separate low-level current output devices (such as photodiodes) can be directly connected to its inputs and digitized.

For each of the 16 inputs, the DDC316 provides a dual-switched integrator front-end. This configuration allows for continuous current integration: while one integrator is being digitized by the on-chip ADC, the other is integrating the input current. Adjustable integration times range from 10µs to 1ms.



DDC316 functional block diagram.

Quad/Octal, 16-Bit, Simultaneous Sampling ADCs

ADS1174, ADS1178

NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/ADS1174; www.ti.com/sc/device/ADS1178**

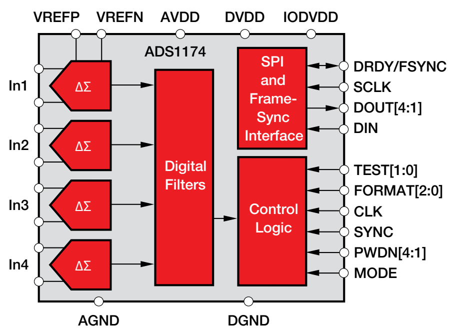
Key Features

- Selectable operating modes:
  - High-speed: 52kSPS
  - Low-power: 7mW per channel
- AC performance:
  - Bandwidth: 25kHz
  - SNR : 97dB
  - THD: –105dB
- DC performance:
  - Offset drift: 2mV/°C
  - Gain drift: 2ppm/°C
- Digital filter:
  - Linear phase response
  - Passband ripple: ±0.005dB
  - Stop band attenuation: 100dB
- Analog supply: 5V
- I/O supply: 1.8V to 3.3V
- Package: HTQFP-64 PowerPAD™

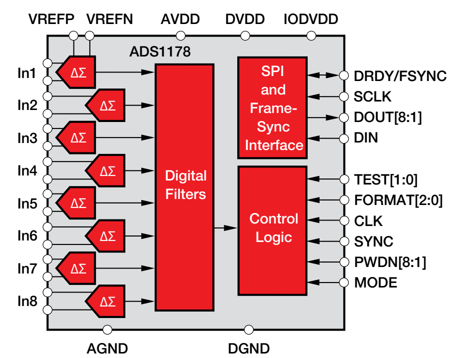
Applications

- 3-Phase power monitors
- Defibrillators and ECG monitors
- Coriolis flow meters
- Vibration/modal analysis
- Scientific instrumentation

The ADS1174 (quad) and ADS1178 (octal) are delta-sigma ADCs with data rates up to 52kSPS, which allow synchronous sampling of all channels. The delta-sigma architecture allows near ideal 16-bit ac performance, and the high-order, chopper-stabilized modulator achieves very low drift and low noise. A SYNC input control pin allows conversions to be started and synchronized to an external event. SPI and FrameSync serial interfaces are supported. These devices use identical packages and are compatible with the high-performance, 24-bit ADS1274 and ADS1278, permitting drop-in upgrades.



ADS1174 functional block diagram.



ADS1178 functional block diagram.

24-Bit ADCs with DC Accuracy and AC Performance

ADS1274, ADS1278

NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/ADS1274; www.ti.com/sc/device/ADS1278**

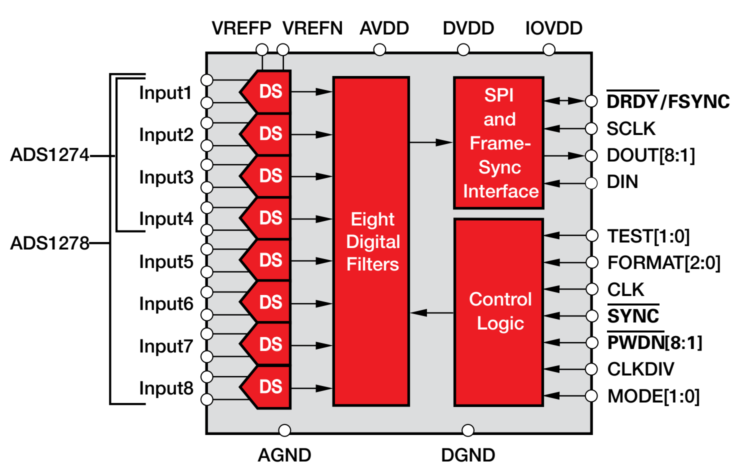
Key Features

- AC performance:
  - Bandwidth: 62kHz
  - THD: –106dB
- DC accuracy:
  - Offset drift: 0.8µV/°C
  - Gain drift: 3ppm/°C
- Selectable operating modes:
  - High speed: 128kSPS data rate
  - High resolution: 110dB SNR
  - Low power: 7mW/channel
- Selectable SPI or FrameSync serial interface
- Modulator output option (digital filter bypass)
- Analog supply: 5V
- Digital supply: 1.8V to 3.3V
- Packaging: HTQFP-64 PowerPAD™

Applications

- Vibration/modal analysis
- Acoustics
- Dynamic strain gauges
- Pressure sensors
- Multi-channel data acquisition

The ADS1274 (quad) and ADS1278 (octal) ADCs offer simultaneous sampling rates up to 128kSPS (max) and offer a unique combination of excellent DC accuracy and outstanding AC performance. The high-order, chopper-stabilized modulator achieves very low drift with low in-band noise. The onboard decimation filter suppresses modulator and out-of-band noise.



ADS1274 and ADS1278 functional block diagram.

Delta-Sigma (ΔΣ) ADCs

Delta-Sigma (ΔΣ) ADCs Selection Guide

Device	Res. (Bits)	Sample Rate (kSPS)	Number of Input Channels	Interface	Input Voltage (V)	V_{REF}	Linearity (%)	Power (mW)	Package(s)	Price*
ADS1281	31	4	1	Serial, SPI	5	Ext	0.00006	12	TSSOP-24	$28.95
ADS1282	31	4	1	Serial, SPI	PGA (1-64), 5	Ext	0.00006	27	TSSOP-28	$36.95
ADS1672	24	625	1	Serial	+5	Ext	0.0003	350	TQFP-64	$11.75
ADS1258	24	125	16 SE/8 Diff	Serial, SPI	5, ±2.5	Ext	0.0015	40	QFN-48	$7.95
ADS1278	24	128	8 Diff Simultaneous	Serial, SPI w/FSYNC	2.5	Ext	0.001	60-600	TQFP-64	$23.95
ADS1274	24	128	4 Diff Simultaneous	Serial, SPI w/FSYNC	2.5	Ext	0.001	30-300	TQFP-64	$13.95
ADS1271	24	105	1 Diff	Serial, SPI w/FSYNC	2.5	Ext	0.0015	35-100	TSSOP-16	$5.90
ADS1252	24	41	1 SE/1 Diff	Serial	5	Ext	0.0015	40	SOIC-8	$6.45
ADS1256	24	30	8 SE/4 Diff	Serial, SPI	PGA (1-64), 5	Ext	0.001	35	SSOP-28	$6.95
ADS1255	24	30	2 SE/1 Diff	Serial, SPI	PGA (1-64), 5	Ext	0.001	35	SSOP-20	$6.50
ADS1253	24	20	4 SE/4 Diff	Serial	5	Ext	0.0015	7.5	SSOP-16	$6.70
ADS1254	24	20	4 SE/4 Diff	Serial	5	Ext	0.0015	4	SSOP-20	$6.70
ADS1251	24	20	1 SE/1 Diff	Serial	5	Ext	0.0015	7.5	SOIC-8	$5.60
ADS1246	24	2	1 Diff	Serial, SPI	3 to +5, ±2.5	Ext	0.0003	2.56	TSSOP-16	$3.45
ADS1247	24	2	3 SE/2 Diff	Serial, SPI	3 to +5, ±2.5	Ext	0.0003	2.56	TSSOP-20	$4.45
ADS1248	24	2	7 SE/4 Diff	Serial, SPI	3 to +5, ±2.5	Ext	0.0003	2.56	TSSOP-28	$4.95
ADS1216	24	0.78	8 SE/4 Diff	Serial, SPI	PGA (1-128), 2.5	Int/Ext	0.0015	0.6	TQFP-48	$5.00
ADS1217	24	0.78	8 SE/4 Diff	Serial, SPI	PGA (1-128), 5	Int/Ext	0.0012	0.8	TQFP-48	$5.00
ADS1218	24	0.78	8 SE/4 Diff	Serial, SPI	PGA (1-128), 2.5	Int/Ext	0.0015	0.8	TQFP-48	$5.50
ADS1224	24	0.24	4 SE/4 Diff	Serial	5	Ext	0.0015	0.5	TSSOP-20	$3.25
ADS1222	24	0.24	2 SE/2 Diff	Serial	5	Ext	0.0015	0.5	TSSOP-14	$2.95
ADS1234	24	0.08	4 SE/4 Diff	Serial	PGA (1-128), 2.5	Ext	0.0015	3	TSSOP-28	$4.50
ADS1232	24	0.08	2 SE/2 Diff	Serial	PGA (1-128), 2.5	Ext	0.0015	3	TSSOP-24	$3.90
ADS1226	24	0.08	2 Diff	Serial	5	Ext	0.0015	0.5	QFN-16	$2.95
ADS1225	24	0.08	1 Diff	Serial	5	Ext	0.0015	0.5	QFN-16	$2.75
ADS1241	24	0.015	8 SE/4 Diff	Serial, SPI	PGA (1-128), 2.5	Ext	0.0015	0.5	SSOP-28	$4.20
ADS1243	24	0.015	8 SE/4 Diff	Serial, SPI	PGA (1-128), 2.5	Ext	0.0015	0.6	TSSOP-20	$3.95
ADS1240	24	0.015	4 SE/2 Diff	Serial, SPI	PGA (1-128), 2.5	Ext	0.0015	0.6	SSOP-24	$3.80
ADS1242	24	0.015	4 SE/2 Diff	Serial, SPI	PGA (1-128), 2.5	Ext	0.0015	0.6	TSSOP-16	$3.60
ADS1244	24	0.015	1 SE/1 Diff	Serial	5	Ext	0.0008	0.3	MSOP-10	$2.95
ADS1245	24	0.015	1 SE/1 Diff	Serial	2.5	Ext	0.0015	0.5	MSOP-10	$3.10
ADS1250	20	25	1 SE/1 Diff	Serial, SPI	PGA (1-8), 4	Ext	0.003	75	SOIC-16	$6.95
ADS1230	20	0.08	1 SE/1 Diff	Serial	0.02	Ext	0.003	3	TSSOP-16	$2.50
ADS1112	16	0.24	3 SE/2 Diff	Serial, I^2C	PGA (1-8), 2.048	Int	0.01	0.7	MSOP-10, SON-10	$2.65
ADS1110	16	0.24	1 SE/1 Diff	Serial, I^2C	PGA (1-8), 2.048	Int	0.01	0.7	SOT23-6	$1.95
ADS1100	16	0.128	1 SE/1 Diff	Serial, I^2C	PGA (1-8), V_{DD}	Ext	0.0125	0.3	SOT23-6	$1.80
ADS1158	16	125	16 SE/8 Diff	Serial, SPI	+5, ±2.5	Ext	0.0045	42	QFN-40	$5.95
ADS1174	16	52	4	Serial, SPI w/FS	2.5	Ext	0.0045	135	HTQFP-64	$9.95
ADS1178	16	52	8	Serial, SPI w/FS	2.5	Ext	0.0045	245	HTQFP-64	$15.95
ADS1000	12	0.128	1 SE/1 Diff	Serial, I^2C	PGA (1-8), V_{DD}	Ext	0.0125	0.3	SOT23-6	$0.99
Delta-Sigma (ΔΣ) ADCs for Measuring Low-Level Currents (Photodiodes)										
DDC232	20	3	32	Serial	12-350pC	Ext	0.025	224-320	BGA-64	$70.00
DDC118	20	3	8	Serial	12-350pC	Ext	0.025	110	QFN-48	$32.00
DDC114	20	3	4	Serial	12-350pC	Ext	0.025	55	QFN-48	$18.00
DDC112	20	3	2	Serial	50-1000pC	Ext	0.025	80	SOIC-28	$12.10
DDC316	16	100	16	Serial	3pC - 12pC	Ext	0.0125	540	BGA-64	$48.25

*Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red**. Preview products are listed in **bold blue**.*

Wide Bandwidth ΔΣ ADCs

TI's wide bandwidth Delta-Sigma (ΔΣ) ADCs are capable of very high resolution and are capable of converting signals over a very wide range of frequencies from DC to several megahertz. Systems using these ADCs benefit from high speed, precision performance, and wide bandwidth (DC to 5MHz).

These ADCs employ a multi-stage propriatary-modulator architecture, which offer the advantage of inherent stability, and higher SQNR with lower oversampling ratio (OSR). Furthermore, these high-speed, ΔΣ converters are highly resistant to system clock jitter. The action of oversampling effectively averages the jitter, reducing the impact on noise.

The combination of speed and precision enable wide bandwidth signal processing applications for advanced scientific instrumentation for biomedical, bench test and measure, and communications applications.

24-Bit, 625kSPS, Wide-Bandwidth, Low-Latency ADC
ADS1672

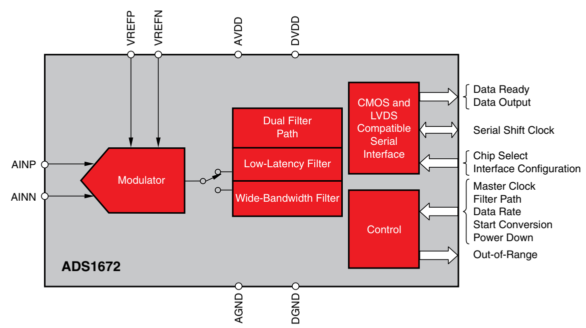
NEW

Get samples and datasheets at: **www.ti.com/sc/device/ADS1672**

Key Features
- Output data rate: 625kSPS
- Signal bandwidth: 305kHz
- Latency: 5.5μs
- SNR:105dBFS
- THD: –115db at 10kHz
- SFDR: 107dB
- Power dissipation: 350mW
- START pin for simultaneous sampling with multiple DS1672s
- Packaging: TQFP-64

Applications
- Automated test equipment
- Vibration analysis
- SONAR
- Test and measurement

The ADS1672 is a 625kSPS, high-speed, high-precision ΔΣ ADC operating from a +5V analog and +3V digital supply. Featuring a low-drift, chopper-stabilized modulator with out-of-range detection and a dual-path programmable digital filter, the ADS1672 achieves 105dBFS SNR at a 305kHz bandwidth. The wide bandwidth and high resolution are great when working with small, fast signals. Output data is supplied over an SPI or LVDS interface that allows for direct connection to a wide range of microcontrollers, digital signal processors (DSPs), or field-programmable grid arrays (FPGAs). Power dissipation can be adjusted with an external resistor, allowing for reduction at lower operating speeds.



ADS1672 functional block diagram.

Delta-Sigma (ΔΣ) ADCs Selection Guide

Device	Res. (Bits)	Sample Rate (kSPS)	Number of Input Channels	Interface	Signal Bandwidth (kHz)	SNR (dB)	THD (dB)	Power (mW)	Package	Price*
Wide Bandwidth Delta-Sigma (ΔΣ) ADCs										
ADS1672	24	625	1 Diff	SPI/LVDS	305	105	–115	350	TQFP-64	$11.75
ADS1626	18	1250	1 Diff	P18 w/FIFO	615	93	–101	515	TQFP-64	$15.50
ADS1625	18	1250	1 Diff	P18	615	93	–101	515	TQFP-64	$14.95
ADS1610	16	10MSPS	1 Diff	P16	4900	86	–94	960	TQFP-64	$19.95
ADS1606	16	5000	1 Diff	P16 w/FIFO	2450	88	–99	570	TQFP-64	$15.50
ADS1605	16	5000	1 Diff	P16	2450	88	–99	570	TQFP-64	$14.95
ADS1602	16	2500	1 Diff	Serial	1230	91	–103	530	TQFP-48	$12.50
ADS1601	16	1250	1 Diff	Serial	615	92	–103	350	TQFP-48	$9.95

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.***

SAR ADCs

Successive-approximation register (SAR) converters are frequently the architecture of choice for medium-to-high-resolution applications with medium sampling rates. SAR ADCs range in resolution from 8- to 18-bits with speeds typically less than 10MSPS. They provide low power consumption and a small form factor.

A SAR converter operates on the same principle as a balance scale. On the scale, an unknown weight is placed on one side of the balance point, while known weights are placed on the other side and rejected or kept until the two sides are perfectly balanced. The unknown weight can then be measured by totaling up the kept, known weights. In the SAR converter, the input signal is the unknown weight, which is sampled and held. This voltage is then compared to successive known voltages, and the results are output by the converter. Unlike the weigh scale, conversion occurs very quickly through the use of charge redistribution techniques.

Because the SAR ADC samples the input signal and holds the sampled value until conversion is complete, this architecture does not make any assumptions about the nature of the input signal, and the signal therefore does not need to be continuous. This makes the SAR architecture ideal for applications where a multiplexer may be used prior to the converter, or for applications where the converter may only need to make a measurement once every few seconds, or for applications where a "fast" measurement is required. The conversion time remains the same in all cases, and has little sample-to-conversion latency compared to a pipeline or delta-sigma converter. SAR converters are ideal for real-time applications such as industrial control, motor control, power management, portable/battery-powered instruments, PDAs, test equipment and data/signal acquisition.

Technical Information

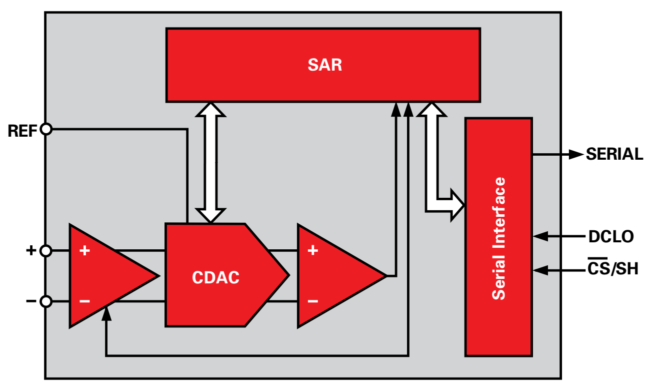
Modern SAR ADCs use a sample capacitor that is charged to the voltage of the input signal. Due to the ADC's input capacitance, input impedance, and external circuitry, a settling time will be required for the sample capacitor's voltage to match the measured input voltage.

Minimizing the external circuitry's source impedance is one way to minimize this settling time, assuring that the input signal is accurately acquired within the ADC's acquisition time. A more troublesome design constraint, however, is the dynamic load that the SAR ADC's input presents to the driving circuitry. The op amp driver to the ADC input must be able to handle this dynamic load and settle to the desired accuracy within the required acquisition time.

The SAR ADC's reference input circuitry presents a similar load to the reference voltage. While the reference voltage is supposed to be a very stable DC voltage, the dynamic load that the ADC's reference input presents makes achieving this goal somewhat difficult. Thus, buffer circuitry is required for the reference voltage, and the op amp used for this has similar requirements as that used for driving the ADC input; in fact, the requirements on the op amp may be even higher than for the input signal as the reference input must be settled within one clock cycle. Some converters have this reference buffer amplifier built in.

Buffering these inputs using op amps with a low, wideband output impedance is the best way to preserve accuracy with these converters.

To help facilitate the selection process, an interactive online data converter parametric search engine is available at ***dataconverter.ti.com*** with links to all data converter specifications.



In a SAR ADC, the bits are decided by a single high-speed, high-accuracy comparator bit by bit, from the MSB down to the LSB. This is done by comparing the analog input with a DAC whose output is updated by previously decided bits and successively approximates the analog input.

12-Bit, 1MSPS, 16-/12-/8-/4-Channel, microPower ADCs
ADS7950, ADS7951, ADS7952, ADS7953

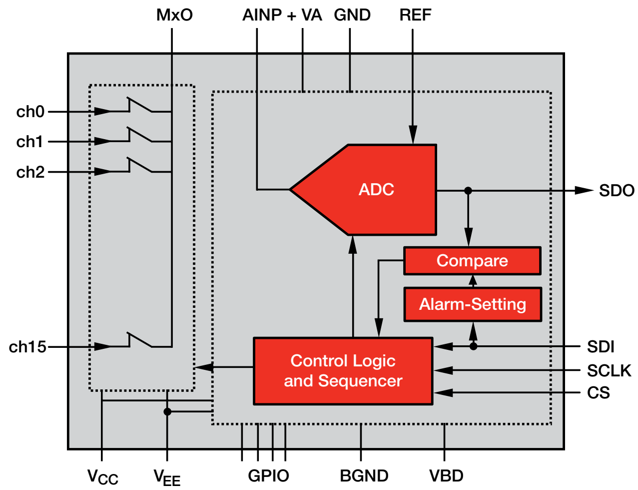
NEW

Get samples, datasheets and app reports at: www.ti.com/sc/device/PARTnumber (Replace PARTnumber with ADS7950, ADS7951, ADS7952 or ADS7953)

Key Features
- Zero latency
- 20MHz serial interface
- Analog supply range: 2.7V to 5.25V
- I/O supply range: 1.8V to 5.25V
- Two software-selectable unipolar input ranges: 0 to 2.5V; 0 to 5V
- Power dissipation: 12mW (5V_{DD}) at 1MSPS
- Four individually configurable GPIOs
- Two programmable alarm levels per channel
- Package: TSSOP-30, TSSOP-38

Applications
- Industrial process and control
- Battery-powered systems
- Medical instrumentation
- Digital power supplies
- High-speed data acquisition systems
- High-speed closed-loop systems

The ADS795x devices are capacitor-based SAR ADCs with inherent sample and hold. They feature a wide 1.8V to 5.25V I/O supply range to facilitate glueless interface with most commonly used CMOS digital hosts, and the serial interface is easily connected to microprocessors and digital signal processors (DSPs). Each channel has two software programmable input ranges, four individually configurable GPIOs and two alarm thresholds.



ADS7953 functional block diagram.

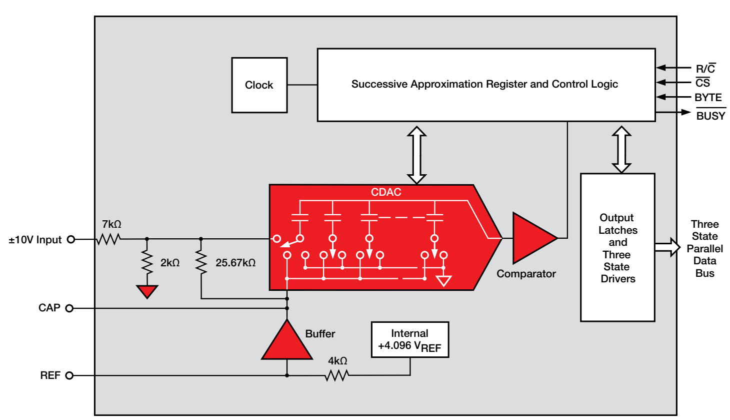
16-Bit, 250kSPS, Serial CMOS ADCs
ADS8515, ADS8519

Get samples, datasheets and app reports at: **www.ti.com/sc/device/ADS8515; www.ti.com/sc/device/ADS8519**

Key Features
- Input ranges: 0V to 8.192V, ±5V and ±10V
- SNR: 90dB with 20kHz input
- INL: ±2 LSB (max)
- DNL: ±1 LSB, no missing codes
- SPI-compatible serial output with daisy-chain (TAG) feature and 3-state bus
- Internal or external reference
- Simple DSP interface
- Power dissipation: 100mW at 250kSPS
- Analog supply: 5V
- I/O supply: 5.25V ~ 1.65V
- Package: QFN-32, SSOP-28

Applications
- Industrial process and control
- Data acquisition systems
- Digital signal processing
- Medical equipment
- Instrumentation

The ADS8515 and ADS8519 are state-of-the-art CMOS ADCs complete with sample and hold, reference, clock and a serial data interface. The devices' innovative design allows operation from a single 5V supply with power dissipation under 100mW. Data can be output using the internal clock or synchronized to an external data clock. An output synchronization pulse for ease of use with standard DSPs is also provided.



ADS8515 functional block diagram.

SAR ADCs

16-/18-Bit, 1MSPS SAR ADCs with On-Chip Driver

ADS8254, ADS8255, ADS8284, ADS8285

PREVIEW*

Get samples, datasheets and evaluation modules at:
www.ti.com/sc/device/PARTnumber (Replace PARTnumber with ADS8254, ADS8255, ADS8284 or ADS8285)

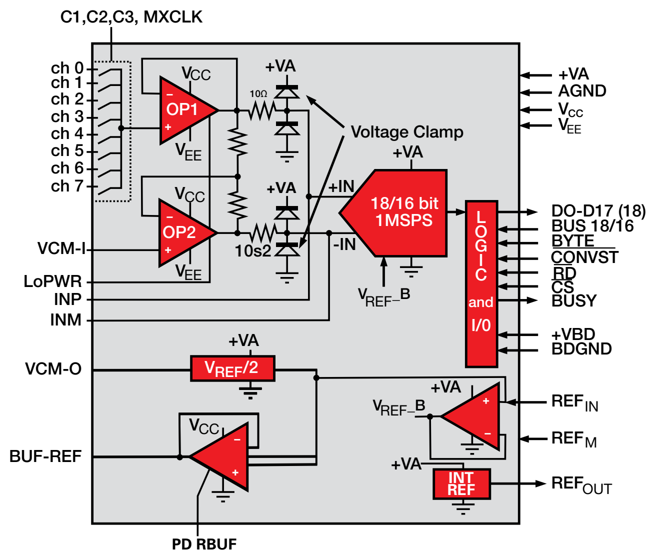
Key Features

- Sample rate: 1MHz, zero latency at full speed
- SNR: 98dB (typ) at 2kHz input
- THD: –121dB (typ) at 2kHz input
- Pseudo-bipolar differential input range: –4 to +4 with 2V common mode
- Unipolar single-ended input range
- 4-channel, differential ended multiplexer with auto and manual mode
- 8-channel, single-ended multiplexer with auto and manual mode
- Power dissipation: 270mW at 1MSPS
- Internal reference and buffer
- Packaging: QFN-64

Applications

- Medical imaging, CT scanners
- Automated test equipment
- High-speed data acquisition systems
- High-speed closed-loop systems

The ADS8254, ADS8255, ADS8284 and ADS8285 are 16-/18-bit, pseudo-bipolar and single-ended 1MSPS SAR ADCs with onboard 4V reference, driver amplifier and multiplexer.



ADS8284 functional block diagram. Estimated release date 4Q 2008.

16-Bit, 500kSPS and 1MSPS, Low-Power, Single/Dual Unipolar Input ADCs

ADS8327, ADS8328 and ADS8329, ADS8330

Get samples, datasheets and app reports at: **www.ti.com/sc/device/PARTnumber** (Replace PARTnumber with ADS8327, ADS8328, ADS8329 or ADS8330)

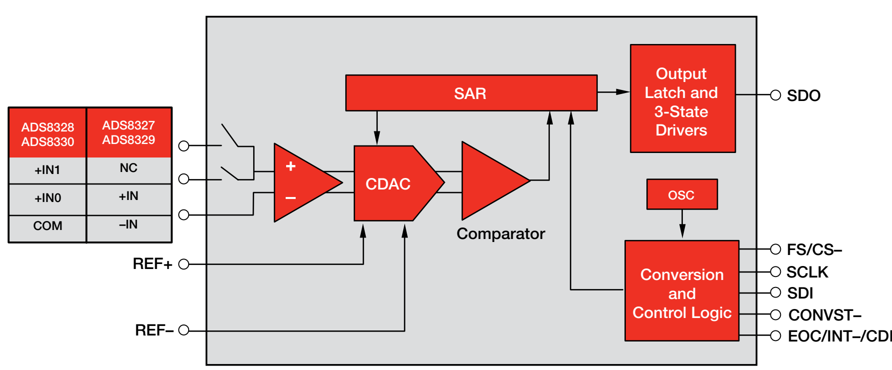
Key Features

- Excellent DC performance (ADS8329):
  - INL: ±1LSB (typ)
  - DNL: ±0.5LSB (typ)
- Excellent AC performance (ADS8329):
  - SNR: 92dB
  - SFDR: 102dB
  - THD: –102dB
- Internal conversion clock
- Analog supply: 2.7V to 5.5V
- SPI/DSP-compatible serial interface
- Unipolar input range: 0V to V_{REF}
- Multiple power-down modes: Deep, Nap and Autonap
- Packaging: TSSOP-16, 4x4 QFN

Applications

- Communications
- Medical instruments
- Magnetometers
- Industrial process control
- ATE

The ADS8327 and ADS8328 (10.6mW at 500kHz) and the ADS8329 and ADS8330 (15.5mW at 1MHz) are low-power ADCs with unipolar input and inherent sample and hold. The ADS8328 and ADS8330 include a 2:1 input MUX with programmable option of TAG bit output. All offer a high-speed, wide-voltage serial interface and are capable of chain mode operation when multiple converters are used.



ADS8327 functional block diagram.

SAR ADCs

Successive Approximation (SAR ADCs) Selection Guide

Device	Res. (Bits)	Sample Rate (kSPS)	Number of Input Channels	Interface	Input Voltage (V)	V_{REF}	Linearity (%)	NMC	SINAD (dB)	Power (mW)	Package(s)	Price*
High-Speed SAR ADCs: >500kSPS												
ADS8484	18	1,250	1 Diff	P8/P16/P18	±V_{REF} (4.1V) at V_{REF}/2	Int/Ext	0.0011	18	98	220	7x7 QFN, TQFP-48	$23.40
ADS8285	18	1,000	8 SE	P8/P16/P18	±V_{REF} (4.1V)	Int/Ext	0.00095	18	TBD	270	8x8 QFN	$22.00
ADS8284	18	1,000	4 Diff	P8/P16/P18	±V_{REF} (4.1V) at V_{REF}/2	Int/Ext	0.00095	18	TBD	270	8x8 QFN	$22.00
ADS8481	18	1,000	1 SE, 1 PDiff	P8/P16/P18	V_{REF} (4.1)	Int/Ext	0.0013	18	92	220	7x7 QFN, TQFP-48	$19.80
ADS8482	18	1,000	1 Diff	P8/P16/P18	±V_{REF} (4.1V) at V_{REF}/2	Int/Ext	0.0011	18	98	220	7x7 QFN, TQFP-48	$20.25
ADS8380	18	600	1 SE, 1 PDiff	Serial, SPI	V_{REF}	Int/Ext	0.0015	18	90	110	6x6 QFN-28	$16.50
ADS8382	18	600	1 Diff	Serial, SPI	±V_{REF} (4.1V) at V_{REF}/2	Int/Ext	0.0012	18	95	110	6x6 QFN-28	$16.95
ADS8381	18	580	1 SE, 1 PDiff	P8/P16/P18	V_{REF} (4.1)	Ext	0.0019	18	88	115	TQFP-48	$16.65
ADS8383	18	500	1 SE, 1 PDiff	P8/P16/P18	V_{REF} (4.1)	Ext	0.0026	18	85	110	TQFP-48	$15.75
ADS8422	16	4,000	1 Diff	P8/P16	±V_{REF} (4.1V) at V_{REF}/2	Int/Ext	0.0023	16	92.5	160	7x7 QFN, TQFP-48	$23.95
ADS8410	16	2,000	1 SE, 1 PDiff	Serial, LVDS	V_{REF} (4.1)	Int/Ext	0.0038	16	87.5	290	7x7 QFN-48	$23.00
ADS8411	16	2,000	1 SE, 1 PDiff	P8/P16	V_{REF}	Int	0.0038	16	85	175	TQFP-48	$22.00
ADS8413	16	2,000	1 Diff	Serial, LVDS	±V_{REF} (4.1V) at V_{REF}/2	Int/Ext	0.0038	16	92	290	7x7 QFN-48	$24.05
ADS8412	16	2,000	1 Diff	P8/P16	±V_{REF} (4.1V) at V_{REF}/2	Int	0.0038	16	88	175	TQFP-48	$23.05
ADS8401	16	1,250	1 SE, 1 PDiff	P8/P16	V_{REF}	Int	0.0053	16	85	155	TQFP-48	$12.55
ADS8405	16	1,250	1 SE, 1 PDiff	P8/P16	V_{REF}	Int/Ext	0.003	16	85	155	TQFP-48	$14.10
ADS8402	16	1,250	1 Diff	P8/P16	±V_{REF} (4.1V) at V_{REF}/2	Int	0.0053	16	88	155	TQFP-48	$13.15
ADS8406	16	1,250	1 Diff	P8/P16	±V_{REF}(4.1V) at V_{REF}/2	Int/Ext	0.003	16	90	155	TQFP-48	$14.70
ADS8255	16	1,000	8 SE	P8/P16	V_{REF} (4.1)	Int/Ext	0.0011	16	TBD	270	8x8 QFN	$18.50
ADS8254	16	1,000	4 Diff	P8/P16	±V_{REF}(4.2V) at V_{REF}/2	Int/Ext	0.0011	16	TBD	270	8x8 QFN	$18.50
ADS8400	16	1,000	1 Diff	Serial, SPI	±V_{REF}(4.2V) at V_{REF}/2	Ext	0.0023	16	96	40	MSOP-10	$14.00
ADS8403	16	1,250	1 SE, 1 PDiff	Serial, SPI	V_{REF} (4.1)	Ext	0.003	16	93.9	40	MSOP-10	$15.00
ADS8330	16	1,000	2 SE, 2 PDiff	Serial, SPI	V_{REF} (5V at 5V, 2.5V at 2.7V Supply)	Ext	0.0026	16	92	15.5	TSSOP-16, 4x4 QFN-16	$11.85
ADS8472	16	1,000	1 Diff	Serial, SPI	±V_{REF} (4.2V) at V_{REF}/2	Int/Ext	0.00098	16	94	110	6x6 QFN-28	$13.00
ADS8471	16	1,000	1 SE, 1 PDiff	Serial, SPI	V_{REF}	Int/Ext	0.0015	16	90	110	6x6 QFN-28	$12.50
ADS8329	16	1,000	1 SE, 1 PDiff	Serial, SPI	V_{REF} (4.2V at 5V, 2.5V at 2.7V Supply)	Ext	0.0026	16	92	20	TSSOP-16	$11.25
ADS8556	16	800	1 x 6 Diff	Serial, SPI/ P16/P8	±2x/±4xV_{REF} (±1V to ±12V)	Int/Ext	0.0046	16	90	160	LQFP-64, 9x9 QFN-64	$16.00
ADS8371	16	750	1 SE, 1 PDiff	P8/P16	V_{REF}	Ext	0.0022	16	87.6	130	TQFP-48	$12.00
ADS8370	16	600	1 SE, 1 PDiff	Serial, SPI	V_{REF}	Int/Ext	0.0015	16	90	110	6x6 QFN-28	$12.50
ADS8372	16	600	1 Diff	Serial, SPI	±V_{REF} (4.2V) at V_{REF}/2	Int/Ext	0.0011	16	93.5	110	6x6 QFN-28	$13.00
ADS8332	16	500	8 SE, 8 PDiff	Serial, SPI	V_{REF} (2.5)	Int/Ext	0.0031	16	87.5	10.6	4x4 QFN-24	$15.00
ADS8331	16	500	4 SE, 4 PDiff	Serial, SPI	V_{REF} (2.5)	Int/Ext	0.0031	16	87.5	10.6	4x4 QFN-24	$13.50
ADS8361	16	500	2 x 2 Diff	Serial, SPI	±2.5V at +2.5	Int/Ext	0.00375	14	83	150	SSOP-24	$8.75
ADS8328	16	500	2 SE, 2 PDiff	Serial, SPI	V_{REF} (5V at 5V, 2.5V at 2.7V Supply)	Ext	0.00305	16	88.5	10.6	TSSOP-16, 4x4 QFN-16	$9.30
ADS8327	16	500	2 SE	Serial, SPI	V_{REF} (4.2V at 5V, 2.5V at 2.7V Supply)	Ext	0.00305	16	88.5	10.6	TSSOP-16	$9.30
ADS8318	16	500	1 Diff	Serial, SPI	±V_{REF} (4.2V) at V_{REF}/2	Ext	0.0015	16	96	18	MSOP-10	$9.00

Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red.** Preview products are listed in **bold blue.***

Successive Approximation Analog-to-Digital Converters (SAR ADC)

Successive Approximation (SAR ADCs) Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Number of Input Channels	Interface	Input Voltage (V)	V_{REF}	Linearity (%)	NMC	SINAD (dB)	Power (mW)	Package(s)	Price*
ADS8319	16	500	1 SE, 1 PDiff	Serial, SPI	V_{REF} (4.1)	Ext	0.0023	16	93.8	18	MSOP-10	$8.00
ADS8322	16	500	1 PDiff	P8/P16	5	Int/Ext	0.009	15	83	85	TQFP-32	$7.10
ADS8323	16	500	1 Diff	P8/P16	±2.5V at 2.5	Int/Ext	0.009	15	83	85	TQFP-32	$7.10
ADS7891	14	3,000	1 SE	P8/P14	2.5	Int	0.009	14	78	85	TQFP-48	$10.50
ADS7890	14	1,250	1 SE	Serial, SPI	2.5	Int	0.009	14	77	45	TQFP-48	$10.50
ADS7280	14	1,000	2 SE	Serial, SPI	V_{REF} (5V at 5V, 2.5V at 2.7V Supply)	Ext	0.0061	14	85.7	13.7	TSSOP-16, 4x4 QFN-16	$4.50
ADS7279	14	1,000	1 SE	Serial, SPI	V_{REF} (4.2V at 5V, 2.5V at 2.7V Supply)	Ext	0.0061	14	85.7	15.5	TSSOP-16	$4.50
ADS8557	14	800	1 X 6 Diff	Serial, SPI/ P14/P8	±2x/±4xV_{REF} (±1V to ±12V)	Int/Ext	0.0061	14	82	160	LQFP-64, 9x9 QFN-64	$12.00
ADS7881	12	4,000	1 SE	P8/P12	2.5	Int	0.024	12	71.5	95	7x7 QFN, TQFP-48	$7.35
ADS7883	12	3,000	1 SE	Serial, SPI	V_{DD} (2.7V to 5.5V)	Ext (VDD)	0.03	12	72	15	SOT23-6	$2.50
ADS7863	12	2,000	2 x 2 Diff	Serial, SPI	±2.5 at 2.5	Int/Ext	0.003	12	71	13.5	SSOP-24, 4x4 QFN-24	$4.90
ADS7865	12	2,000	2 x 2 Diff	P12	±2.5 at 2.5	Int/Ext	0.003	12	71.3	13.5	TQFP-32	$4.90
ADS7230	12	1,000	2 SE	Serial/SPI	V_{REF} (5V at 5V, 2.5V at 2.7 Supply)	Ext	0.0122	12	73.7	13.7	TSSOP-16, 4x4 QFN-16	$2.50
ADS7229	12	1,000	1 SE	Serial/SPI	V_{REF} (4.2V at 5V, 2.5V at 2.7 Supply)	Ext	0.0122	12	73.7	15.5	TSSOP-16	$2.30
ADS7953	12	1,000	16 SE	Serial, SPI	V_{REF} (2.5V)	Ext	0.024	12	71.3	12.5	TSSOP-38	$4.90
ADS7952	12	1,000	12 SE	Serial, SPI	V_{REF} (2.5V)	Ext	0.024	12	71.3	12.5	TSSOP-38	$4.10
ADS7951	12	1,000	8 SE	Serial, SPI	V_{REF} (2.5V)	Ext	0.024	12	71.3	12.5	TSSOP-30	$3.30
ADS7950	12	1,000	4 SE	Serial, SPI	V_{REF} (2.5V)	Ext	0.024	12	71.3	12.5	TSSOP-30	$2.50
ADS7869	12	1,000	12 Diff	Serial, SPI/ P12	±2.5 at +2.5	Int/Ext	0.048	11	—	175	TQFP-100	$14.60
ADS7886	12	1,000	1 SE	Serial, SPI	V_{DD} (2.35V to 5.25V)	Ext (VDD)	0.03	12	71.2	7.5	SOT23-6, SC-70	$1.70
ADS8558	12	800	1 x 6 Diff	Serial, SPI/ P12/P8	±2x/±4xV_{REF} (±1V to ±12V)	Int/Ext	0.0121	12	72	160	LQFP-64, 9x9 QFN-64	$10.00
ADS7810	12	800	1 SE	P12	±10	Int/Ext	0.018	12	71	225	SOIC-28	$27.80
ADS7852	12	500	8 SE	P12	5	Int/Ext	0.024	12	72	13	TQFP-32	$3.40
ADS7864	12	500	3 x 2 Diff	P12	±2.5 at +2.5	Int/Ext	0.024	12	71	52.5	TQFP-48	$6.65
ADS7861	12	500	2 x 2 Diff	Serial, SPI	±2.5 at +2.5	Int/Ext	0.024	12	70	25	SSOP-24, QFN-32	$4.05
ADS7862	12	500	2 x 2 Diff	P12	±2.5 at +2.5	Int/Ext	0.024	12	71	25	TQFP-32	$5.70
ADS7818	12	500	1 PDiff	Serial, SPI	5	Int	0.024	12	70	11	PDIP-8, VSSOP-8	$2.50
ADS7834	12	500	1 PDiff	Serial, SPI	2.5	Int	0.024	12	70	11	VSSOP-8	$2.45
ADS7835	12	500	1 SE	Serial, SPI	±2.5	Int	0.024	12	72	17.5	VSSOP-8	$2.75
ADS7884	10	3,000	1 SE	Serial, SPI	V_{DD} (2.7V to 5.5V)	Ext (V_{DD})	0.781	10	61.7	15	SOT23-6	$1.60
ADS7957	10	1,000	16 SE	Serial, SPI	V_{REF} (2.5V)	Ext	0.078	10	60	12.5	TSSOP-38	$3.90
ADS7956	10	1,000	12 SE	Serial, SPI	V_{REF} (2.5V)	Ext	0.078	10	60	12.5	TSSOP-38	$3.30
ADS7955	10	1,000	8 SE	Serial, SPI	V_{REF} (2.5V)	Ext	0.078	10	60	12.5	TSSOP-30	$2.70
ADS7954	10	1,000	4 SE	Serial, SPI	V_{REF} (2.5V)	Ext	0.078	10	60	12.5	TSSOP-30	$2.10

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.** Preview products are listed in **bold blue.***

Successive Approximation Analog-to-Digital Converters (SAR ACD)

Successive Approximation (SAR ADCs) Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Number of Input Channels	Interface	Input Voltage (V)	V_{REF}	Linearity (%)	NMC	SINAD (dB)	Power (mW)	Package(s)	Price*
TLV1570	10	1,250	8 SE	Serial, SPI	2V, V_{REF}	Int/Ext	0.1	10	60	9	SOIC-20, TSSOP-20	$3.80
TLV1578	10	1,250	8 SE	P/0	V_{REF}	Ext	0.1	10	60	12	TSSOP-32	$3.85
ADS7887	10	1,250	1 SE	Serial, SPI	V_{DD} (2.35V to 5.25V)	Ext (V_{DD})	0.073	10	61	8	SOT23-6, SC-70	$1.50
TLV1571	10	1,250	1 SE	P/0	V_{REF}	Ext	0.1	10	60	12	SOIC-24, TSSOP-24	$3.70
TLV1572	10	1,250	1 SE	Serial, SPI	V_{REF}	Ext	0.1	10	60	8.1	SOIC-8	$3.30
ADS7885	8	3,000	1 SE	Serial, SPI	V_{DD} (2.7V to 5.5V)	Ext (V_{DD})	0.156	8	49.8	15	SOT23-6	$0.95
ADS7888	8	1,250	1 SE	Serial, SPI	V_{DD} (2.35V to 5.25V)	Ext (V_{DD})	0.2	8	49.5	8	SOT23-6, SC-70	$0.85
TLV571	8	1,250	1 SE	P8	V_{REF}	Ext	0.5	8	49	12	SOIC-24, TSSOP-24	$2.35
ADS7961	8	1,000	16 SE	Serial, SPI	V_{REF} (2.5V)	Ext	0.112	8	49	12.5	TSSOP-38	$2.45
ADS7960	8	1,000	12 SE	Serial, SPI	V_{REF} (2.5V)	Ext	0.112	8	49	12.5	TSSOP-38	$2.05
ADS7959	8	1,000	8 SE	Serial, SPI	V_{REF} (2.5V)	Ext	0.112	8	49	12.5	TSSOP-30	$1.65
ADS7958	8	1,000	4 SE	Serial, SPI	V_{REF} (2.5V)	Ext	0.112	8	49	12.5	TSSOP-30	$1.25

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.** Preview products are listed in **bold blue.***

Bipolar Input SAR ADCs

Device	Res. (Bits)	Sample Rate (kSPS)	Number of Input Channels	Interface	Input Voltage (V)	V_{REF}	Linearity (%)	NMC	SINAD (dB)	Power (mW)	Package(s)	Price*
ADS8515	16	250	1 SE	P16	±10	Int/Ext	0.0022	16	92	100	SSOP-28	$10.95
ADS8519	16	250	1 SE	Serial, SPI	+4, 10, ±3.3, 5, 10	Int/Ext	0.0022	16	91	100	SSOP-28	$12.95
ADS8509	16	250	1 SE	Serial, SPI	+4, 10, ±3.3, 5, 10	Int/Ext	0.003	16	86	70	SOIC-20, SSOP-28	$12.95
ADS8505	16	250	1 SE	P8/P16	±10	Int/Ext	0.0022	16	86	70	SOIC-28, SSOP-28	$12.95
ADS7811	16	250	1 SE	P16	±2.5	Int/Ext	0.006	15	87	200	SOIC-28	$36.15
ADS7815	16	250	1 SE	P16	±2.5	Int/Ext	0.006	15	84	200	SOIC-28	$21.30
ADS8517	16	200	1 SE	Serial, SPI/P8	4, 5, ±10	Int/Ext	0.0022	16	89	38	SO-28, SSOP-28	$13.00
ADS8514	16	200	1 SE	Serial, SPI	+4, 10, ±3.3, 5, 10	Int/Ext	0.0022	16	89.9	24	SOIC-16, TSSOP-20	TBD
ADS7805	16	100	1 SE	P8/P16	±10	Int/Ext	0.0045	16	86	81.5	PDIP-28, SOIC-28	$21.80
ADS7809	16	100	1 SE	Serial, SPI	+4, 10, ±3.3, 5, 10	Int/Ext	0.0045	16	88	81.5	SOIC-20	$25.00
ADS7825	16	40	4 SE	Serial, SPI/P8	±10	Int/Ext	0.003	16	83	50	PDIP-28, SOIC-28	$29.55
ADS8507	16	40	1 SE	Serial, SPI/P8	4, 5, ±10	Int/Ext	0.0022	16	88	24	SOIC-28	$13.00
ADS7807	16	40	1 SE	Serial, SPI/P8	4, 5, ±10	Int/Ext	0.0022	16	88	28	PDIP-28, SOIC-28	$32.30
ADS8513	16	40	1 SE	Serial, SPI	+4, 10, ±3.3, 5, 10	Int/Ext	0.0023	16	89.9	30	SOIC-16	$12.00
ADS7813	16	40	1 SE	Serial, SPI	+4, 10, ±3.3, 5, 10	Int/Ext	0.003	16	89	35	PDIP-16, SOIC-16	$24.70
TLC3578	14	200	8 SE	Serial, SPI	±10	Ext	0.006	14	79	29	SOIC-24, TSSOP-24	$8.65
TLC3574	14	200	4 SE	Serial, SPI	±10	Ext	0.006	14	79	29	SOIC-24, TSSOP-24	$6.85
ADS7810	12	800	1 SE	P12	±10	Int/Ext	0.018	12	71	225	SOIC-28	$27.80
ADS7835	12	500	1 SE	Serial, SPI	±2.5	Int	0.024	12	72	17.5	VSSOP-8	$2.75
ADS7800	12	333	1 SE	P8/P12	±5, 10	Int	0.012	12	72	135	CDIP SB-24	$30.50
ADS8508	12	250	1 SE	Serial, SPI	+4, 10, ±3.3, 5, 10	Int/Ext	0.011	12	73	70	SSOP-28, SOIC-20	$10.50
ADS8504	12	250	1 SE	P8/P16	±10	Int/Ext	0.011	12	72	70	SSOP-28, SOIC-28	$10.50
TLC2578	12	200	8 SE	Serial, SPI	±10	Ext	0.024	12	79	29	SOIC-24, TSSOP-24	$5.80
TLC2574	12	200	4 SE	Serial, SPI	±10	Ext	0.024	12	79	29	SOIC-20, TSSOP-20	$5.30
ADS7804	12	100	1 SE	P8/P16	±10	Int/Ext	0.011	12	72	81.5	PDIP-28, SOIC-28	$16.55

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.** Preview products are listed in **bold blue.***

Successive Approximation Analog-to-Digital Converters (SAR ADC)

Bipolar Input SAR ADCs (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Number of Input Channels	Interface	Input Voltage (V)	V_{REF}	Linearity (%)	NMC	SINAD (dB)	Power (mW)	Package(s)	Price*
ADS7808	12	100	1 SE	Serial, SPI	+4, 10 , ±3.3, 5, 10	Int/Ext	0.011	12	73	81.5	SOIC-20	$12.80
ADS8512	12	40	1 SE	Serial, SPI	+4, 10 , ±3.3, 5, 10	Int/Ext	0.011	12	74	24	SOIC-16	$7.00
ADS8506	12	40	1 SE	Serial, SPI/P8	+4, 5, ±10	Int/Ext	0.011	12	73	24	SOIC-28	$7.00
ADS7824	12	40	4 SE	Serial, SPI/P8	±10	Int/Ext	0.012	12	73	50	PDIP-28, SOIC-28	$13.10
ADS7806	12	40	1 SE	Serial, SPI/P8	+4, 5, ±10	Int/Ext	0.011	12	73	28	PDIP-28, SOIC-28	$15.05
ADS7812	12	40	1 SE	Serial, SPI	+4, 10, ±3.3, 5, 10	Int/Ext	0.012	12	74	35	PDIP-16, SOIC-16	$11.80

General Purpose SAR ADCs

Device	Res. (Bits)	Sample Rate (kSPS)	Number of Input Channels	Interface	Input Voltage (V)	V_{REF}	Linearity (%)	NMC	SINAD (dB)	Power (mW)	Package(s)	Price*
ADS8342	16	250	8 SE	P8/P16	±2.5	Ext	0.006	16	85	200	TQFP-48	$11.30
ADS8365	16	250	1 x 6 Diff	P16	±2.5V at +2.5	Int/Ext	0.006	14	87	190	TQFP-64	$16.25
ADS8364	16	250	1 x 6 Diff	P16	±2.5V at +2.5	Int/Ext	0.009	14	82.5	413	TQFP-64	$18.10
ADS8317	16	250	1 Diff	Serial, SPI	$\pm V_{REF}$ at V_{REF}	Ext	0.0022	16	89.5	6	VSSOP-8, QFN-8	$5.90
ADS8326	16	250	1 SE, 1 PDiff	Serial, SPI	V_{REF}	Ext	0.0022	16	91	6	VSSOP-8, QFN-8	$5.90
TLC4541	16	200	1 SE	Serial, SPI	V_{REF}	Ext	0.0038	16	84.5	17.5	SOIC-8, VSSOP-8	$6.85
TLC4545	16	200	1 PDiff	Serial, SPI	V_{REF}	Ext	0.0038	16	84.5	17.5	SOIC-8, VSSOP-8	$6.85
ADS8344	16	100	8 SE/4 Diff	Serial, SPI	V_{REF}	Ext	0.006	15	86	3.6	SSOP-20	$8.00
ADS8345	16	100	8 SE/4 Diff	Serial, SPI	$\pm V_{REF}$ at V_{REF}	Ext	0.006	15	85	3.6	SSOP-20	$8.00
ADS8341	16	100	4 SE/2 Diff	Serial, SPI	V_{REF}	Ext	0.006	15	86	3.6	SSOP-16	$7.40
ADS8343	16	100	4 SE/2 Diff	Serial, SPI	$\pm V_{REF}$ at V_{REF}	Ext	0.006	15	86	3.6	SSOP-16	$7.45
ADS8320	16	100	1 SE, 1 PDiff	Serial, SPI	V_{REF}	Ext	0.012	15	84	1.95	VSSOP-8	$5.15
ADS8325	16	100	1 SE, 1 PDiff	Serial, SPI	V_{REF}	Ext	0.006	16	91	2.25	VSSOP-8, QFN-8	$5.90
ADS8321	16	100	1 Diff	Serial, SPI	$\pm V_{REF}$ at $+V_{REF}$	Ext	0.012	15	84	5.5	VSSOP-8	$5.15
TLC3548	14	200	8 SE	Serial, SPI	4	Int/Ext	0.006	14	81	20	SOIC-24, TSSOP-24	$6.40
TLC3544	14	200	4 SE	Serial, SPI	4	Int/Ext	0.006	14	81	20	SOIC-20, TSSOP-20	$6.00
TLC3541	14	200	1 SE	Serial, SPI	V_{REF}	Ext	0.006	14	81.5	17.5	SOIC-8, VSSOP-8	$5.00
TLC3545	14	200	1 PDiff	Serial, SPI	V_{REF}	Ext	0.006	14	81.5	17.5	SOIC-8, VSSOP-8	$5.00
ADS8324	14	50	1 Diff	Serial, SPI	$\pm V_{REF}$ at $+V_{REF}$	Ext	0.012	14	78	2.5	VSSOP-8	$4.15
ADS7871	14	40	8 SE/4 Diff	Serial, SPI	PGA (1, 2, 4, 8, 10, 16, 20)	Int	0.03	13	—	6	SSOP-28	$5.00
TLC2558	12	400	8 SE	Serial, SPI	4	Int/Ext	0.024	12	71	9.5	SOIC-20, TSSOP-20	$5.30
TLC2554	12	400	4 SE	Serial, SPI	4	Int/Ext	0.024	12	71	9.5	SOIC-16, TSSOP-16	$5.30
TLC2552	12	400	2 SE	Serial, SPI	V_{REF}	Ext	0.024	12	72	15	SOIC-8, VSSOP-8	$3.95
TLC2551	12	400	1 SE	Serial, SPI	V_{REF}	Ext	0.024	12	72	15	SOIC-8, VSSOP-8	$3.95
TLC2555	12	400	1 Diff	Serial, SPI	V_{REF}	Int	0.024	12	72	15	SOIC-8, MSOP-8	$3.95
ADS7844	12	200	8 SE/4 Diff	Serial, SPI	V_{REF}, $\pm V_{REF}$ at V_{REF}	Ext	0.024	12	72	0.84	SSOP-20	$2.90
AMC7823	12	200	8 SE I/O DAS	Serial, SPI	V_{REF} (5.0)	Int/Ext	0.024	12	74	100	QFN-40	$9.75
TLV2548	12	200	8 SE	Serial, SPI	+2, 4	Int/Ext	0.024	12	70	3.3	SOIC-20, TSSOP-20	$4.85
ADS7841	12	200	4 SE/2 Diff	Serial, SPI	V_{REF} , $\pm V_{REF}$ at V_{REF}	Ext	0.024	12	72	0.84	SSOP-16	$2.50

*Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red.***

Successive Approximation Analog-to-Digital Converters (SAR ADC)

General Purpose SAR ADCs (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Number of Input Channels	Interface	Input Voltage (V)	V_{REF}	Linear-ity (%)	NMC	SINAD (dB)	Power (mW)	Package(s)	Price*
ADS7842	12	200	4 SE	P12	V_{REF}	Ext	0.024	12	72	0.84	SSOP-28	$3.10
TLV2544	12	200	4 SE	Serial, SPI	+2, 4	Int/Ext	0.024	12	70	3.3	SOIC-16, TSSOP-16	$4.20
TLV2542	12	200	2 SE	Serial, SPI	V_{REF}	Ext	0.024	12	72	2.8	SOIC-8, VSSOP-8	$3.85
TLV2553	12	200	11 SE	Serial, SPI	V_{REF}	Ext	0.024	12	—	2.43	SOIC-20, TSSOP-20	$3.40
TLV2556	12	200	11 SE	Serial, SPI	V_{REF}	Int/Ext	0.024	12	—	2.43	SOIC-20, TSSOP-20	$3.55
ADS7866	12	200	1 SE, 1 PDiff	Serial, SPI	V_{DD} (1.2V to 3.6V)	Ext	0.024	12	70	0.25	SOT23-6	$1.85
TLV2541	12	200	1 SE	Serial, SPI	V_{REF}	Ext	0.024	12	72	2.8	SOIC-8, VSSOP-8	$3.85
ADS7816	12	200	1 PDiff	Serial, SPI	V_{REF}	Ext	0.024	12	72	1.9	PDIP, SOIC, VSSOP-8	$1.95
TLV2545	12	200	1 PDiff	Serial, SPI	+5.5 (V_{REF} = V_{DD})	Ext	0.024	12	72	2.8	SOIC-8, VSSOP-8	$3.85
ADS7822	12	200	1 PDiff	Serial, SPI	V_{REF}	Ext	0.018	12	71	0.6	PDIP, SOIC, VSSOP-8	$1.55
ADS7817	12	200	1 Diff	Serial, SPI	$\pm V_{REF}$ at $+V_{REF}$	Ext	0.024	12	71	2.3	SOIC-8, VSSOP-8	$1.95
ADS7829	12	125	1 PDiff	Serial, SPI	V_{REF}	Ext	0.018	12	71	0.6	QFN-8	$1.50
AMC7820	12	100	8 SE DAS	Serial, SPI	V_{REF} (5.0)	Int/Ext	0.024	12	72 (typ)	40	TQFP-48	$3.75
TLC2543	12	66	11 SE	Serial, SPI	V_{REF}	Ext	0.024	12	—	5	CDIP, PDIP, PLCC, SOIC, SSOP-20	$4.45
TLV2543	12	66	11 SE	Serial, SPI	V_{REF}	Ext	0.024	12	—	3.3	PDIP-20, SOIC-20, SSOP-20	$4.45
ADS7828	12	50	8 SE/4 Diff	Serial, I^2C	V_{REF}	Int/Ext	0.024	12	71	0.675	TSSOP-16	$3.35
ADS7870	12	50	8 SE	Serial, SPI	PGA (1, 2, 4, 8, 10, 16, 20)	Int	0.06	12	72	4.6	SSOP-28	$4.15
ADS7823	12	50	1 SE	Serial, I^2C	V_{REF}	Ext	0.024	12	71	0.75	VSSOP-8	$2.85
ADS1286	12	37	1 PDiff	Serial, SPI	V_{REF}	Ext	0.024	12	72	1	PDIP-8, SOIC-8	$2.80
TLC1518	10	400	8 SE/7 Diff	Serial, SPI	+5.5 (V_{REF} = V_{DD})	Int/Ext	0.012	10	60	10	SOIC-20, TSSOP-20	$3.45
TLC1514	10	400	4 SE/3 Diff	Serial, SPI	+5.5 (V_{REF} = V_{DD})	Int/Ext	0.012	10	60	10	SOIC-16, TSSOP-16	$2.90
TLV1508	10	200	8 SE	Serial, SPI	+2, 4	Int/Ext	0.05	10	60	3.3	SOIC-20, TSSOP-20	$3.15
TLV1504	10	200	4 SE	Serial, SPI	+2, 4	Int/Ext	0.05	10	60	3.3	SOIC-16, TSSOP-16	$2.65
ADS7867	10	200	1SE, 1 PDiff	Serial, SPI	V_{DD} (1.2V to 3.6V)	Ext	0.05	10	61	0.25	SOT23-6	$1.40
ADS7826	10	200	1 PDiff	Serial, SPI	V_{REF}	Ext	0.0048	10	62	0.6	QFN-8	$1.25
TLC1550	10	164	1 SE	P10	V_{REF}	Ext	0.05	10	—	10	PLCC-28, SOIC-24	$3.90
TLC1551	10	164	1 SE	P10	V_{REF}	Ext	0.1	10	—	10	PLCC-28, SOIC-24	$3.35
TLV1548	10	85	8 SE	Serial, SPI	V_{REF}	Ext	0.1	10	—	1.05	CDIP, LCCC, SSOP-20	$2.30
TLV1544	10	85	4 SE	Serial, SPI	V_{REF}	Ext	0.1	10	—	1.05	SOIC-16, TSSOP-16	$1.95
TLC1542	10	38	11 SE	Serial, SPI	V_{REF}	Ext	0.05	10	—	4	CDIP, LCCC, PDIP, PLCC, SOIC-20	$2.50
TLC1543	10	38	11 SE	Serial, SPI	V_{REF}	Ext	0.1	10	—	4	PLCC/SOIC/SSOP-20	$1.90
TLV1543	10	38	11 SE	Serial, SPI	V_{REF}	Ext	0.1	10	—	2.64	CDIP, LCCC, PDIP, PLCC, SOIC, SSOP-20	$2.15
TLC1549	10	38	1 SE	Serial, SPI	V_{REF}	Ext	0.1	10	—	4	PDIP-8, SOIC-8	$1.71
TLC1541	10	32	11 SE	Serial, SPI	V_{REF}	Ext	0.1	10	—	6	PDIP, PLCC, SOIC-20	$3.20
TLC0820A	8	392	1 SE	P8	V_{REF}	Ext	0.2	8	—	37.5	PLCC, SOIC, SSOP-20	$1.90

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue**.*

Successive Approximation Analog-to-Digital Converters (SAR ADC)

General Purpose SAR ADCs (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Number of Input Channels	Interface	Input Voltage (V)	V_{REF}	Linearity (%)	NMC	SINAD (dB)	Power (mW)	Package(s)	Price*
ADS7827	8	250	1 PDiff	Serial, SPI	V_{REF}	Ext	0.2	8	48	0.6	QFN-8	$1.00
ADS7868	8	200	1 SE, 1 PDiff	Serial, SPI	V_{DD} (1.2V to 3.6V)	Ext	0.1	8	50	0.25	SOT23-6	$0.80
TLC545	8	76	19 SE	Serial, SPI	V_{REF}	Ext	0.2	8	—	6	PDIP-28, PLCC-28	$3.10
ADS7830	8	75	8 SE/4 Diff	Serial, I^2C	V_{REF}	Int/Ext	0.19	8	50	0.675	TSSOP-16	$1.40
TLV0831	8	49	1 SE	Serial, SPI	+3.6 (V_{REF} = V_{DD})	Ext	0.2	8	—	0.66	PDIP-8, SOIC-8	$1.40
TLC548	8	45.5	1 SE	Serial, SPI	V_{REF}	Ext	0.2	8	—	9	PDIP-8, SOIC-8	$1.20
TLV0832	8	44.7	2 SE/1 Diff	Serial, SPI	V_{REF}	Ext	0.2	8	—	5	PDIP-8, SOIC-8	$1.40
TLV0834	8	41	4 SE/2 Diff	Serial, SPI	V_{REF}	Ext	0.2	8	—	0.66	PDIP, SOIC,TSSOP-14	$1.45
TLC541	8	40	11 SE	Serial, SPI	V_{REF}	Ext	0.2	8	—	6	PDIP, PLCC, SOIC-20	$1.50
TLC549	8	40	1 SE	Serial, SPI	V_{REF}	Ext	0.2	8	—	9	PDIP-8, SOIC-8	$0.95
TLV0838	8	37.9	8 S/4 Diff	Serial, SPI	V_{REF}	Ext	0.2	8	—	0.66	PDIP, SOIC, TSSOP-20	$1.45
TLC0831	8	31	1 Diff	Serial, SPI	V_{REF}	Ext	0.2	8	—	3	PDIP-8, SOIC-8	$1.40
TLC542	8	25	11 SE	Serial, SPI	V_{REF}	Ext	0.2	8	—	6	PDIP, PLCC, SOIC-20	$1.50
TLC0832	8	22	2 SE/1 Diff	Serial, SPI	V_{REF}	Ext	0.2	8	—	12.5	PDIP-8, SOIC-8	$1.40
TLC0838	8	20	8 SE/4 Diff	Serial, SPI	V_{REF}	Ext	0.2	8	—	3	PDIP, SOIC, TSSOP-20	$1.45
TLC0834	8	20	4 SE/2 Diff	Serial, SPI	V_{REF}	Ext	0.2	8	—	3	PDIP-14, SOIC-14	$1.45

**Suggested resale price in U.S. dollars in quantities of 1,000.*

New products are listed in ***bold red.***

Pipeline ADCs

Analog-to-digital converters featuring sampling rates of 10s of MSPS are likely based on the pipeline architecture. The pipelined ADC consists of N cascaded stages. The concurrent operation of all pipeline stages makes this architecture suitable for achieving very high conversion rates. The stages themselves are essentially identical, lined up in an assembly line fashion and designed to convert only a portion of the analog sample. The digital output of each stage is combined to produce the parallel data output bits. A new digitized sample becomes available with every clock cycle. The internal combination process itself requires a digital delay, which is commonly referred to as the pipeline delay, or data latency. For most applications this is not a limitation since the delay, expressed in number of clock cycles, is a constant and can be accounted for.

One of the key architectural features of pipeline ADCs that allows high dynamic performances at high signal frequencies is the differential signal input. The differential input configuration results in the optimum dynamic range since it leads to smaller signal amplitude and a reduction in even-order harmonics. Almost all high-speed pipeline ADCs use a single-supply voltage, ranging from +5V down to +1.8V. Therefore, most require the analog input to operate with a common-mode voltage, which typically is at the mid-supply level. This common-mode or input bias requirement comes into consideration when defining the input interface circuitry that will drive the ADC. Switched capacitor inputs should also be considered.

Technical Information

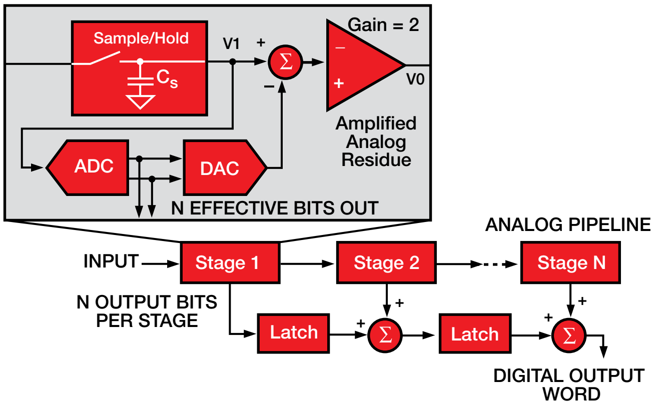
Pipeline ADCs also employ the basic idea of moving charge samples, which represent the input voltage level at the particular sample incident, from one stage to the next. The differential pipeline structure is highly repetitive where each of the pipeline stages consists of a sample-and-hold (S/H), a low-resolution ADC and DAC, and a summing circuit that includes an interstage amplifier to provide gain.

The analog signal is sampled with the first S/H circuit, which may also facilitate a single-ended to differential conversion. This S/H is one of the most critical blocks as it typically sets the performance limits of the converter. As the captured sample passes through the pipeline, the conversion is iterated by the stages that refine the conversion with increasing resolution as they pass the remainder signal from stage to stage. Each stage performs an analog-to-digital conversion, and a back-conversion to analog. The difference between the D/A output and the held input is the residue that is amplified and sent to the next stage where this process is repeated.

In order to properly design the interface circuit to the pipeline ADC, its switched-capacitor input structure needs to be considered. The input impedance of the pipeline converter represents a capacitive load to the driving source. Furthermore, it is dynamic since it is a function of the sampling rate (1/fs). The internal switches generate small transient current pulses that may affect the settling behavior of the source. To reduce the effects of this switched-capacitor, input series resistors and a shunt capacitor are typically recommended. This will also ensure stability and fast settling of the driving amplifier.

To select an appropriate interface circuit configuration, it is important to determine whether the application is time domain in nature (e.g. CCD-based imaging system) or a frequency domain application (e.g. communication system). Time domain applications usually have an input frequency bandwidth that includes DC. Frequency domain applications, on the other hand, are typically ac-coupled. The key converter specifications here are SFDR, SNR, aperture jitter and analog input bandwidth; the last two specifications particularly apply to undersampling applications. The optimum interface configuration will depend on whether the application calls for wide dynamic range (SFDR), or low noise (SNR), or both.

Critical to the performance of high-speed ADCs is the clock signal, since a variety of internal timing signals are derived from this clock. Pipeline ADCs may use both the rising and falling clock edge to trigger internal functions. For example, sampling occurs on the rising edge prompting this edge to have very low jitter. Clock jitter leads to aperture jitter, which can be the ultimate limitation in achieving good SNR performance. Particularly in undersampling applications, special consideration should be given to clock jitter.



Pipeline ADCs consist of consecutive stages, each containing a S/H, a low-resolution ADC and DAC, and a summing circuit that includes an interstage amplifier to provide gain.

Pipeline ADCs

12-Bit, Up to 65MSPS, 8-Channel ADCs with LVDS Outputs
ADS5281, ADS5282

NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/ADS5281**, **www.ti.com/sc/device/ADS5282**

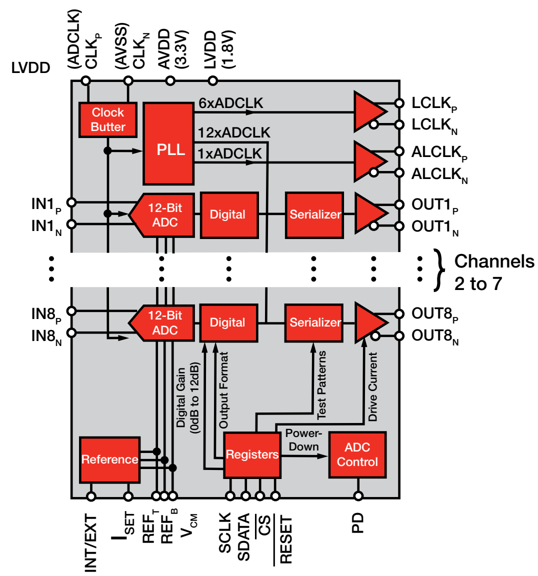
Key Features

- 12-bit, 50MSPS (ADS5281) 12-bit, 65MSPS (ADS5282)
- Power dissipation:
  - 64mW/channel at 50MSPS
  - 77mW/channel at 65MSPS
- SNR: 70dBFS at 10MHz IF
- Analog input full-scale range: 2Vpp
- Analog supply: 3.3V; Digital supply: 1.8V
- Programmable digital gain: 0dB to 12dB
- External and internal (trimmed) reference
- Serialized DDR LVDS output
- Packaging: QFN-64, HTQFP-80 PowerPAD™

Applications

- Medical imaging
- Wireless base-station infrastructure
- Test and measurement instrumentation

The ADS528x is a family of high-performance, low-power octal ADCs with serialized low-voltage differential signaling (LVDS) outputs and a wide variety of programmable features, allowing customization for various applications. For information on how to interface TI's ADCs to Xilinx® field-programmable gate arrays (FPGAs), go to *www.xilinx.com* and down load application note, XAPP774.



ADS5281 functional block diagram.

12-/14-Bit, 400/500MSPS ADCs with LVDS-Compatible Outputs
ADS5463, ADS5474

NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/ADS5463**, **www.ti.com/sc/device ADS5474**

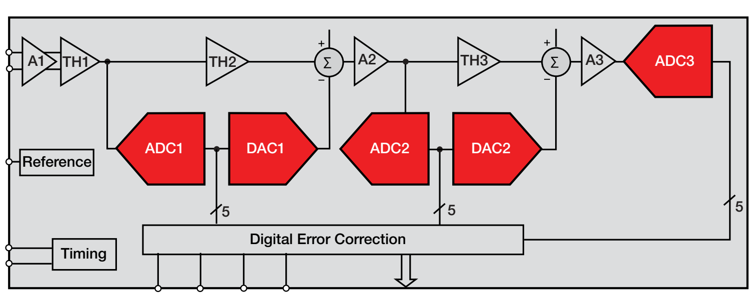
Key Features

- ADS5463: 12-bit, 500MSPS, 10.4 ENOB
- ADS5474: 14-Bit, 400MSPS, 11.2 ENOB
- Input bandwidth: 2.3GHz
- SFDR: 75dBc at 450MHz and 500MSPS
- SNR: 64.6dBFS at 450MHz and 500MSPS
- Differential input voltage: 2.2Vpp
- Power dissipation: 2.2W
- Offset binary output format
- Packaging: HTQFP-80 PowerPAD™

Applications

- Test and measurement instrumentation
- Software-defined radio
- Data acquisition
- Power amplifier linearization
- Communication instrumentation
- RADAR

The ADS5463 (12-bit, 500MSPS) and ADS5474 (14-bit, 400MSPS) are high-speed, high-performance ADCs that operate from 5V and 3.3V supplies and provide LVDS-compatible digital outputs. The devices are complete with on-chip analog buffer and track and hold. An internal reference generator is provided to simplify system design.



ADS5463 functional block diagram.

14-Bit, Up to 125MSPS, 2-Channel ADCs with DDR LVDS/CMOS Outputs
ADS62P45, ADS62P44, ADS62P43, ADS62P42

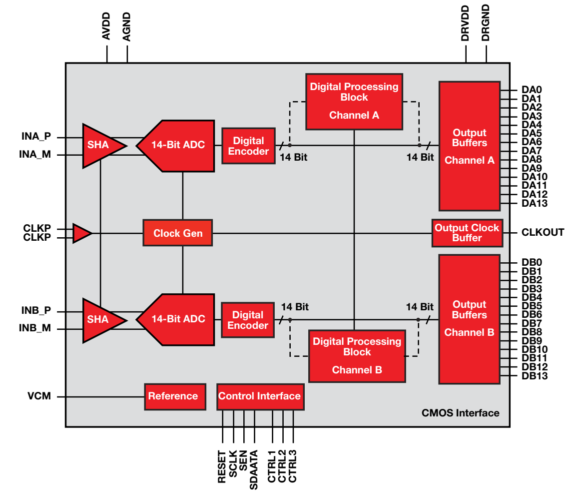
NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/PARTnumber** (Replace PARTnumber with ADS62P45, ADS62P44, ADS62P43, or ADS62P42)

Features
- Sample rates: 65, 80, 105, 125MSPS
- Resolution: 14-bits, no missing codes
- Selectable parallel CMOS or DDR LVDS outputs
- 3dB coarse gain and programmable fine gain up to 6dB for SNR/SFDR trade-off
- Digital processing block:
  - Fine gain correction, in steps of 0.05dB
  - Decimation by 2/4/8
  - Built-in and custom programmable 24-tap low-/high-bandpass filters
- Supports Sine, LVPECL, LVDS and LVCMOS clocks and amplitude down to 400mVpp
- Packaging: QFN-64

Applications
- Wireless communications infrastructure
- Software-defined radio
- Power amplifier linearization
- 802.16d/e
- Medical imaging
- RADAR systems
- Test and measurement
- Instrumentation

The ADS62P4x is a family of dual-channel, low-power ADCs with sample rates up to 125MSPS. Using an internal sample and hold and low jitter clock buffer, the device supports high SNR and high SFDR at high input frequencies. Coarse and fine gain options can be used to improve SFDR performance at lower full-scale input ranges. Pre-defined and user programmable decimation filters are also included.



ADS62P functional block diagram.

16-Bit, 80/105/135/170/200MSPS ADCs with Buffered Inputs
ADS5481, ADS5482, ADS5483, ADS5484, ADS5485

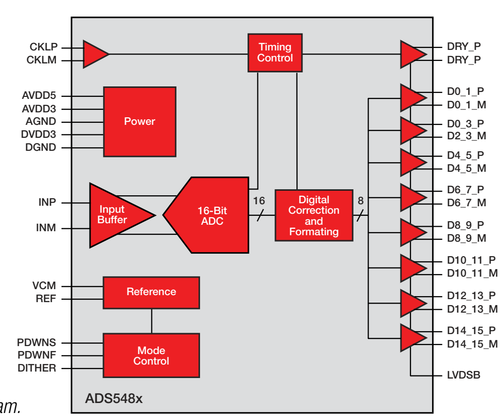
NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/PARTnumber** (Replace PARTnumber with ADS5481, ADS5482, ADS5483, ADS5484, or ADS5485)

Features
- Sample rates: 80, 105, 135, 170, 200MSPS
- Resolution: 16-bits
- Input bandwidth: 1GHz+
- SFDR: 95dBc at 70MHz and 135MSPS
- SNR: 78.6dBFS at 70MHz and 135MSPS
- LVDS-compatible outputs
- Power dissipation: 2.1W
- On-chip, high-impedance analog buffer
- Packaging: QFN-64 PowerPAD™

Applications
- Wireless infrastructure
- Medical imaging
- Test and measurement instrumentation
- Software-defined radio
- Data acquisition
- Power amplifier linearization
- Communication instrumentation
- RADAR

The ADS548x is a family of high-speed, high-performance ADCs that operate from 5V and 3.3V supplies and provide LVDS-compatible digital outputs. The devices are complete with on-chip analog buffer and track and hold. An internal reference generator is provided to simplify system design. Designed for highest total ENOB, the devices offer outstanding low-noise performance and spurious-free dynamic range for input frequencies well above 100MHz.



ADS548x functional block diagram.

Pipeline ADCs

Pipeline ADCs Selection Guide

Device	Res. (Bits)	Sample Rate (MSPS)	# of Input Channels	Input Voltage (V)	Analog Input Bandwidth (MHz)	DNL (± LSB)	INL (± LSB)	SNR (dB)	SFDR (dB)	Supply Voltage (V)	Power (mW)	Package(s)	Price*
ADS5485	16	200	1 Diff	3	730	0.99	10	75	87	4.75, 5.25	2160	QFN-64	$98.95
ADS5484	16	170	1 Diff	3	730	0.99	10	75.7	87	4.75, 5.25	2160	QFN-64	$78.95
ADS5483	16	135	1 Diff	3	485	0.5	3	79	97	4.75, 5.25	2130	QFN-64	$65.00
ADS5482	16	105	! Diff	3	125	0.5	3	80.5	98	4.75, 5.25	2100	QFN-64	$56.65
ADS5481	16	80	1 Diff	3	125	0.5	3	80.6	98	4.75, 5.25	2100	QFN-64	$48.33
ADS5562	16	80	1 Diff	3.56	300	0.95	8.5	84	85	3.0, 3.6	865	QFN-48	$48.35
ADS5560	16	40	1 Diff	3.56	300	0.95	8.5	84.3	90	3.0, 3.6	674	QFN-48	$31.80
ADS5474	14	400	1 Diff	2.2	1440	0.7	1	70.2	86	4.75, 5.25	2500	HTQFP-80	$160.65
ADS6149	14	250	1 Diff	2	700	0.4	2	72.7	86	3.0, 3.6	687	QFN-48	$96.50
ADS6B149	14	250	1 Diff	2	700	0.4	2	72.4	86	3.0, 3.6	690	QFN-48	$99.95
ADS5547	14	210	1 Diff	2	800	0.5	3.5	73.3	85	3.0, 3.6	1230	QFN-48	$82.50
ADS6148	14	210	1 Diff	2	700	0.4	2	72.7	82	3.0, 3.6	628	QFN-48	$82.50
ADS5546	14	190	1 Diff	2	500	0.5	3	73.2	84	3.0, 3.6	1130	QFN-48	$72.50
ADS5545	14	170	1 Diff	2	500	0.5	3	73.5	85	3.0, 3.6	1100	QFN-48	$62.50
ADS5500	14	125	1 Diff	2	750	0.75	2.5	70.5	82	3.0, 3.6	780	HTQFP-64	$49.00
ADS6145	14	125	1 Diff	2	450	0.6	2.5	74.1	84	3.0, 3.6	417	QFN-32	$49.00
ADS6245	14	125	2 Diff	2	500	0.6	3	73.2	83	3.0, 3.6	1000	QFN-48	$73.50
ADS62P45	14	125	2 Diff	2	450	0.8	3	73.8	85	3.0, 3.6	792	QFN-64	$73.50
ADS6445	14	125	4 Diff	2	500	0.6	3	73.2	83	3.0, 3.6	1680	QFN-64	$132.30
ADS5424	14	105	1 Diff	2.2	570	–0.95, 1.5	1.5	74	93	4.75,5.25	1900	HTQFP-52	$56.00
ADS5541	14	105	1 Diff	2	750	–0.9, 1.1	5	72	85.1	3.0, 3.6	739	HTQFP-64	$41.00
ADS6144	14	105	1 Diff	2	450	0.6	2.5	74.1	84	3.0, 3.6	374	QFN-32	$41.00
ADS6244	14	105	2 Diff	2	500	0.6	3	73	81	3.0, 3.6	810	QFN-48	$61.50
ADS62P44	14	105	2 Diff	2	450	0.7	2.5	73.8	86	3.0, 3.6	700	QFN-64	$61.50
ADS6444	14	105	4 Diff	2	500	0.6	3	73	81	3.0, 3.6	1350	QFN-64	$110.70
ADS5423	14	80	1 Diff	2.2	570	–0.95, 1.5	1.5	74	94	4.75,5.25	1850	HTQFP-52	$40.00
ADS5433	14	80	1 Diff	2.2	570	–0.95, 1.5	1.5	74	97.2	4.75,5.25	1850	HTQFP-52	$48.00
ADS5542	14	80	1 Diff	2	750	–0.9, 1.1	5	72.9	88	3.0, 3.6	674	HTQFP-64	$25.00
ADS6143	14	80	1 Diff	2	450	0.5	2	74.4	89	3.0, 3.6	318	QFN-32	$25.00
ADS6243	14	80	2 Diff	2	500	0.5	2	73.8	87.5	3.0, 3.6	700	QFN-48	$37.50
ADS62P43	14	80	2 Diff	2	450	0.5	1.5	74.3	88	3.0, 3.6	587	QFN-64	$37.50
ADS6443	14	80	4 Diff	2	500	0.5	2	73.8	87.5	3.0, 3.6	1180	QFN-64	$71.25
ADS5553	14	65	2 Diff	2.3	750	1	4	74	84	3.0, 3.6	890	HTQFP-80	$30.00
ADS6142	14	65	1 Diff	2	450	0.5	2	74.6	89	3.0, 3.6	285	QFN-32	$18.65
ADS6242	14	65	2 Diff	2	500	0.5	2	74	88	3.0, 3.6	630	QFN-48	$35.00
ADS62P42	14	65	2 Diff	2	450	0.4	1.5	74.4	88	3.0, 3.6	518	QFN-64	$35.00
ADS6442	14	65	4 Diff	2	500	0.5	2	74	88	3.0, 3.6	1180	QFN-64	$61.50
ADS5422	14	62	1 Diff	2 to 4	300	1	—	72	85	4.75, 5.25	1200	LQFP-64	$30.45
ADS5421	14	40	1 Diff	2 to 4	300	1	—	75	83	4.75, 5.25	900	LQFP-64	$20.15
ADS850	14	10	1 SE/1 Diff	2 to 4	300	1	5	76	85	4.7, 5.3	250	TQFP-48	$10.50
THS1408	14	8	1 SE/1 Diff	1.5	140	1	5	72	80	3.0, 3.6	270	HTQFP-48, TQFP-48	$14.85
THS1403	14	3	1 SE/1 Diff	1.5	140	1	5	72	80	3.0, 3.6	270	HTQFP-48, TQFP-48	$11.05
THS14F03	14	3	1 SE/1 Diff	1.5	140	1	2.5	72	80	3.0, 3.6	270	TQFP-48	$12.60
THS1401	14	1	1 SE/1 Diff	1.5	140	1	5	72	80	3.0, 3.6	270	HTQFP-48, TQFP-48	$8.90
THS14F01	14	1	1 SE/1 Diff	1.5	140	1	2.5	72	80	3.0, 3.6	270	TQFP-48	$9.65
ADS5444	13	250	1 SE/1 Diff	2.2	800	0.4	2.5	68.7	73	4.75, 5.25	2100	HTQFP-80	$59.00
ADS5440	13	210	1 SE/1 Diff	2.2	800	0.4	2.5	69	80	4.75, 5.25	2100	HTQFP-80	$42.00
ADS54RF63	12	550	1 Diff	2.2	2300	0.95	2.5	62.6	76	4.75, 5.25	2250	HTQFP-80	$174.95
ADS5463	12	500	1 Diff	2.2	2000	0.25	2.5	65.2	84	4.75, 5.25	2200	HTQFP-80	$125.00
ADS6129	12	250	1 Diff	2	700	0.2	1	70.5	86	3.0, 3.6	687	QFN-48	$59.00
ADS5527	12	210	1 Diff	2	800	0.5	2	69	81	3.0, 3.6	1230	QFN-48	$45.00

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.** Preview products are listed in **bold blue.***

Pipeline ADCs

Pipeline ADCs Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (MSPS)	# of Input Channels	Input Voltage (V)	Analog Input Bandwidth (MHz)	DNL (± LSB)	INL (± LSB)	SNR (dB)	SFDR (dB)	Supply Voltage (V)	Power (mW)	Package(s)	Price*
ADS6128	12	210	1 Diff	2	700	0.2	1	70.5	82	3.0, 3.6	628	QFN-48	$45.00
ADS5525	12	170	1 Diff	2	500	0.5	1.5	70.5	84	3.0, 3.6	1100	QFN-48	$35.00
ADS5520	12	125	1 Diff	2	750	0.5	1.5	69.7	83.6	3.0, 3.6	780	HTQFP-64	$27.50
ADS6125	12	125	1 Diff	2	450	0.6	2.5	71.3	84	3.0, 3.6	417	QFN-32	$27.50
ADS6225	12	125	2 Diff	2	500	0.5	2.5	70.3	83	3.0, 3.6	1000	QFN-48	$41.25
ADS62P25	12	125	2 Diff	2	450	0.8	3	70.8	85	3.0, 3.6	792	QFN-64	$41.25
ADS6425	12	125	4 Diff	2	500	0.5	2.5	70.3	83	3.0, 3.6	1650	QFN-64	$74.25
ADS5521	12	105	1 Diff	2	750	0.5	1.5	70	86	3.0, 3.6	736	HTQFP-64	$23.00
ADS6124	12	105	1 Diff	2	450	0.5	2	71.3	84	3.0, 3.6	374	QFN-32	$23.00
ADS6224	12	105	2 Diff	2	500	0.5	2.2	70.6	81	3.0, 3.6	900	QFN-48	$34.50
ADS62P24	12	105	2 Diff	2	450	0.7	2.5	71	86	3.0, 3.6	700	QFN-64	$34.50
ADS6424	12	105	4 Diff	2	500	0.5	2.2	70.6	81	3.0, 3.6	1350	QFN-64	$62.10
ADS5410	12	80	1 SE/1 Diff	2	1000	1	2	65	76	3.0, 3.6	360	TQFP-48	$19.00
ADS5522	12	80	1 Diff	2	750	0.5	1.5	69.7	82.8	3.0, 3.6	663	HTQFP-64	$16.70
ADS809	12	80	1 SE/1 Diff	1 to 2	1000	1.7	6	63	67	4.75, 5.25	905	TQFP-48	$24.95
ADS6123	12	80	1 Diff	2	450	0.5	2	71.5	89	3.0, 3.6	318	QFN-32	$16.70
ADS61B23	12	80	1 Diff	2	450	0.5	2	70	82	3.0, 3.6	351	QFN-32	$19.50
ADS6223	12	80	2 Diff	2	500	0.4	2	70.9	87	3.0, 3.6	760	QFN-48	$25.05
ADS62P23	12	80	2 Diff	2	450	0.5	1.5	71.2	88	3.0, 3.6	587	QFN-64	$25.05
ADS6423	12	80	4 Diff	2	500	0.4	2	70.9	87	3.0, 3.6	1180	QFN-64	$47.60
ADS808	12	70	1 SE/1 Diff	1 to 2	1000	1.7	7	64	68	4.75, 5.25	720	TQFP-48	$19.50
ADS5273	12	70	8 Diff	1.5	300	0.99, 1.2	3	71	85	3.0, 3.6	1003	HTQFP-80	$121.00
ADS5413	12	65	1 Diff	2	1000	1	2	68.5	79	3.0, 3.6	400	HTQFP-48	$14.75
ADS5221	12	65	1 SE/1 Diff	1 to 2	300	1	1.5	70	88	3.0, 3.6	285	TQFP-48	$13.95
ADS6122	12	65	1 Diff	2	450	0.5	2	71.6	89	3.0, 3.6	318	QFN-32	$12.00
ADS5232	12	65	2 Diff	2	300	0.9	2	70.7	86	3.0, 3.6	340	TQFP-64	$16.00
ADS6222	12	65	2 Diff	2	500	0.4	2	71.2	89	3.0, 3.6	760	QFN-48	$18.10
ADS62P22	12	65	2 Diff	2	450	0.4	1.5	71.3	88	3.0, 3.6	518	QFN-64	$18.10
ADS5242	12	65	4 Diff	1.5	300	0.95, 1	2	71	85	3.0, 3.6	660	HTQFP-64	$30.00
ADS6422	12	65	4 Diff	2	500	0.4	2	71.2	88	3.0, 3.6	1180	QFN-64	$36.85
ADS5272	12	65	8 Diff	1.5	300	0.95, 1	2	71.1	85	3.0, 3.6	984	HTQFP-80	$54.85
ADS5282	12	65	8 Diff	2	520	0.3	1.5	70	85	3.0, 3.6	616	QFN-64	$54.85
ADS807	12	53	1 SE/1 Diff	2 to 3	270	1	4	69	82	4.75, 5.25	335	SSOP-28	$11.30
ADS2807	12	50	2 SE/2 Diff	2 to 3	270	1	5	65	70	4.75, 5.25	720	TQFP-64	$18.05
ADS5271	12	50	8 Diff	1.5	300	0.9	2	70.5	85	3.0, 3.6	927	HTQFP-80	$48.00
ADS5281	12	50	8 Diff	2	52	0.3	1.5	70	85	3.0, 3.6	510	QFN-64, HTQFP-80	$48.00
ADS5220	12	40	1 SE/1 Diff	1 to 2	300	1	1.5	70	88	3.0, 3.6	195	TQFP-48	$9.85
ADS800	12	40	1 SE/1 Diff	2	65	1	—	62	61	4.75, 5.25	390	SO-28, TSSOP-28	$30.85
ADS5231	12	40	2 Diff	2	300	0.9	2	70.7	86	3.0, 3.6	285	TQFP-64	$11.75
ADS5240	12	40	4 Diff	1.5	300	0.9	2	70.5	85	3.0, 3.6	607	HTQFP-64	$20.00
ADS5270	12	40	8 Diff	1.5	300	0.9	2	70.5	85	3.0, 3.6	888	HTQFP-80	$44.00
ADS2806	12	32	2 SE/2 Diff	2 to 3	270	1	4	66	73	4.75, 5.25	430	TQFP-64	$14.10
THS1230	12	30	1 SE/1 Diff	1 to 2	180	1	2.5	67.7	74.6	3.0, 3.6	168	SOIC-28, TSSOP-28	$10.50
ADS801	12	25	1 SE/1 Diff	1 to 2	65	1	—	64	61	4.75, 5.25	270	SO-28, SSOP-28	$12.55
ADS805	12	20	1 SE/1 Diff	2	270	0.75	2	68	74	4.75, 5.25	300	SSOP-28	$9.90
THS1215	12	15	1 SE/1 Diff	1 to 2	180	0.9	1.5	68.9	81.7	3.0, 3.6	148	SOIC-28, SSOP-28	$9.85
ADS802	12	10	1 SE/1 Diff	2	65	1	2.75	66	66	4.75, 5.25	260	SO-28, SSOP-28	$12.60
ADS804	12	10	1 SE/1 Diff	2	270	0.75	2	69	80	4.7, 5.3	180	SSOP-28	$9.20
THS12082	12	8	2 SE/1 Diff	2.5	96	1	1.5	69	71	4.75, 5.25	186	TSSOP-32	$8.40

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**.*

Pipeline ADCs

Pipeline ADCs Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (MSPS)	# of Input Channels	Input Voltage (V)	Analog Input Bandwidth (MHz)	DNL (± LSB)	INL (± LSB)	SNR (dB)	SFDR (dB)	Supply Voltage (V)	Power (mW)	Package(s)	Price*
THS1209	12	8	2 SE/1 Diff	2.5	98	1	1.5	69	71	4.75, 5.25	186	TSSOP-32	$7.90
THS1206	12	6	4 SE/2 Diff	2.5	96	1	1.8	69	71	4.75, 5.25	186	TSSOP-32	$7.80
THS1207	12	6	4 SE/2 Diff	2.5	96	1	1.5	69	71	4.75, 5.25	186	TSSOP-32	$7.25
ADS803	12	5	1 SE/1 Diff	2	270	2	0.75	69	82	4.7, 5.3	115	SSOP-28	$7.40
ADS5517	11	200	1 Diff	2	800	0.3	1.5	66.9	84	3.0, 3.6	1230	QFN-48	$32.95
ADS5510	11	125	1 Diff	2	750	1.1	5	66.8	83	3.0, 3.6	780	HTQFP-64	$14.20
ADS62C15	11	125	2 Diff	2	450	0.4	3.5	67	82	3.0, 3.6	740	QFN-64	$41.25
ADS62P15	11	125	2 Diff	2	450	0.4	3.5	67.1	85	3.0, 3.6	740	QFN-64	$18.00
ADS5411	11	105	1 Diff	2.2	750	0.5	0.5	66.4	90	4.75, 5.25	1900	HTQFP-52	$25.50
ADS5413-11	11	65	1 Diff	2	1000	0.75	1	65	77	3.0, 3.6	400	HTQFP-48	$14.75
ADS828	10	75	1 SE/1 Diff	2	300	1	3	57	68	4.75, 5.25	340	SSOP-28	$8.70
ADS5102	10	65	1 Diff	1	950	1	2.5	57	71	1.65, 2	160	TQFP-48	$7.10
ADS5237	10	65	2 Diff	2	300	0.1	1	61.7	85	3.0, 3.6	330	HTQFP-64	$7.50
ADS5277	10	65	8 Diff	1.5	300	0.5	1	61.7	85	3.0, 3.6	911	HTQFP-80	$32.00
ADS5287	10	65	8 Diff	2	520	0.1	1	61.7	85	3.0, 3.6	592	QFN-64	$32.00
ADS5122	10	65	8 Diff	1	22	1	2.5	59	72	1.65, 2.0	733	BGA-257	$42.85
ADS823	10	60	1 SE/1 Diff	2	300	1	2	60	74	4.75, 5.25	295	SSOP-28	$8.40
ADS826	10	60	1 SE/1 Diff	2	300	1	2	59	73	4.75, 5.25	295	SSOP-28	$8.40
ADS5103	10	40	1 Diff	1	950	0.8	1.5	58	66	1.65, 2	105	TQFP-48	$5.25
ADS821	10	40	1 SE/1 Diff	2	65	1	2	58	62	4.75, 5.25	390	SSOP-28, SO-28	$13.05
ADS822	10	40	1 SE/1 Diff	2	300	1	2	60	66	4.75, 5.25	200	SSOP-28	$5.25
ADS825	10	40	1 SE/1 Diff	2	300	1	2	60	65	4.75, 5.25	200	SSOP-28	$5.25
THS1040	10	40	1 SE/1 Diff	2	900	0.9	1.5	57	70	3.0, 3.6	100	SOIC-28, TSSOP-28	$5.10
THS1041	10	40	1 SE/1 Diff	2	900	1	1.5	57	70	3.0, 3.6	103	SOIC-28, TSSOP-28	$5.45
ADS5203	10	40	2 SE/2 Diff	1	300	1	1.5	60.5	73	3.0, 3.6	240	TQFP-48	$9.65
ADS5204	10	40	2 SE/2 Diff	2	300	1	1.5	60.5	73	3.0, 3.6	275	TQFP-48	$11.05
ADS5120	10	40	8 Diff	1	300	1	1.5	58	72	1.65, 2	794	BGA-257	$36.15
ADS5121	10	40	8 Diff	1	28	1	1.5	60	74	1.65, 2.0	500	BGA-257	$38.85
THS1030	10	30	1 SE/1 Diff	2	150	1	2	49.4	53	3.0, 5.5	150	SOIC-28, TSSOP-28	$3.75
THS1031	10	30	1 SE/1 Diff	2	150	1	2	49.3	52.4	3.0, 5.5	160	SOIC-28, TSSOP-28	$4.10
ADS820	10	20	1 SE/1 Diff	2	65	1	2	60	62	4.75, 5.25	200	SSOP-28, SO-28	$6.75
ADS900	10	20	1 SE/1 Diff	1 to 2	100	1	—	49	53	2.7, 3.7	54	SSOP-28	$3.55
ADS901	10	20	1 SE/1 Diff	1 to 2	100	1	—	53	49	2.7, 3.7	49	SSOP-28	$3.40
THS10082	10	8	2 SE/1 Diff	2.5	96	1	1	61	65	4.75, 5.25	186	TSSOP-32	$3.70
THS1009	10	8	2 SE/1 Diff	+1.5, +3.5	96	1	1	61	65	4.75, 5.25	186	TSSOP-32	$3.20
THS10064	10	6	4 SE/2 Diff	2.5	96	1	1	61	65	4.75, 5.25	186	TSSOP-32	$4.15
THS1007	10	6	4 SE/2 Diff	+1.5, +3.5	96	1	1	61	65	4.75, 5.25	186	TSSOP-32	$3.70
TLV1562	10	2	4 SE/2 Diff	3	120	1.5	1.5	58	70.3	2.7, 5.5	15	SOIC-28, TSSOP-28	$4.15
ADS831	8	80	1 SE/1 Diff	1 or 2	300	1	2	49	65	4.75, 5.25	310	SSOP-20	$3.15
ADS830	8	60	1 SE/1 Diff	1 or 2	300	1	1.5	49.5	65	4.75, 5.25	215	SSOP-20	$2.75
TLC5540	8	40	1 SE	2	75	1	1	44	42	4.75, 5.25	85	SOP-24, TSSOP-24	$1.99
THS0842	8	40	2 SE/2 Diff	1.3	600	2	2.2	42.7	52	3.0, 3.6	320	TQFP-48	$5.05
TLV5535	8	35	1 SE	1 to 1.6	600	1.3	2.4	46.5	58	3.0, 3.6	106	TSSOP-28	$2.40
ADS931	8	30	1 SE	1 to 4	100	1	2.5	48	49	2.7, 5.5	154	SSOP-28	$2.20
ADS930	8	30	1 SE/1 Diff	1	100	1	2.5	46	50	2.7, 5.25	168	SSOP-28	$2.30
TLC5510	8	20	1 SE	2	14	0.75	1	46	42	4.75, 5.25	127.5	SOP-24	$1.95
TLC5510A	8	20	1 SE	2	14	0.75	1	46	42	4.75, 5.25	150	SOP-24	$1.95

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.***

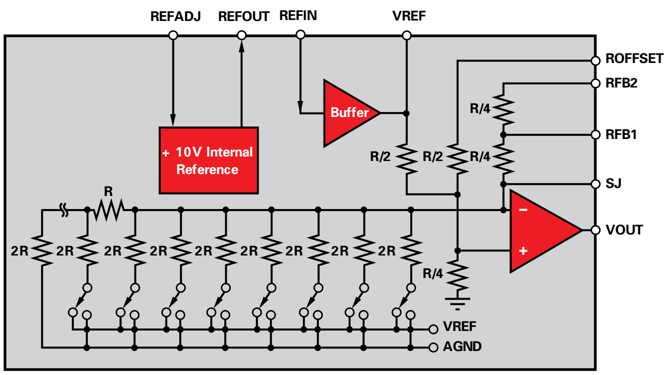
High-Accuracy, Bipolar and General Purpose DACs

Resistor "String" and R-2R DACs consist of three major elements: logic circuitry; some type of resistor network means of switching either a reference voltage or current to the proper input terminals of the network as a function of the digital value of each digital input bit, and a reference voltage.

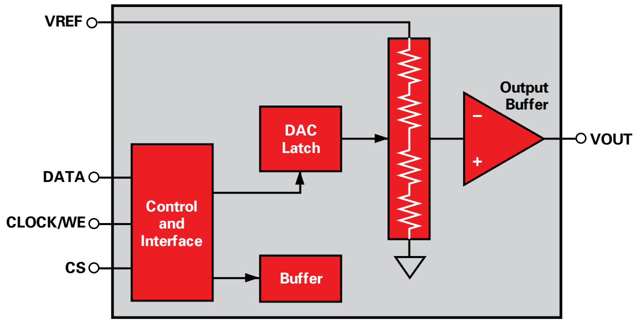
Technical Information

R-2R DACs—are used to achieve the best integral linearity (INL) performance. In an R-2R DAC, a current is generated by a reference voltage, which flows through the R-2R resistor network based on the digital input, which divides the current by two at each R-2R node. The advantage of an R-2R type DAC is that it relies on the matching of the R and 2R resistor segments and not the absolute value of the resistors thus allowing trim techniques to be used to adjust the integral linearity (INL) and differential linearity (DNL).

Voltage Segment DACs (String DACs)—are simply a string of resistors, each of value R. The code loaded into the DAC register determines at which node on the string the voltage is tapped off to be fed into the output amplifier by closing one of the switches connecting the string to the amplifier. The DAC is monotonic, because it is a string of resistors. In higher resolution 12- and 16-bit DACs, two resistor strings are used to minimize the number of switches in the design. In a two-resistor string configuration, the most significant bits drive a decoder tree, which selects the voltages from two adjacent taps of the first resistor string and applies them to the inputs of two buffers. These buffers then force these voltages across the endpoints of the second resistor string. The least significant data bits drive a second decoder tree, which selects the voltage at one of the switch outputs and directs it to the output buffer.



Segmented R-2R DAC.



Voltage segment DAC.

Precision DACs

16-/18-Bit, Single-Channel, Low-Noise V_{OUT} DACs
DAC8881, DAC9881

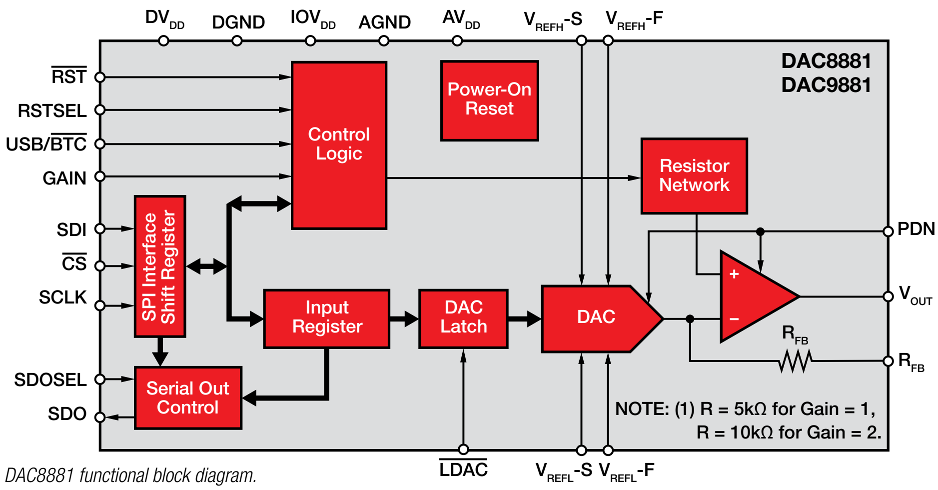
NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/DAC8881, www.ti.com/sc/device/DAC9881**

DAC9881
Key Features
- Relative accuracy: ±0.5 LSB (DAC8881)
- Full monotonicity over temperature range
- Low noise: 24nV/√Hz
- Fast settling: 5μs
- On-chip output buffer amp with rail-to-rail operation
- Unipolar straight binary or 2's complement input mode
- Fast SPI interface with Schmitt-Triggered inputs
- Supply range: +2.7V to +5.5V
- Packaging: QFN-24

Applications
- Industrial and process control
- Data acquisition systems
- Automatic test equipment
- Communications
- Optical networking

The DAC8881 and DAC9881 are 16-bit and 18-bit single-channel DACs with low-power operation, a flexible SPI serial interface, excellent linearity and fast settling time. The on-chip precision output amplifier allows rail-to-rail output swing over the full 2.7V to 5.5V supply range. The devices require an external reference. A power-on reset circuit is incorporated to ensure the DAC output powers up at zero-scale or midscale and remains there until a valid write command.



DAC8881 functional block diagram.

12-/14-/16-Bit, Quad-Channel, Ultra-Low Glitch V_{OUT} DACs with Reference
DAC8564, DAC8565, DAC8164, DAC8165, DAC7564, DAC7565

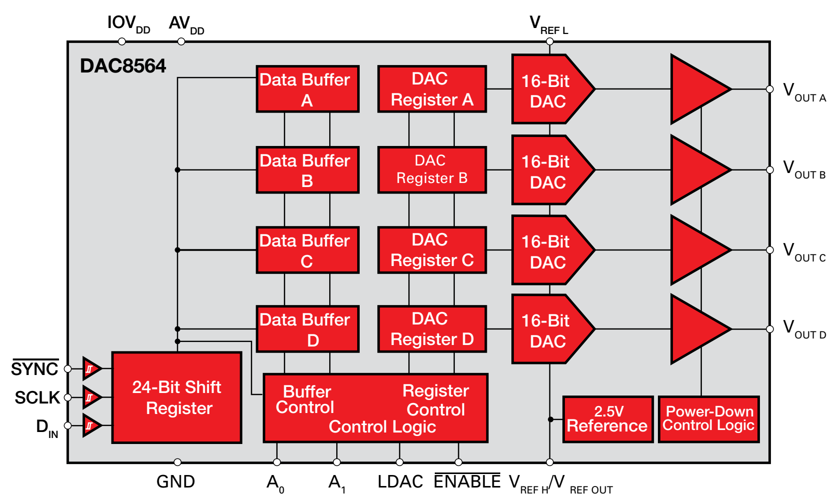
NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/PARTnumber** (Replace **PARTnumber** with **DAC8564**, **DAC8565**, **DAC8164**, **DAC8165**, **DAC7564** or **DAC7565**)

Key Features
- Relative accuracy: ±4 LSB INL at 16-bits
- Glitch energy: 0.15nV-s
- 2.5V internal reference:
  - 0.02% initial accuracy
  - 2ppm/°C (typ) temp drift
  - 20mA sink/source capability
- Power-on reset to zero-scale or mid-scale
- Ultra-low power operation: 1mA at 5V
- Settling time: 10μs to ±0.003% FSR
- Low-power serial interface with Schmitt-Triggered inputs
- Supply range: +2.7V to +5.5V
- Packaging: TSSOP-16

Applications
- Portable instruments
- Closed-loop servo control
- Process control
- Data acquisition systems
- Programmable attenuation
- PC peripherals

The DAC8564 family is a low-power, voltage-output DAC family that includes a 2.5V, 2ppm°C internal reference (enabled by default), giving a full-scale output voltage range of 2.5V. The devices are monotonic, provide very good linearity, and minimizes undesired code-to-code transients voltages (glitch). Power consumption as low as 2.6mW at 3V makes it useful for battery operated equipment. It uses a versatile, 3-wire serial interface that operates up to 50MHz and is compatible with standard SPI, QSPI, Microwire and DSP interfaces.



DAC8564 functional block diagram.

12-/14-/16-Bit, 8-Channel, ±15V V_{OUT} DACs

DAC7728, DAC8228, DAC8728

PREVIEW*

Get samples, datasheets and evaluation modules at: **www.ti.com/sc/device/PARTnumber** (Replace **PARTnumber** with **DAC7728**, **DAC8228** or **DAC8728**)

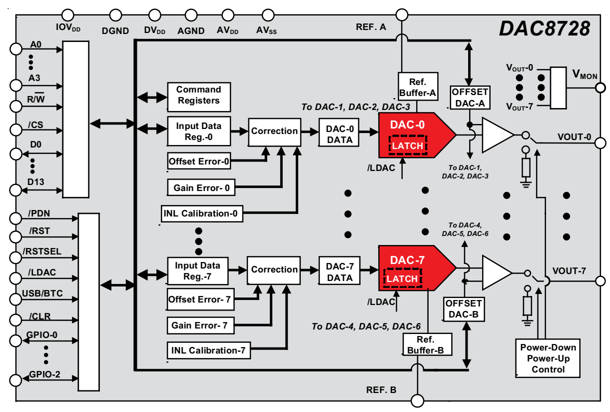
Key Features

- Bipolar output: ±15V, up to ±16.5V
- Unipolar output: 0 to +32V
- Relative accuracy: ±4 LSB INL at 16-bits
- Lower zero-code/gain error:
  - ±1 LSB (max) after user calibration
  - ±10 LSB (max) before user calibration
- Settling time: 10µs
- Programmable gain: x4, x6
- 16-bit parallel interface, 50MHz
- Low power: 20.6mW/Ch
- Low glitch
- Packaging: QFN-56, TQFP-64

Applications

- Automatic test equipment
- PLC and industrial process control
- Communications

The DAC7728, DAC8228 and DAC8728 are a families of 12-, 14- and 16-bit, octal, low-power DACs that provide good linearity and low glitch over the –40°C to +105°C temperature range. Trimmed in manufacturing, they have very low zero-code and gain error. In addition, users can perform system level calibration to achieve a ±1 LSB zero-code and gain error over the entire signal chain. The devices feature a standard high-speed 1.8V, 3V or 5V parallel 12-, 14- and 16-bit interface (up to 50MHz) to communicate with DSPs or microprocessors.



DAC8728 functional block diagram. Expected release date, 2Q 2009.

8-/10-/12-/14-/16-Bit, Single-Channel, Low-Power V_{OUT} DACs

DAC8311, DAC8411, DAC5311, DAC6311, DAC7311

NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/PARTnumber** (Replace **PARTnumber** with **DAC8311**, **DAC8411**, **DAC5311**, **DAC6311** or **DAC7311**)

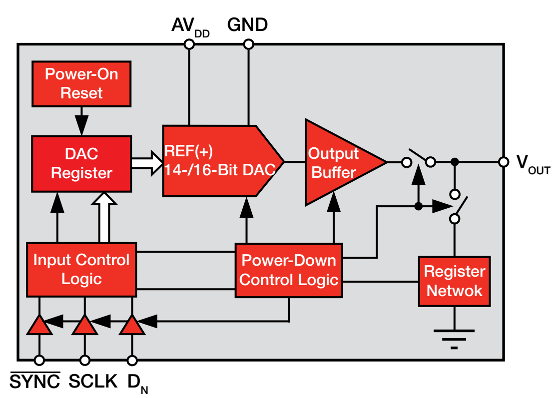
Key Features

- Relative accuracy: ±4 LSB INL (DAC8411); ±1 LSB INL (DAC8311)
- microPower operation: 80µA at 1.8V
- Power-on reset to zero scale
- Straight binary data format
- SPI™, QSPI™, MICROWIRE™ and digital signal processor (DSP) interfaces
- On-chip output buffer amp with rail-to-rail operation
- SYNC interrupt facility
- Supply range: +1.8V to +5.5V
- Packaging: SC70-6

Applications

- Portable, battery-powered instruments
- Process control
- Digital gain and offset adjustment
- Programmable voltage and current sources

The DAC5311 (8-bit), DAC6311 (10-bit), DAC7311 (12-bit), DAC8311 (14-bit) and DAC8411 (16-bit) are single-channel, low-power, voltage-output DACs with a flexible SPI serial interface with Schmitt-triggered inputs up to 50MHz. Monotonic by design, they provide excellent linearity and minimize undesired code-to-code transient voltages. The on-chip precision output amplifier allows rail-to-rail output swing over the full 1.8V to 5.5V supply range. A power-on reset circuit ensures the DAC powers up at 0V and remains there until a valid write occurs. The devices use an external power supply as a reference voltage to set the output range. The entire DACx311 family comes in an ultra-small SC70 package.



DAC8311 functional block diagram.

Precision DACs

12-/14-/16-Bit, Octal, Ultra-Low Glitch, Voltage-Output DACs

DAC8568, DAC8168, DAC7568

PREVIEW*

Get samples, datasheets and evaluation modules at: **www.ti.com/sc/device/PARTnumber** (Replace **PARTnumber** with **DAC8568**, **DAC8168** or **DAC7568**)

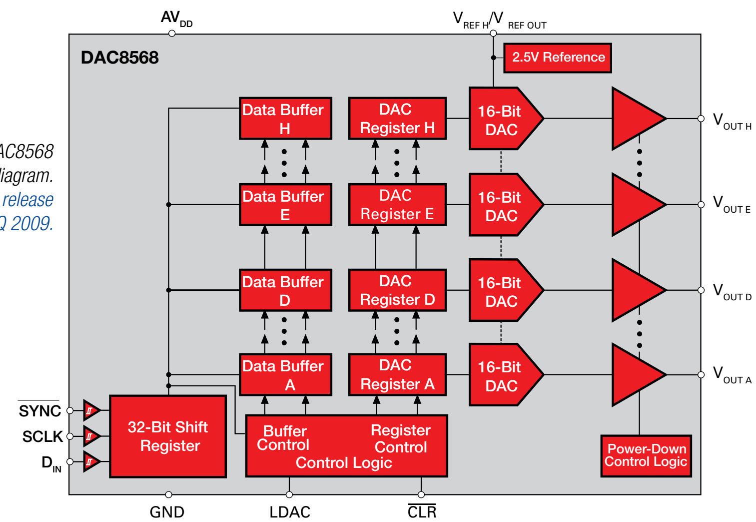
Key Features

- Relative Accuracy:
  - DAC8568 (16 bit): 8 LSB INL
  - DAC8168 (14 bit): 2 LSB INL
  - DAC7568 (12 bit): 0.5 LSB INL
- Glitch energy: 0.2nV-s
- Internal reference: 2.5V (disabled by default)
- Power-on resert to zero-scale or mid-scale
- Wide power-supply range: 2.7V to +5.5V
- Monotonic over entire temperature range
- Settling time: 10µs to ±0.024%
- Packaging: TSSOP-16, TSSOP-14

Applications

- Portable instrumentation
- Closed-loop servo-control/ process control
- Data acquisition systems
- Programmable attenuation
- Programmable voltage and current sources

The DAC8568 (16-bit), DAC8168 (14-bit) and DAC7568 (12-bit) are low-power, monotonic, voltage-output DACs that include an internal 2.5V, 2ppm/°C internal reference (disabled by default), giving a full-scale output voltage range of 2.5V or 5V. The reference has an initial accuracy of 0.004% and can source up to 20mA at the V_{REFIN}/V_{REFOUT} pin. The versatile 3-wire serial interface operates up to 50MHz and is compatible with standard SPI, QSPI, Microwire and DSP interfaces.



DAC8568 functional block diagram. Estimated release date 1Q 2009.

Precision DACs Selection Guide

Device	Res. (Bits)	Settling Time (µs) (max)	# of DAC Ch.	Interface	Output (V)	V_{REF}	INL (%) (%)	Monotonic (Bits)	Archi-tecture	Power (mW) (typ)	Package(s)	Price*
Highest Accuracy, Low-Power DACs												
DAC9881	18	5	1	Serial, SPI	5	Ext	0.0008	18	R-2R	6	QFN-24	$24.90
DAC8811	16	0.5	1	Serial, SPI	I_{OUT} (±15V)	Ext	0.0015	16	R-2R	0.027	MSOP-8, SON-8	$7.15
DAC8820	16	0.5	1	P16	I_{OUT} (±15V)	Ext	0.0015	16	R-2R	0.027	SSOP-28	$8.50
DAC8814	16	0.5	4	Serial, SPI	I_{OUT} (±15V)	Ext	0.0015	16	R-2R	0.027	SSOP-28	$16.95
DAC8812	16	0.5	2	Serial, SPI	I_{OUT} (±15V)	Ext	0.0015	16	R-2R	0.027	TSSOP-16	$8.40
DAC8822	16	0.5	2	P16	I_{OUT} (±18V)	Ext	0.0015	16	R-2R	0.027	TSSOP-18	$8.65
DAC8830	16	1	1	Serial, SPI	$+V_{REF}$	Ext	0.0015	16	R-2R	0.015	SOIC-8	$7.95
DAC8831	16	1	1	Serial, SPI	$+V_{REF}$, $\pm V_{REF}$	Ext	0.0015	16	R-2R	0.015	SOIC-14, QFN-14	$7.95
DAC8832	16	1	1	Serial, SPI	$+V_{REF}$	Ext	0.0015	16	R-2R	0.015	QFN-14	$7.95
DAC8814	16	1	4	Serial, SPI	I_{OUT} (±15V)	Ext	0.0015	16	R-2R	0.027	SSOP-28	$16.95
DAC8881	16	5	1	Serial, SPI	5	Ext	0.0015	16	R-2R	6	QFN-20	$8.00
DAC8734	16	8	4	Serial, SPI	±15	Ext	0.0015	16	R-2R	—	QFN-40, TQFP-48	$33.60
DAC8801	14	0.5	1	Serial, SPI	I_{OUT} (±15V)	Ext	0.0061	14	R-2R	0.027	MSOP-8, SON-8	$4.60
DAC8802	14	0.5	2	Serial, SPI	I_{OUT} (±15V)	Ext	0.0061	14	R-2R	0.027	TSSOP-16	$6.10
DAC8803	14	0.5	4	Serial, SPI	I_{OUT} (±15V)	Ext	0.0061	14	R-2R	0.027	SSOP-28	$12.65
DAC8805	14	0.5	2	P14	I_{OUT} (±18V)	Ext	0.0061	14	R-2R	0.0027	TSSOP-38	$6.15
DAC8806	14	0.5	1	P14	I_{OUT} (±15V)	Ext	0.0061	14	R-2R	0.027	SSOP-28	$5.50

Suggested resale price in U.S. dollars in quantities of 1,000. Pricing is low-grade pricing if applicable.* *New products are listed in **bold red. Preview products are listed in **bold blue**.*

Precision DACs

Precision DACs Selection Guide (continued)

Device	Res. (Bits)	Settling Time (µs) (max)	# of DAC Ch.	Interface	Output (V)	V_{REF}	INL (%) (max)	Monotonic (Bits)	Archi-tecture	Power (mW) (typ)	Package(s)	Price*
Industrial, Bipolar Output DACs												
DAC8811	16	0.5	1	Serial, SPI	I_{OUT} (±15V)	Ext	0.0015	16	R-2R	0.027	MSOP-8, SON-8	$7.15
DAC8820	16	0.5	1	P16	I_{OUT} (±15V)	Ext	0.0015	16	R-2R	0.027	SSOP-28	$8.50
DAC8812	16	0.5	2	Serial, SPI	I_{OUT} (±15V)	Ext	0.0015	16	R-2R	0.027	TSSOP-16	$8.40
DAC8822	16	0.5	2	P16	I_{OUT} (±18V)	Ext	0.0015	16	R-2R	0.027	TSSOP-38	$11.70
DAC8580	16	0.65	1	Serial, SPI	$\pm V_{REF}$	Ext	0.096	16	R-String	200	TSSOP-16	$3.00
DAC8581	16	0.65	1	Serial, SPI	$\pm V_{REF}$	Ext	0.096	16	R-String	200	TSSOP-16	$3.00
DAC8871	16	5	1	Serial, SPI	±10	Ext	0.0015	16	R-2R	0.015	SOIC-14	$8.00
DAC7731	16	5	1	Serial, SPI	+10, ±10	Int/Ext	0.0015	16	R-2R	100	SSOP-24	$8.20
DAC7742	16	5	1	P16	+10, ±10	Int/Ext	0.0015	16	R-2R	100	LQFP-48	$8.70
DAC7741	16	5	1	P16	+10, ±10	Int/Ext	0.0015	16	R-2R	100	LQFP-48	$8.30
DAC8734	16	8	4	Serial, SPI	±15	Ext	0.0015	16	R-2R	420	QFN-40, TQFP-48	$33.60
DAC712	16	10	1	P16	±10	Int	0.003	15	R-2R	525	SOIC-28, PDIP-28	$14.50
DAC714	16	10	1	Serial, SPI	±10	Int	0.0015	16	R-2R	525	SOIC-16	$14.50
DAC7734	16	10	4	Serial, SPI	$+V_{REF}$, $\pm V_{REF}$	Ext	0.0015	16	R-2R	50	SSOP-48	$31.45
DAC7744	16	10	4	P16	$+V_{REF}$, $\pm V_{REF}$	Ext	0.0015	16	R-2R	50	SSOP-48	$31.45
DAC7641	16	10	1	P16	$+V_{REF}$, $\pm V_{REF}$	Ext	0.0045	15	R-2R	1.8	TQFP-32	$6.30
DAC7631	16	10	1	Serial, SPI	$+V_{REF}$, $\pm V_{REF}$	Ext	0.0045	15	R-2R	1.8	SSOP-20	$5.85
DAC7642	16	10	2	P16	$+V_{REF}$, $\pm V_{REF}$	Ext	0.0045	15	R-2R	2.5	LQFP-32	$10.55
DAC7643	16	10	2	P16	$+V_{REF}$, $\pm V_{REF}$	Ext	0.0045	15	R-2R	2.5	LQFP-32	$10.55
DAC7632	16	10	2	Serial, SPI	$+V_{REF}$, $\pm V_{REF}$	Ext	0.0045	15	R-2R	2.5	LQFP-32	$10.45
DAC7634	16	10	4	Serial, SPI	$+V_{REF}$, $\pm V_{REF}$	Ext	0.0045	15	R-2R	7.5	SSOP-48	$19.95
DAC7644	16	10	4	P16	$+V_{REF}$, $\pm V_{REF}$	Ext	0.0045	15	R-2R	7.5	SSOP-48	$19.95
DAC7654	16	12	4	Serial, SPI	±2.5	Int	0.0045	16	R-2R	18	LQFP-64	$21.80
DAC7664	16	12	4	P16	±2.5	Int	0.0045	16	R-2R	18	LQFP-64	$20.75
DAC8718	16	20	8	Serial, SPI	±16.5	Ext	0.012	16	String	165	QFN-48, TQFP-64	$22.90
DAC8728	16	20	8	P16	±16.5	Ext	0.012	16	String	165	QFN-56, TQFP-64	$22.90
DAC8801	14	0.5	1	Serial, SPI	I_{OUT} (±15V)	Ext	0.0061	14	R-2R	0.027	MSOP-8, SON-8	$4.60
DAC8802	14	0.5	2	Serial, SPI	I_{OUT} (±15V)	Ext	0.0061	14	R-2R	0.027	TSSOP-16	$6.10
DAC8805	14	0.5	2	P14	I_{OUT} (±18V)	Ext	0.0061	14	R-2R	0.027	TSSOP-38	$6.15
DAC8806	14	0.5	1	P14	I_{OUT} (±15V)	Ext	0.0061	14	R-2R	0.027	SSOP-28	$5.50
DAC8803	14	1	4	Serial, SPI	I_{OUT} (±15V)	Ext	0.0061	14	R-2R	0.027	SSOP-28	$12.65
DAC8234	14	8	4	Serial, SPI	±15	Ext	0.0061	14	R-2R	420	QFN-40, TQFP-48	$24.90
DAC8218	14	20	8	Serial, SPI	±16.5	Ext	0.006	14	String	165	QFN-48, TQFP-64	$19.90
DAC7811	12	0.2	1	Serial, SPI	I_{OUT} (±15V)	Ext	0.012	12	R-2R	0.025	MSOP-10, SON-10	$2.55
DAC7821	12	0.2	1	P12	I_{OUT} (±15V)	Ext	0.012	12	R-2R	0.027	QFN-20, TSSOP-20	$2.60

**Suggested resale price in U.S. dollars in quantities of 1,000. Pricing is low-grade pricing if applicable.*

*New products are listed in **bold red.** Preview products are listed in **bold blue.***

Precision DACs

Precision DACs Selection Guide (continued)

Device	Res. (Bits)	Settling Time (µs) (max)	# of DAC Ch.	Interface	Output (V)	V_{REF}	INL (%) (max)	Monotonic (Bits)	Archi-tecture	Power (mW) (typ)	Package(s)	Price*
Industrial, Bipolar Output DACs (continued)												
DAC7822	12	0.2	2	P12	I_{OUT} (±15V)	Ext	0.012	12	R-2R	0.027	QFN-40	$3.80
DAC7800	12	0.8	2	Serial, SPI	I_{OUT} (±10V)	Ext	0.012	12	R-2R	1	PDIP-16, SOIC-16	$13.55
DAC7801	12	0.8	2	P(8+4)	I_{OUT} (±10V)	Ext	0.012	12	R-2R	1	PDIP-24, SOIC-24	$17.95
DAC7802	12	0.8	2	P12	I_{OUT} (±10V)	Ext	0.012	12	R-2R	1	PDIP-24, SOIC-24	$14.00
DAC7541	12	1	1	P12	I_{OUT} (±10V)	Ext	0.012	12	R-2R	30	PDIP-18, SOP-18	$6.70
DAC8043	12	1	1	Serial, SPI	I_{OUT} (±10V)	Ext	0.012	12	R-2R	2.5	SOIC-8	$3.60
DAC7545	12	2	1	P12	I_{OUT} (±10V)	Ext	0.012	12	R-2R	30	SOIC-20	$5.25
DAC811	12	4	1	P12	+10, ±5, 10	Int	0.006	12	R-2R	625	CDIP SB-28, SOIC-28	$11.00
DAC813	12	4	1	P12	+10, ±5, 10	Int/Ext	0.006	12	R-2R	270	PDIP-28, SOIC-28	$12.60
DAC7716	12	8	4	Serial, SPI	$\pm V_{REF}$	Ext	0.024	12	R-2R	420	QFN-40, TQFP-48	$14.90
DAC7613	12	10	1	P12	$+V_{REF}$, $\pm V_{REF}$	Ext	0.024	12	R-2R	1.8	SSOP-24	$2.50
DAC7614	12	10	4	Serial, SPI	$+V_{REF}$, $\pm V_{REF}$	Ext	0.024	12	R-2R	15	SOIC-16, SSOP-20	$6.70
DAC7615	12	10	4	Serial, SPI	$+V_{REF}$, $\pm V_{REF}$	Ext	0.024	12	R-2R	15	SOIC-16, SSOP-20	$6.70
DAC7616	12	10	4	Serial, SPI	$+V_{REF}$, +(1.25V)	Ext	0.024	12	R-2R	2.4	SOIC-16, SSOP-20	$5.40
DAC7617	12	10	4	Serial, SPI	$+V_{REF}$, +(1.25V)	Ext	0.024	12	R-2R	2.4	SOIC-16, SSOP-20	$5.40
DAC7624	12	10	4	P12	$+V_{REF}$, +(1.25V)	Ext	0.024	12	R-2R	15	PDIP-28, SOIC-28	$10.25
DAC7625	12	10	4	P12	$+V_{REF}$, $\pm V_{REF}$	Ext	0.024	12	R-2R	15	PDIP-28, SOIC-28	$10.25
DAC7714	12	10	4	Serial, SPI	$\pm V_{REF}$	Ext	0.024	12	R-2R	45	SOIC-16	$11.45
DAC7715	12	10	4	Serial, SPI	$+V_{REF}$, $\pm V_{REF}$	Ext	0.024	12	R-2R	45	SOIC-16	$11.45
DAC7724	12	10	4	P12	$+V_{REF}$, $\pm V_{REF}$	Ext	0.024	12	R-2R	45	PLCC-28, SOIC-28	$11.85
DAC7725	12	10	4	P12	$+V_{REF}$, $\pm V_{REF}$	Ext	0.024	12	R-2R	45	PLCC-28, SOIC-28	$11.85
DAC7718	12	20	8	Serial, SPI	$\pm V_{REF}$	Ext	0.024	12	R-String	165	QFN-48, TQFP-64	$16.90
TLC7524	8	0.1	1	P8	I_{OUT} (±10V)	Ext	0.2	8	R-2R	5	SOIC-16, TSSOP-16	$1.45
TLC7528	8	0.1	2	P8	I_{OUT} (±10V)	Ext	0.2	8	R-2R	7.5	SOIC-20, TSSOP-20	$1.55
TLC7628	8	0.1	2	P8	I_{OUT} (±10V)	Ext	0.2	8	R-2R	20	SOIC-20, PDIP-20	$1.45
Low-Power, Single-Supply DACs												
DAC8411	16	10	1	Serial, SPI	$+V_{DD}$	Ext	0.012	16	R-String	0.1	SC70-6	$3.20
DAC8550	16	10	1	Serial, SPI	$+V_{REF}$	Ext	0.012	16	R-String	0.4	MSOP-8	$2.65
DAC8551	16	10	1	Serial, SPI	$+V_{REF}$	Ext	0.012	16	R-String	0.4	MSOP-8	$2.65
DAC8560	16	10	1	Serial, SPI	$+V_{REF}$ (+2.5)	Int/Ext	0.012	16	R-String	1.4	MSOP-8	$3.50
DAC8501	16	10	1	Serial, SPI	$+V_{REF}$/MDAC	Ext	0.0987	16	R-String	0.6	MSOP-8	$3.00
DAC8531	16	10	1	Serial, SPI	$+V_{REF}$	Ext	0.0987	16	R-String	0.6	MSOP-8, SON-8	$3.00
DAC8541	16	10	1	P16	$+V_{REF}$	Ext	0.096	16	R-String	0.6	TQFP-32	$3.00
DAC8571	16	10	1	Serial, I^2C	$+V_{REF}$	Ext	0.0987	16	R-String	0.4	MSOP-8	$2.95
DAC715	16	10	1	P16	10	Int	0.003	16	R-2R	525	PDIP-28, SOIC-28	$15.85
DAC716	16	10	1	Serial, SPI	10	Int	0.003	16	R-2R	525	PDIP-16, SOIC-16	$15.85
DAC8552	16	10	2	Serial, SPI	$+V_{REF}$	Ext	0.018	16	R-String	0.8	MSOP-8	$5.25
DAC8532	16	10	2	Serial, SPI	$+V_{REF}$	Ext	0.0987	16	R-String	1.35	MSOP-8	$5.35
DAC8564	16	10	4	Serial, SPI	$+V_{REF}$ (+2.5)	Int/Ext	0.012	16	R-String	2.6	TSOP-16	$10.45

**Suggested resale price in U.S. dollars in quantities of 1,000. Pricing is low-grade pricing if applicable.*

*New products are listed in **bold red.** Preview products are listed in **bold blue.***

Precision DACs

Precision DACs Selection Guide (continued)

Device	Res. (Bits)	Settling Time (µs) (max)	# of DAC Ch.	Interface	Output (V)	V_{REF}	INL (%) (max)	Monotonic (Bits)	Archi-tecture	Power (mW) (typ)	Package(s)	Price*
DAC8565	16	10	4	Serial, SPI	$+V_{REF}$ (+2.5)	Int/Ext	0.012	16	R-String	2.6	TSSOP-16	$10.45
DAC8554	16	10	4	Serial, SPI	$+V_{REF}$	Ext	0.018	16	R-String	1.6	TSSOP-16	$10.40
DAC8555	16	10	4	Serial, SPI	$+V_{REF}$	Ext	0.018	16	R-String	1.6	TSSOP-16	$10.40
DAC8544	16	10	4	P16	$+V_{REF}$	Ext	0.098	16	R-String	2.6	TQFP-48	$9.75
DAC8534	16	10	4	Serial, SPI	$+V_{REF}$	Ext	0.0987	16	R-String	2.7	TSSOP-16	$8.75
DAC8574	16	10	4	Serial, I^2C	$+V_{REF}$	Ext	0.0987	16	R-String	2.4	TSSOP-16	$10.25
DAC8568	16	10	8	Serial, SPI	$+V_{REF}$ (+2.5)	Int/Ext	0.018	16	R-String	1.8	TSSOP-16	$13.20
DAC8311	14	10	1	Serial, SPI	$+V_{DD}$	Ext	0.024	14	R-String	0.1	SC70-6	$2.00
DAC8168	14	10	8	Serial, SPI	$+V_{REF}$ (+2.5)	Int/Ext	0.024	14	R-String	1.8	TSSOP-16, TSSOP-14	$10.20
TLV5613	12	1	1	P8	$+V_{REF}$	Ext	0.096	12	R-String	1.2	SOIC-20, TSSOP-20	$2.60
TLV5619	12	1	1	P12	$+V_{REF}$	Ext	0.096	12	R-String	4.3	SOIC-20, TSSOP-20	$2.60
TLV5633	12	1	1	P8	$+V_{REF}$ (+2, 4)	Int/Ext	0.072	12	R-String	2.7	SOIC-20, TSSOP-20	$4.70
TLV5636	12	1	1	Serial, SPI	$+V_{REF}$ (+2, 4)	Int/Ext	0.096	12	R-String	4.5	SOIC-8, VSSOP-8	$3.65
TLV5639	12	1	1	P12	$+V_{REF}$ (+2, 4)	Int/Ext	0.072	12	R-String	2.7	SOIC-20, TSSOP-20	$3.45
TLV5638	12	1	2	Serial, SPI	$+V_{REF}$ (+2, 4)	Int/Ext	0.096	12	R-String	4.5	SOIC-8, CDIP-8, LCCC-20	$3.25
TLV5610	12	1	8	Serial, SPI	$+V_{REF}$	Ext	0.146	12	R-String	18	SOIC-20, TSSOP-20, CSP-20	$8.50
TLV5630	12	1	8	Serial, SPI	$+V_{REF}$	Int/Ext	0.146	12	R-String	18	SOIC-20, TSSOP-20	$8.85
TLV5618A	12	2.5	2	Serial, SPI	$+V_{REF}$	Ext	0.096	12	R-String	1.8	SOIC-8, LCCC-20	$4.75
TLV5616	12	3	1	Serial, SPI	$+V_{REF}$	Ext	0.096	12	R-String	0.9	VSSOP-8, SOIC-8	$2.60
TLV5614	12	3	4	Serial, SPI	$+V_{REF}$	Ext	0.096	12	R-String	3.6	SOIC-16, TSSOP-16, CSP-16	$7.45
DAC7551	12	5	1	Serial, SPI	$+V_{REF}$	Ext	0.024	12	R-String	0.3	SON-12	$1.40
DAC7552	12	5	2	Serial, SPI	$+V_{REF}$	Ext	0.024	12	R-String	0.7	QFN-16	$2.35
DAC7553	12	5	2	Serial, SPI	$+V_{REF}$	Ext	0.024	12	R-String	0.7	QFN-16	$2.35
DAC7554	12	5	4	Serial, SPI	$+V_{REF}$	Ext	0.024	12	R-String	1.5	MSOP-10	$4.80
DAC7558	12	5	8	Serial, SPI	$+V_{REF}$	Ext	0.024	12	String	2.7	QFN-32	$7.50
DAC7611	12	7	1	Serial, SPI	4.096	Int	0.024	12	R-2R	2.5	PDIP-8, SOIC-8	$2.55
DAC7621	12	7	1	P12	4.096	Int	0.024	12	R-2R	2.5	SSOP-20	$2.75
DAC7612	12	7	2	Serial, SPI	4.096	Int	0.024	12	R-2R	3.5	SOIC-8	$3.10
DAC7311	12	10	1	Serial, SPI	$+V_{DD}$	Ext	0.024	12	R-String	0.2	SC70-6	$1.20
DAC7512	12	10	1	Serial, SPI	$+V_{DD}$	Ext	0.192	12	R-String	0.3	MSOP-8, SOT23-6	$1.45
DAC7513	12	10	1	Serial, SPI	$+V_{REF}$	Ext	0.192	12	R-String	0.3	MSOP-8, SOT23-8	$1.65
DAC7571	12	10	1	Serial, I^2C	$+V_{REF}$	Ext	0.192	12	R-String	0.3	SOT23-6	$1.55
DAC7573	12	10	4	Serial, I^2C	$+V_{REF}$	Ext	0.192	12	R-String	1.5	TSSOP-16	$6.15
DAC7574	12	10	4	Serial, I^2C	$+V_{REF}$	Ext	0.192	12	R-String	1.5	MSOP-10	$6.15
DAC7568	12	10	8	Serial, SPI	$+V_{REF}$ (2.5)	Int/Ext	0.024	12	R-String	1.8	TSSOP-16, TSSOP-14	$8.20
TLV5637	10	0.8	2	Serial, SPI	$+V_{REF}$ (+2, 4)	Int/Ext	0.098	10	R-String	4.2	SOIC-8	$3.20
TLV5608	10	1	8	Serial, SPI	$+V_{REF}$	Ext	0.196	10	R-String	18	SOIC-20, TSSOP-20, CSP-20	$4.90

Suggested resale price in U.S. dollars in quantities of 1,000. Pricing is low-grade pricing if applicable.* *New products are listed in **bold red. Preview products are listed in **bold blue.***

Precision DACs

Precision DACs Selection Guide (continued)

Device	Res. (Bits)	Settling Time (μs) (max)	# of DAC Ch.	Interface	Output (V)	V_{REF}	INL (%) (max)	Monotonic (Bits)	Archi-tecture	Power (mW) (typ)	Package(s)	Price*
TLV5631	10	1	8	Serial, SPI	$+V_{REF}$	Int/Ext	0.196	10	R-String	18	SOIC-20, TSSOP-20	$5.60
TLV5617A	10	2.5	2	Serial, SPI	$+V_{REF}$	Ext	0.098	10	R-String	1.8	SOIC-8	$2.25
TLV5606	10	3	1	Serial, SPI	$+V_{REF}$	Ext	0.147	10	R-String	0.9	SOIC-8, MSOP-8	$1.30
TLV5604	10	3	4	Serial, SPI	$+V_{REF}$	Ext	0.098	10	R-String	3	SOIC-16, TSSOP-16	$3.70
DAC6571	10	9	1	Serial, I^2C	$+V_{DD}$	Ext	0.196	10	R-String	0.5	SOT23-6	$1.40
DAC6573	10	9	4	Serial, I^2C	$+V_{REF}$	Ext	0.196	10	R-String	1.5	TSSOP-16	$3.05
DAC6574	10	9	4	Serial, I^2C	$+V_{REF}$	Ext	0.196	10	R-String	1.5	MSOP-10	$3.05
DAC6311	10	10	1	Serial, SPI	$+V_{DD}$	Ext	0.049	10	R-String	0.2	SC70-6	$1.10
TLC5615	10	12.5	1	Serial, SPI	$+V_{REF}$	Ext	0.098	10	R-String	0.8	PDIP-8, SOIC-8	$1.90
TLV5626	8	0.8	2	Serial, SPI	$+V_{REF}$ (+2, 4)	Int/Ext	0.392	8	R-String	4.2	SOIC-8	$1.90
TLV5624	8	1	1	Serial, SPI	$+V_{REF}$ (+2, 4)	Int/Ext	0.196	8	R-String	5	SOIC-8, MSOP-8	$1.60
TLV5629	8	1	8	Serial, SPI	$+V_{REF}$	Ext	0.392	8	R-String	18	SOIC-20, TSSOP-20	$3.15
TLV5632	8	1	8	Serial, SPI	$+V_{REF}$ (+2, 4)	Int/Ext	0.392	8	R-String	18	SOIC-20, TSSOP-20	$3.35
TLV5627	8	2.5	4	Serial, SPI	$+V_{REF}$	Ext	0.196	8	R-String	3	SOIC-16, TSSOP-16	$2.05
TLV5623	8	3	1	Serial, SPI	$+V_{REF}$	Ext	0.196	8	R-String	2.1	SOIC-8, MSOP-8	$0.99
TLV5625	8	3	2	Serial, SPI	$+V_{REF}$	Ext	0.196	8	R-String	2.4	SOIC-8	$1.70
TLC7225	8	5	4	P8	$+V_{REF}$	Ext	0.392	8	R-2R	75	SOIC-24	$2.35
TLC7226	8	5	4	P8	$+V_{REF}$	Ext	0.392	8	R-2R	90	PDIP-20, SOIC-20	$2.15
DAC5571	8	8	1	Serial, I^2C	$+V_{DD}$	Ext	0.196	8	R-String	0.3	SOT23-6	$0.90
DAC5573	8	8	4	Serial, I^2C	$+V_{REF}$	Ext	0.196	8	R-String	1.5	TSSOP-16	$2.55
DAC5574	8	8	4	Serial, I^2C	$+V_{REF}$	Ext	0.196	8	R-String	1.5	MSOP-10	$2.55
DAC5311	8	10	1	Serial, SPI	$+V_{DD}$	Ext	0.098	8	R-String	0.2	SC70-6	$0.90
TLC5620	8	10	4	Serial, SPI	$+V_{REF}$	Ext	0.392	8	R-String	8	PDIP-14, SOIC-14	$1.75
TLV5620	8	10	4	Serial, SPI	$+V_{REF}$	Ext	0.392	8	R-2R	6	PDIP-14, SOIC-14	$1.00
TLV5621	8	10	4	Serial, SPI	$+V_{REF}$	Ext	0.392	8	R-2R	3.6	SOIC-14	$1.65
TLC5628	8	10	8	Serial, SPI	$+V_{REF}$	Ext	0.392	8	R-String	15	PDIP-16, SOIC-16	$2.45
TLV5628	8	10	8	Serial, SPI	$+V_{REF}$	Ext	0.392	8	R-String	12	PDIP-16, SOIC-16	$2.20

**Suggested resale price in U.S. dollars in quantities of 1,000. Pricing is low-grade pricing if applicable*

*New products are listed in **bold red.** Preview products are listed in **bold blue.***

High-Speed DACs

Modern high-speed DACs, fabricated on submicron CMOS or BiCMOS processes, have reached new performance levels with update rates of 500MSPS and resolutions of 14- or even 16-bits. In order to realize such high update rates and resolutions, the DACs employ a current-steering architecture with segmented current sources. The core element within the monolithic DAC is the current source array designed to deliver the full-scale output current, typically 20mA. An internal decoder addresses the differential current switches each time the DAC is updated. Steering the currents from all current sources to either of the differential outputs forms a corresponding signal output current. Differential signaling is used to improve the dynamic performance while reducing the output voltage swing that is developed across the load resistors. Ideally, this signal voltage amplitude should be as small as possible to maintain optimum linearity of the DAC. The upper limit of this signal voltage, and consequently the load resistance, is defined by the output voltage compliance specification.

The segmented current-steering architecture provides a significant reduction in circuit complexity and consequently in reduced glitch energy. This translates into an overall improvement of the DAC's linearity and ac performance. As new system architectures require the synthesis of output frequencies in the 100s of MHz range, an approach often referred to as "direct IF" achieves high update rates, while maintaining excellent dynamic performance.

16-Bit, 1GSPS, Dual DAC with 1GSPS Input Bus
DAC5682Z, DAC5681Z, DAC5681

NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/PARTnumber**
(Replace **PARTnumber** with **DAC5682Z**, **DAC5681Z** or **DAC5681**)

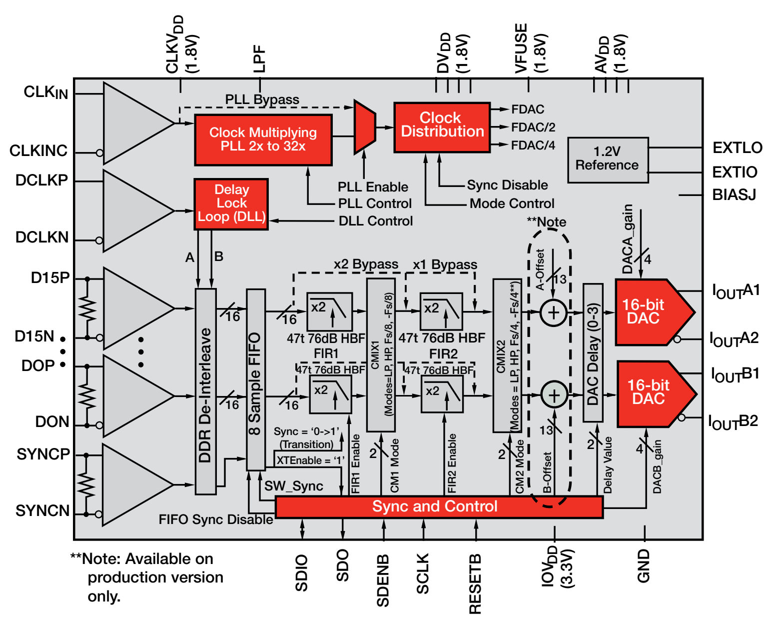
Key Features

- 16-bit LVDS input data bus:
  - 8 sample input FIFO
  - On-chip display delay lockloop
- Interleaved IQ data for dual DAC mode
- Superior ACLR/ACPR performance
- 2x to 32x clock multiplying PLL
- 2x or 4x selectable interpolation filters
- Configurable low-pass/high-pass option
- Fs/4, Fs/8 coarse mixer
- Scalable differential outputs: 2 to 20mA
- Packaging: 64-pin QFN (9x9), QFN-64

Applications

- Cellular base stations
- Broadband wireless access
- WiMAX / 802.16
- Fixed wireless backhaul
- Cable modem termination systems
- Test equipment

The DAC5682Z is designed to enable the conversion of wide bandwidth signals from digital to analog. The LVDS interface enables the input of high data rates while controlling EMI emissions and reducing footprint size of the device. Several configurable device features also save cost, such as the on-board multiplying clock which eliminates the use of expensive off-chip clocking. In addition, the low-pass/high-pass interpolation filters and digital mixer options enable system design flexibility.



DAC5682Z functional block diagram.

High-Speed DACs

16-Bit, 800MSPS, Dual-Channel, 2x to 8x Interpolating DAC

DAC5688

NEW

Get samples, datasheets, evaluation modules and app reports at: **www.ti.com/sc/device/DAC5688**

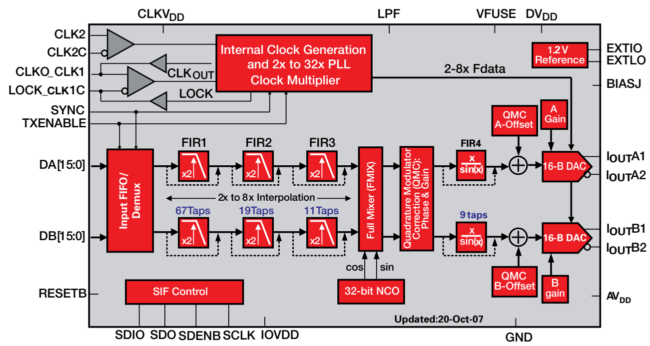
Key Features

- Dual, 16-bit, 800MSPS DACs
- Dual, 16-bit, 250MSPS CMOS input data:
  - 16 sample input FIFO
  - Flexible input data bus option
- High performance: 81dBc ACLR WCDMA TM1 at 70MHz
- 2x to 32x clock multiplying PLL/VCO
- Stop-band attenuation: >80dB
- Complex mixer with 32-bit NCO
- Digital quadrature modulator correction
- On-chip 1.2V reference
- Differential scalable output: 2 to 20mA
- Packaging: QFN-64

Applications

- Cellular base stations
- Broadband wireless access (BWA)
- WiMAX 802.16
- Fixed wireless backhaul
- Cable modem termination systems

The DAC5688 is a dual-channel, 16-bit, 800MSPS DAC with dual CMOS digital data bus, integrated 2x to 8x interpolation filters, a fine frequency mixer with 32-bit complex numerically controlled oscillator (NCO), on-board clock multiplier, IQ compensation and internal voltage reference. Different operational modes enable or bypass various signal processing blocks. The DAC5688 allows either complex or real output. The selectable 32-bit NCO/mixer in complex mode provides frequency up-conversion and the dual DAC output produces a complex Hilbert Transform pair. It also offers superior linearity, noise, crosstalk and PLL phase noise performance.



DAC5688 functional block diagram.

Current Steering DACs Selection Guide

Device	Res. (Bits)	Supply (V)	Update Rate (MSPS)	Settling Time (ns)	Number of DACs	Power (mW) (typ)	DNL (±LSB) (max)	INL (±LSB) (max)	Package(s)	Price*
DAC5681	16	1.8/3.3	1000	10.4	1	650	2	4	QFN-64	$27.50
DAC5681Z	16	1.8/3.3	1000	10.4	1	800	2	4	QFN-64	$30.95
DAC5682Z	16	1.8/3.3	1000	10.4	2	1300	2	4	QFN-64	$31.95
DAC5688	16	1.8/3.3	800	11	2	1750	2	4	QFN-64	$25.00
DAC5687	16	1.8/3.3	500	12	2	750	4	4	HTQFP-100	$22.50
DAC5686	16	1.8/3.3	500	12	2	450	9	12	HTQFP-100	$19.75
DAC904	14	3.0 to 5.0	165	30	1	170	1.75	2.5	SOP-28, TSSOP-28	$6.25
DAC5672A	14	3.0 to 3.6	200	20	2	330	3	4	TQFP-48	$13.25
DAC2904	14	3.3 to 5.0	125	30	2	310	4	5	TQFP-48	$20.19
DAC5675	14	3.0	400	5	1	820	2	4	HTQFP-48	$29.45
DAC902	12	3.0 to 5.0	165	30	1	170	1.75	2.5	SOP-28, TSSOP-28	$6.25
THS5661A	12	3.0 to 5.0	125	35	1	175	2	4	SOP-28, TSSOP-28	$6.25
DAC5662A	12	3.0 to 3.6	200	20	2	330	2	2	TQFP-48	$10.70
DAC2902	12	3.3 to 5.5	125	30	2	310	2.5	3	TQFP-48	$15.41
DAC2932	12	2.7 to 3.3	40	25	2	29	0.5	2	TQFP-48	$7.95
DAC5674	12	1.8/3.3	400	20	1	420	2	3.5	HTQFP-48	$15.00
DAC900	10	3.0 to 5.0	165	30	1	170	0.5	1	SOP-28, TSSOP-28	$4.25
THS5651A	10	3.0 to 5.0	125	35	1	175	0.5	1	SOP-28, TSSOP-28	$4.25
DAC2900	10	3.3 to 5.5	125	30	2	310	1	1	TQFP-48	$6.00
DAC5652A	10	3.0 to 3.6	275	20	2	290	1	0.5	TQFP-48	$7.60
DAC908	8	3.0 to 5.0	165	30	1	170	0.5	0.5	SOP-28, TSSOP-28	$2.90
THS5641A	8	3.0 to 5.0	100	35	1	100	0.5	1	SOP-28, TSSOP-28	$2.90
TLC5602	8	4.75 to 5.25	30	30	1	80	0.5	0.5	SOP-20	$1.55

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue**.*

Analog Monitoring and Control/Fan Controllers

Data acquisition system products from TI come with a reputation for high performance and integration along with the design flexibility required for a broad range of applications such as motor control, smart sensors for fan control, low-power monitoring and control, instrumentation systems, tunable lasers and optical power monitoring.

For motor control and three-phase power control, TI offers the new ADS7869. The ADS7869 is a 12-channel, 12-bit data acquisition system featuring simultaneous sampling with three 12-bit SAR ADCs at 1MSPS with serial and parallel interface for high-speed data transfer and data processing.

The AMC1210 is a four-channel, digital sync filter designed to work with our family of current- shunt and Hall Effect sensor delta-sigma modulators to simplify the completion of the ADC function. The AMC1210 has four individual digital filters that can be used independently with combinations of ADS1202, ADS1203, ADS1204, ADS1205 and ADS1208. It can also be used with the future AMC1203 device with built-in isolation.

The AMC7823 is a highly-integrated data acquisition and control device that has eight multiplexed analog inputs into a 12-bit, 200kSPS SAR ADC and eight analog voltage outputs from the internal eight 12-bit DACs.

Analog Monitoring and Control Circuit
AMC7823

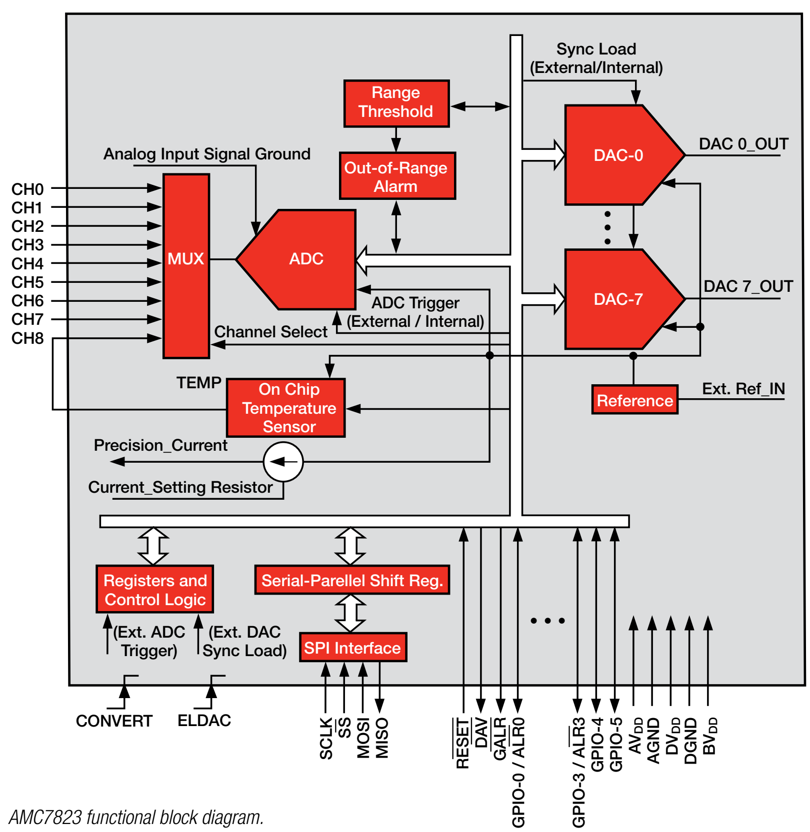
NEW

Get samples, datasheets and evaluation modules at: **www.ti.com/sc/device/AMC7823**

Key Features
- 12-bit, 200kSPS ADC
  - 8 analog inputs
  - Input range: 0 to 2 x V_{REF}
- Programmable V_{REF}, 1.25V or 2.5V
- Eight 12-bit DACs (2µs settling time)
- Internal bandgap reference
- On-chip temperature sensor
- Precision current source
- SPI interface, 3V or 5V logic compatible
- Single supply: 3V to 5V
- Power-down mode
- Packaging: QFN-40 (6x6mm)

Applications
- Communications equipment
- Optical networks
- ATE
- Industrial control and monitoring
- Medical equipment

The AMC7823 is a complete analog monitoring and control circuit that includes an 8-channel, 12-bit ADC, eight 12-bit DACs, four analog input out-of-range alarms and six GPIOs to monitor analog signals and to control external devices. Also included are an internal sensor to monitor chip temperature and a precision current source to drive remote thermistors or RTDs to monitor remote temperatures.



AMC7823 functional block diagram.

Analog Monitoring and Control/Fan Controllers

6-Channel, 16-Bit, 500kSPS ADC
ADS8556

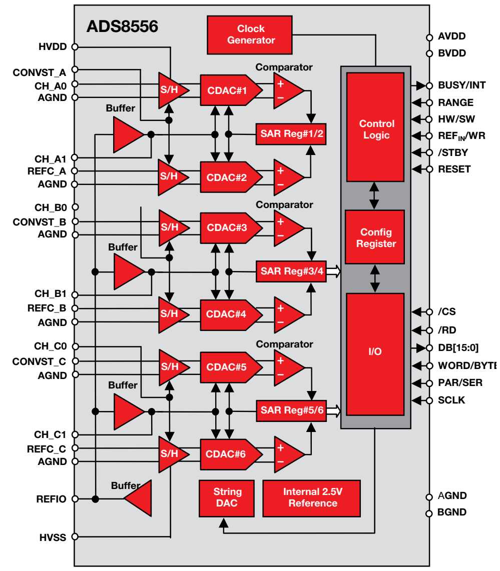
PREVIEW*

Get samples, datasheets and evaluation modules at: **www.ti.com/sc/device/ADS8556**

Key Features
- Six true bipolar +12V input channels
- Six independent 16-bit NMC SAR ADCs
- Excellent DC performance:
  - INL: ±1LSB (typ), ±3 LSB (max)
  - DNL: –1/+2 LSB (max)
  - Offset Error: ±0.5mV
- Excellent AC performance at f_{in} = 2kHz:
  - SNR: 92dB SNR
  - SFDR: 92dB
  - THD: –93dB
- Packaging: LQFP-64, 9x9mm QFN

Applications
- Power quality measurement
- Protection relay
- Motor control
- 3-axis angle measurement

The ADS8556 contains six inde- pendent, low-power, 16-bit, SAR-based ADCs with six true bipolar input channels each with its own sample-and-hold amplifier. Designed for simultaneous, high-speed, multi-channel signal acquisition, the device allows data rates up to 800kSPS in high-speed mode and up to 500kSPS in high-resolution mode. It features both a parallel and serial interface with the bus width of the parallel interface able to be to set to 16 bit or 8 bit.



ADS8556 functional block diagram. Estimated release date 4Q 08.

1-Bit, 10MHz, 2nd-Order, Isolated ΔΣ Modulator
AMC1203

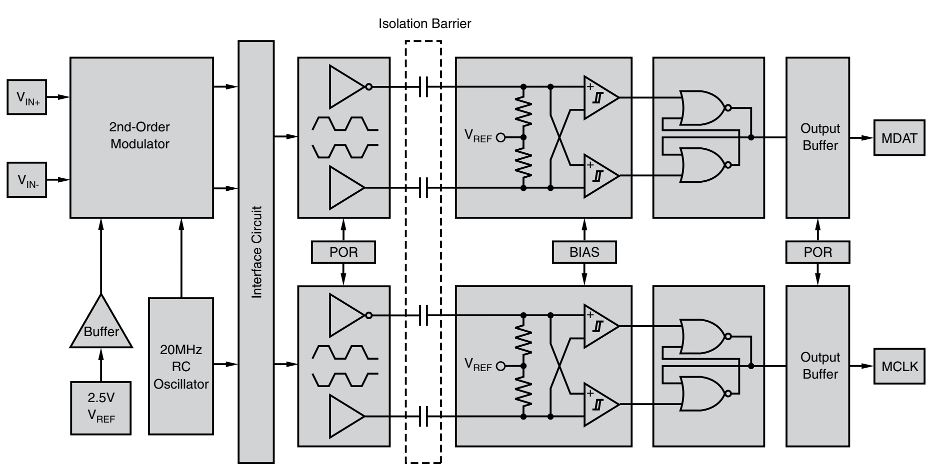
NEW

Get samples and datasheets at: **www.ti.com/sc/device/AMC1203**

Key Features
- 16-bit resolution
- SNR: 80.5dB (min)
- THD: –88dB (max) (AMC1203B)
- Input range: ±280mV with +5V supply
- Internal 2.5V reference voltage: 1% accuracy
- Gain error: ±1% (AMC1203B)
- UL1577, IEC60747-5-2 (VDE0884, Rev. 2) and IEC61010-1 approved
- Isolation: 40000V_{PEAK}, Working voltage: 560V
  - Transient immunity: 15kV/µs
- Typical 25-year life at rated working voltage (see application report SLLA197)
- Operating temperature range: –40°C to +105°C
- Packaging: SO-8, SO-16

Applications
- Shunt-based current sensing in:
  - Motor control
  - Uninterruptible power supplies
  - Power inverters
  - Industrial process control

The AMC1203 is a 1-bit, 10MHz, isolated, delta-sigma (ΔΣ) modulator with an output buffer separated from the input interface circuitry by a silicon dioxide (SiO_2) isolation barrier. The modulator operates from a +5V supply with a dynamic range of 95dB. Its differential inputs directly connect to shunt resistors or other low-level signal sources. Used in conjunction with isolated power supplies, these devices prevent noise currents on a data bus or other circuits from entering the local ground and interfering with or damaging sensitive circuitry.



AMC1203 functional block diagram.

Analog Monitoring and Control/Fan Controllers

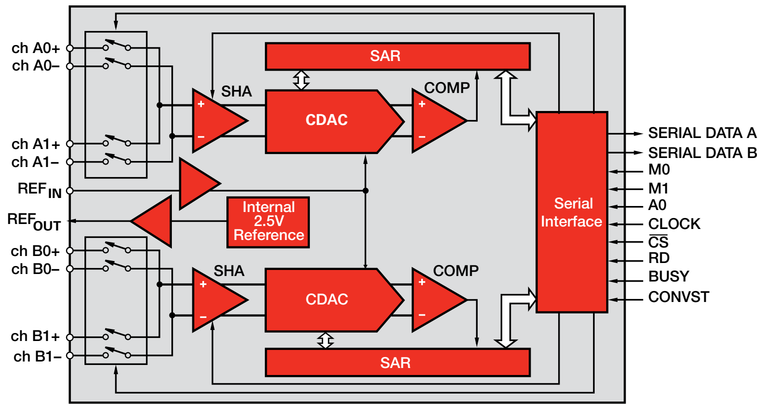
Dual, 1MSPS, 12-Bit, 2 + 2 Channel ADC
ADS7863

Get samples, datasheets and app reports at: **www.ti.com/sc/device/ADS7863**

Key Features
- 4 input channels
- Fully differential inputs
- 500ns total throughput per channel
- No missing codes
- 2MHz effective sampling rate
- Low power: 40mW
- SSI serial interface
- Packaging: SSOP-24, QSOP-24, QFN-24

Applications
- Motor control
- Multi-axis positioning systems
- 3-phase power control

The ADS7863 is a dual, 12-bit, 1MSPS ADC with four fully differential input channels grouped into two pairs for high-speed, simultaneous signal acquisition. Inputs to the sample-and-hold amplifiers are fully differential and are maintained differential to the input of the A/D converter. This provides excellent common-mode rejection of 80dB at 50kHz, which is important in high-noise environments. The ADS7863 offers a high-speed, dual serial interface and control inputs to minimize software overhead.



ADS7863 functional block diagram.

Analog Monitoring and Control Selection Guide

Device	Res. (Bits)	Sample Rate (kSPS)	Number of Input Channels	Interface	Input Voltage (V)	V_{REF}	Linearity (%)	NMC (Bits)	SINAD (dB)	Power (mW)	Package	Price*
ADS1201	24	4	1 SE/1 Diff	Serial	5	Int/Ext	0.0015	24	—	25	SOIC-16	$6.15
AMC1210	16	90MHz Clock	4 Digital Filters	Serial/P4	Digital Bit Stream	—	—	—	—	1.5/MHz/Ch	QFN-40	$1.55
ADS8556	16	500	6	Serial, SPI	—	—	—	—	—	—	LQFP-64	TBD
ADS8361	16	500	2 x 2 Diff	Serial, SPI	±2.5 at 2.5	Int/Ext	0.0012	14	83	150	SSOP-24	$8.75
ADS8364	16	250	1 x 6 Diff	P16	±2.5 at 2.5	Int/Ext	0.009	14	82.5	413	TQFP-64	$18.10
ADS8365	16	250	1 x 6 Diff	P16	±2.5 at 2.5	Int/Ext	0.006	15	87	190	TQFP-64	$16.25
ADS1202	16	40	1 SE/1 Diff	Serial	±0.25	Int/Ext	0.018	16	—	33	TSSOP-8	$2.50
ADS1203	16	40	1 SE/1 Diff	Serial	±0.25	Int/Ext	0.003	16	—	33	TSSOP-8	$2.70
ADS1208	16	40	1 SE/1 Diff	Serial	±0.125	Int/Ext	0.012	16	—	64	TSSOP-16	$2.95
ADS1205	16	40	2 Diff	Serial	±2.5 at 2.5	Int/Ext	0.005	16	—	75	QFN-24	$3.95
ADS1204	16	40	4 SE/4 Diff	Serial	±2.5 at 2.5	Int/Ext	0.003	16	—	122	QFN-32	$6.75
ADS7871	14	48	8 SE/4 Diff	Serial, SPI	PGA (1,2,4,8,10,16,20)	Int/Ext	0.03	13	—	6	SSOP-28	$5.00
ADS7863	12	2000	2 x 2 Diff	Serial, SPI	±2.5 at 2.5	Int/Ext	0.024	12	70	40	SSOP-14	$4.90
ADS7869	12	1000	12 Diff	Serial, SPI/ P12	±2.5 at +2.5	Int	0.06	11	71	175	TQFP-100	$14.60
ADS7861	12	500	2 x 2 Diff	Serial, SPI	±2.5 at 2.5	Int/Ext	0.024	12	70	25	SSOP-14	$4.05
ADS7862	12	500	2 x 2 Diff	P12	±2.5 at 2.5	Int/Ext	0.024	12	71	25	TQFP-32	$5.70
ADS7864	12	500	3 x 2 Diff	P12	±2.5 at 2.5	Int/Ext	0.024	12	71	50	TQFP-48	$6.65
AMC7823	12	200	8 SE I/O DAS	Serial, SPI	5	Int/Ext	0.024	12	74	100	QFN-40	$9.75
AMC7820	12	100	8 DAS	Serial, SPI	5	Int	0.024	12	72 (typ)	40	TQFP-48	$3.75
ADS7870	12	50	8 SE	Serial, SPI	PGA (1,2,4,8,10,16,20)	Int	0.06	12	72	4.6	SSOP-28	$4.15

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.** Preview products are listed in **bold blue.***

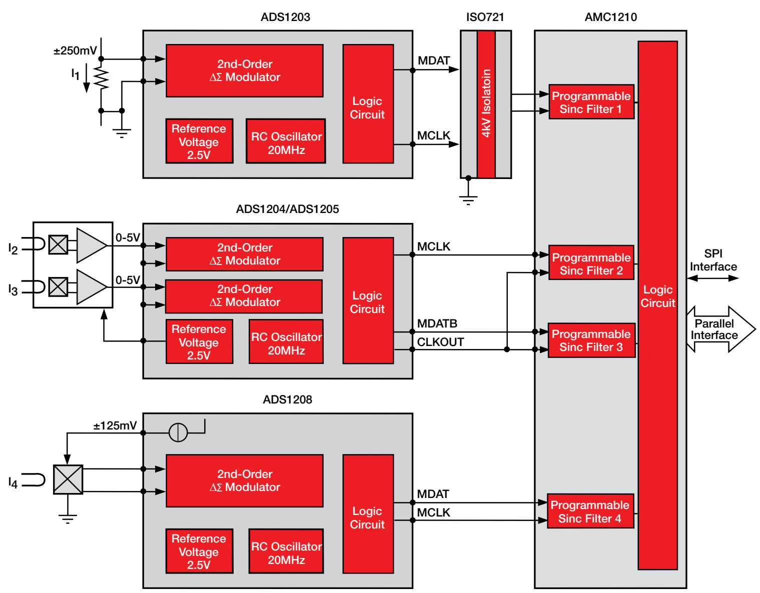
Digital Current Shunt Monitors

The ADS120x series are 2nd-order, precision, delta-sigma (ΔΣ) modulators operating from a single +5V supply at a 10MHz clock rate, specifically used in motor control applications for measuring and digitizing motor current. The targeted application is servo motor control.

Both the ADS1202 and ADS1203 modulators have an input range set for ±250mV to directly digitize current passing through a shunt resistor. The ADS1204 and ADS1205 are optimized for magnetic-based current sensors and feature two and four input channels. In contrast, the ADS1208 is optimized for Hall Effect sensors. It has integrated all the key components needed to directly connect the sensor, including a programmable current source for the sensor excitation and internal operational amplifiers to buffer the analog input.

With the appropriate digital filter and modulator rate, provided by the AMC1210, the ADS120x will achieve 16-bit analog-to-digital conversion performance with no missing codes. They also offer excellent INL, DNL and low distortion at 1kHz. They feature low power and are available in a TSSOP and QFN packages.

See pages 33-34 for a complete selection of analog current shunt monitors.



Possible input modulator configuration for current measurement with AMC1210 digital filter.

Digital Current Shunt ADCs Selection Guide

Device	Res. (Bits)	Sample Rate (kSPS)	Number of Input Channels	Interface	Input Voltage (V)	V_{REF}	Linearity (%)	NMC (Bits)	SINAD (dB)	Power (mW)	Package(s)	Price*
AMC1210	16	90MHz Clock	4 Digital Filters	Serial/P4	Digital Bit Stream	—	—	—	—	0.5/MHz/Ch	QFN-40	$1.55
ADS1204	16	12MHz Clock	4 Diff	Serial	±2.5 at 2.5	Int/Ext	0.005	16	89	112.5	QFN-32	$6.75
ADS1205	16	12MHz Clock	22 Diff	Serial	±2.5 at 2.5	Int/Ext	0.005	16	88	57	QFN-24	$3.95
ADS1202	16	12MHz Clock	21 Diff	Serial	±0.25	Int	0.018	16	70	30	TSSOP-8	$2.50
ADS1203	16	12MHz Clock	1 Diff	Serial	±0.25	Int/Ext	0.005	16	85	33	TSSOP-8, QFN-16	$2.70
AMC1203	16	12MHz Clock	2 Diff	Serial-Isolated	±0.25	Int	0.009	16	85	80	SO-8, SO-16	$3.35
ADS1208	16	12MHz Clock	2 Diff	Serial	±0.125	Int/Ext	0.012	16	81	64	TSSOP-16	$2.95

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue**.*

Voltage References

Precision Voltage and Current References

TI's family of voltage and current references incorporates state-of-the-art technology to offer stable, high-precision, high-performance references in tiny packages.

Series Voltage References

Series voltage references are known for excellent accuracy and stability over temperature. Typically three terminal devices, series voltage references are often used to provide stable reference voltages for ADCs and microcontrollers.

The REF29xx, REF30xx, REF31xx, REF32xx and REF33xx are TI's newest available families of precision, low-power, low-dropout, series voltage references in tiny SOT23-3 packages. Drift specifications range from 100ppm/°C to less than 10ppm/°C. Small size and low power consumption (down to 3.9µA typ) make them ideal for portable and battery-powered applications. These voltage references are stable with a wide range of capacitive load and can sink/source a minimum of up to 5mA of output current and are specified for the temperature range of –40°C to +125°C.

Shunt Voltage References

Shunt voltage references are precision diodes designed to offer good accuracy at extremely low power. These devices require a current source, typically a supply voltage and pull-up resistor to keep forward biased.

The REF1112 is a 1µA, two-terminal reference diode designed for high accuracy with outstanding temperature characteristics at low operating currents. Precision thin-film resistors result in 0.2% initial voltage accuracy and 50ppm/°C maximum temperature drift. The REF1112 is specified from –40°C to +85°C, with operation from 1µA to 5mA, and is offered in a SOT23-3 package.

Current References

Many applications require the use of a precision current source or current sink. The REF200 combines three circuit building-blocks on a single monolithic chip—two 100µA current sources and a current mirror capable of being used as a current source or sink.

Integrated Op Amp and Voltage References

For applications requiring an op amp plus voltage reference or comparator plus voltage reference, TI has an offering of integrated function voltage references. The TLV3011 and TLV3012 are low-power, (5µA) 6µs propagation delay comparators with an integrated shunt voltage reference.

See pages 28-30 for comparator and integrated voltage reference specifications

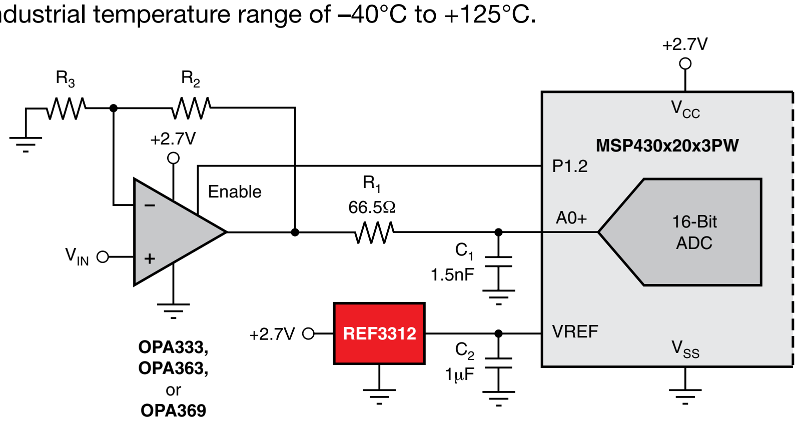
30ppm/°C Drift, 3.9µA, Series Voltage References in SC70
REF3312, REF3318, REF3320, REF3325 REF3330, REF3333

Get samples, datasheets and app reports at: **www.ti.com/sc/device/PARTnumber** (Replace **PARTnumber** with **REF3312**, **REF3318**, **REF3320**, **REF3325**, **REF3330** or **REF3333**)

Key Features
- Low supply current: 3.9µA (typ)
- Low temperature drift: 30ppm/°C (max)
- High output current: ±5mA
- High accuracy: ±0.15% (max)
- microSize packages: SC70-3, SOT23-3

Applications
- Portable/battery powered equipment
- Handheld monitoring
- Data acquisition systems
- Medical equipment
- Test equipment

The REF33xx combines the excellent performance of a 30ppm/°C precision (0.15% accuracy) voltage reference with ultra-low quiescent current (5µA max) and space-saving SC70 micro-packaging ideal for portable and battery-powered applications. The REF33xx can sink and source up to 5mA and is specified over the industrial temperature range of –40°C to +125°C.



Unipolar signal chain configuration.

Voltage References

3ppm/°C Drift, 0.05% Accurate, Low-Noise, Precision Series Voltage References

REF5020, REF5025, REF5030, REF5040, REF5045, REF5050, REF5010

Get samples, datasheets and app reports at: **www.ti.com/sc/device/PARTnumber** (Replace **PARTnumber** with **REF5020**, **REF5025**, **REF5030**, **REF5040**, **REF5045**, **REF5050** or **REF5010**)

Key Features

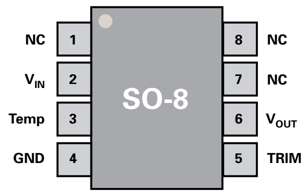
- High accuracy: 0.05%
- Low temperature drift: 3ppm/°C (max)
- Very low noise: $3\mu V_{PP}/V$
- High output current: ±10mA
- Wide supply range: 2.7V to 18V
- Industrial temperature range: –40°C to +125°C
- Packaging: SO-8, MSOP coming soon

Applications

- Test and measurement
- 16-bit data acquisition systems
- Medical and patient monitoring
- Industrial process control

The REF50xx brings a new level of precision to the TI series voltage reference line. Offering 3ppm/°C (max) drift and 0.05% initial accuracy and very low noise, the REF50xx is designed for industrial, medical and test applications that require performance over temperature.

Model	Voltage Out
REF5020	2.048V
REF5025	2.5V
REF5030	3.0V
REF5040	4.096V
REF5045	4.5V
REF5050	5V
REF5010	10V



REF50xx package diagram.

Voltage References Selection Guide

Device	Description	Output (V)	Initial Accuracy (%) (max)	Drift (ppm/°C) (max)	Long-Term Stability (ppm/1000hr) (typ)	Noise 0.1 to 10Hz (µVp-p/V) (typ)	I_Q (mA) (max)	Temperature Range (°C)	Output Current (mA)	Package(s)	Price*
REF50xx	High Accuracy Bandgap Reference	2.048, 2.5, 3.0, 4.096, 4.5, 5, 10	0.05	3	—	3	1	–40 to +125	±10	SOIC-8	$3.50
REF50xxA	High Accuracy Bandgap Reference	2.048, 2.5, 3.0, 4.096, 4.5, 5, 10	0.1	8	—	3	1	–40 to +125	±10	SOIC-8	$1.85
REF33xx	microPower, Bandgap	1.25, 1.8, 2.048, 2.5 3.0, 3.3	0.15	30	—	28	0.005	–40 to +125	±5	SC-70, SOT23-3	$0.85
REF32xx	Low Drift, Bandgap	1.25, 2.048, 2.5 3.0, 3.3, 4.096	0.2	7	55	13	0.120	–40 to +125	±10	SOT23-6	$1.70
REF31xx	Bandgap	1.25, 2.048, 2.5 3.0, 3.3, 4.096	0.2	15	70	13	0.115	–40 to +125	±10	SOT23-3	$1.10
REF30xx	Bandgap	1.25, 2.048, 2.5, 3.0, 3.3, 4.096	0.2	50	24	11	0.05	–40 to +125	25	SOT23-3	$0.60
REF29xx	Bandgap	1.25, 2.048, 2.5, 3.0, 3.3, 4.096	2	100	24	11 to 16	0.05	–40 to +125	25	SOT23-3	$0.49
REF02A	Low Drift, Buried Zener	5	0.3	15	50	0.8	1.4	–40 to +85	+21, –0.5	SOIC, PDIP	$1.45
REF02B	Low Drift, Buried Zener	5	0.2	10	50	0.8	1.4	–40 to +85	+21, –0.5	SOIC, PDIP	$2.05
REF102A	Low Drift, Buried Zener	10	0.1	10	20	0.5	1.4	–25 to +85	+10, –5	SOIC, PDIP	$1.75
REF102B	Low Drift, Buried Zener	10	0.05	5	20	0.5	1.4	–25 to +85	+10, –5	SOIC, PDIP	$3.25
REF102C	Ultra-Low Drift, Buried Zener	10	0.025	2.5	20	0.5	1.4	–25 to +85	+10, –5	SOIC, PDIP	$4.50
Shunt											
REF1112	µPower, 1.25V Shunt	1.25	0.2	30	60	20	0.0015	–40 to +125	0.0012 to 5	SOT23-3	$0.85
Current Reference											
REF200	Dual Current Reference with Current Mirror	100µA/Channel	±1	25 (typ)	—	1nAp-p	—	–25 to +85	50µA to 400µA	PDIP-8, SOIC-8	$2.60

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.***

Temperature Sensors

Digital Temperature Sensors

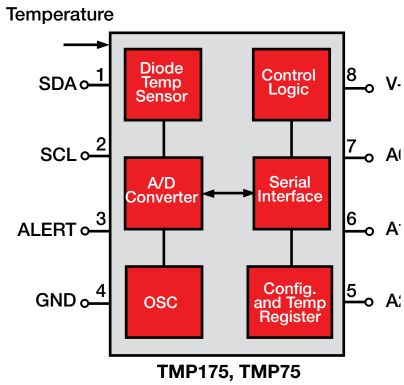
TI's high-accuracy, low-power temperature sensors are specified for operation from –40°C to +125°C and are designed for cost-effective thermal measurement in a variety of communication, computer, consumer, industrial and instrumentation applications.

These silicon-based temperature sensors are designed on a unique topology that offers excellent accuracy and linearity over temperature. Low power and standard communication protocol pair nicely with low-power microcontrollers and battery-powered designs.

The digital temperature output of the TMP family is created using a high-performance, 12-bit, delta-sigma ADC that outputs temperatures as a digital word. Programming and communication with the TMPxxx family of devices is done via an I²C/2-wire interface or SPI interface for easy integration into existing digital systems.

Temperature Sensor Core

A typical block diagram of the TMP family of digital temperature sensors is shown below. Temperature is sensed through the die flag of the lead frame. The temperature sensing element is the chip itself, ensuring the most accurate temperature information of the monitored area and allowing designers to respond quickly to "over" and "under" thermal conditions.



Typical block diagram of the TMP family of digital temperature sensors.

Features of TMP Digital Temperature Sensors

Several TMP digital sensors offer programmable features, including over- and under-temperature thresholds, alarm functions and measurement resolution. With extremely low power consumption in active (50µA) and standby (0.1µA) modes, the TMP12x family offers as low as 1.5°C minimum error in a SOT23 package and is an excellent candidate for low-power thermal monitoring applications.

The new TMP105 and TMP106 are the world's smallest digital temperature sensors. Available in a tiny 1mm x 1.5mm chipscale package, they use only 50µA of current and are ideal for portable applications including mobile phones, portable media players, digital still cameras, hard disk drives, laptops, and computer accessories. TMP105 has 1.8V to 3.0V logic, while TMP106 has 2.7V to 5.5V logic.

Digital Temp Sensor with SMBus/Two-Wire Serial Interface in SOT563

TMP102

NEW

Get samples and data sheet at: **www.ti.com/sc/device/TMP102**

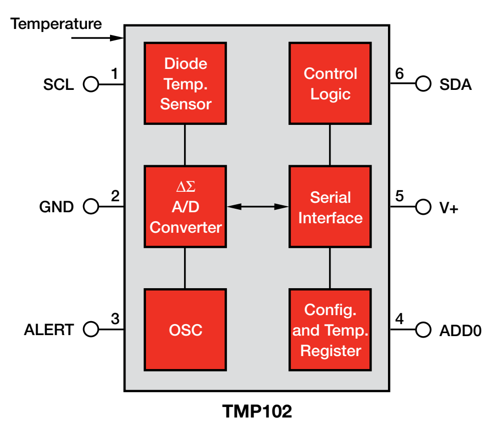
Key Features

- Accuracy: 0.5°C (–25°C to +85°C)
- Low quiescent current:
  - 10µA (max) active
  - 1 µA (max) shutdown
- Supply range: 1.4V to 3.6V
- Resolution: 12-bits
- Digital output: two-wire serial interface
- Packaging: SOT563

Applications

- Portable and battery power applications
- Power supply temperature monitoring
- Computer peripheral thermal protection
- Notebook computers
- Office machines
- Thermostat controls
- Electromechanical temperature measurements

The TMP102 is a two-wire, serial-output temperature sensor available in a tiny SOT563 package. Requiring no external sensing components, the TMP102 is capable of reading temperatures to a resolution of 0.0625°C. It features SMBus and two-wire interface compatibility, and allows up to four devices on one bus. It also features a dedicated alert pin.



TMP102 functional block diagram.

Temperature Sensors

±1°C Remote and Local Temperature Sensors

TMP441, TMP442

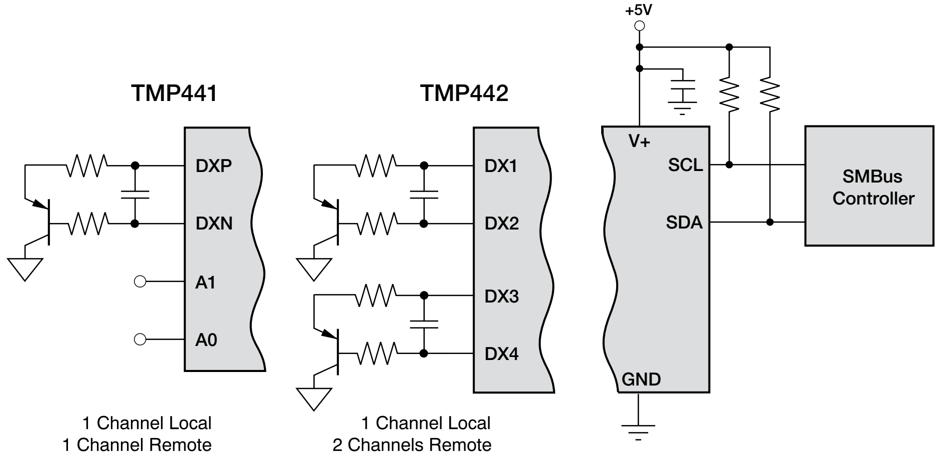
PREVIEW*

Get samples and datasheets at: **www.ti.com/sc/device/TMP441**, **www.ti.com/sc/device/TMP442**

Key Features
- ±1°C remote diode sensor (max)
- ±1.5°C local temp sensor (max)
- Automatic beta compensation
- Series resistance cancellation
- n-factor correction
- 2-wire/SMBus serial interface
- Multiple interface addresses
- Packaging: SOT23-8

Applications
- Processor/FPGA temperature monitoring
- LCD/DLP®/LCOS projectors
- Servers
- Central office telecom equipment
- Storage area networks

The TMP441 and TMP442 are remote temperature sensor monitors with a built-in local temperature sensor. Remote accuracy is ±1°C with no calibration needed. Both devices include beta compensation (correction), series resistance cancellation, programmable non-ideality factor, wide remote temperature measurement range (up to +150°C) and diode fault protection.



TMP441, TMP442 functional block diagrams. Estimated release date 4Q 08.

Remote Temperature Sensors

Device	Description	Remote Sensor Accuracy Over Temp Range (°C) (max)	Local Sensor Accuracy Over Temp Range (°C) (max)	Specified Ambient Temp Range (°C)	Remote Sensor Temp Range (°C)	Supply Voltage (V)	I_Q (µA) (typ)	Package(s)	Price*
TMP400	Remote and Local Temp Sensor with Programmable Non-Ideality Factor	1	2.5	–40 to +125	–40 to 125	2.7 to 5.5	420	QSSOP-16	$1.50
TMP401	Remote and Local Temperature Sensor	1	3	–40 to +125	–40 to 150	3.0 to 5.5	350	MSOP-8	$1.50
TMP411	Remote and Local Temp Sensor with Programmable Non-Ideality Factor	1	2.5	–40 to +125	–40 to 150	2.7 to 5.5	350	MSOP-8, SOIC-8	$1.75
TMP421	Remote and Local Temp Sensor in SOT23-8	1	2	–40 to +125	–40 to 150	2.7 to 5.5	400	SOT23-8	$1.25
TMP422	2xRemote and Local Temp Sensor in SOT23-8	1	2	–40 to +125	–40 to 150	2.7 to 5.5	400	SOT23-8	$1.65
TMP423	3xRemote and Local Temp Sensor in SOT23-8	1	2	–40 to +125	–40 to 150	2.7 to 5.5	400	SOT23-8	$1.40
TMP431	Remote and Local Temp Sensor with Programmable n-Factor and Beta Correction	1	2.5	–40 to +125	–40 to 150	2.7 to 5.5	350	MSOP-8, SOIC-8	TBD
TMP441	Remote and Local Temp Sensor with Beta Correction in SOT23-8	1	2	–40 to +125	–40 to 150	2.7 to 5.5	400	SOT23-8	TBD
TMP442	2xRemote and Local Temp Sensor with Beta Correction in SOT23-8	1	2	–40 to +125	–40 to 150	2.7 to 5.5	400	SOT23-8	TBD

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue**.*

Temperature Sensors

Temperature Sensors Selection Guide

Device	Description	Accuracy Over Temp Range (°C) (max)	Specified Temp Range (°C)	Operating Temp Range (°C)	Temp Resolution (Bits)	Supply Voltage (V)	I_Q (µA) (typ)	Package(s)	Price*
I²C/SMBus Interface									
TMP100	Digital Temp Sensor	2 3	–25 to +85 –55 to +125	–55 to +125	9 to 12	2.7 to 5.5	45	SOT23-6	$0.75
TMP101	Digital Temp Sensor with Prog. Thermostat/Alarm Function	2 3	–25 to +85 –55 to +125	–55 to +125	9 to 12	2.7 to 5.5	45	SOT23-6	$0.80
TMP102	Ultra Low Power Digital Temp Sensor in Micro Surface Mount Pkg.	2 3	–25 to 85 –40 to 125	–55 to 150	12	1.4 to 3.6	7	SOT563-6	$0.80
TMP105	Chipscale Digital Temp Sensor with 1.8V to 3.0V Logic	2 3	–25 to +85 –40 to +125	–55 to +127	9 to 12	2.7 to 5.5	50	1mm x 1.5mm WCSP-6	$0.85
TMP106	Chipscale Digital Temp Sensor with 2.7V to 5.0V Logic	2 3	–25 to +85 –40 to +125	–55 to +127	9 to 12	2.7 to 5.5	50	1mm x 1.5mm WCSP-6	$0.85
TMP275	Ultra-High Accuracy Digital Temp Sensor	0.5 1	+10 to +85 –40 to +125	–55 to +127	9 to 12	2.7 to 5.5	50	MSOP-8, SOIC-8	$1.25
TMP175	Digital Temp Sensor with 2-Wire Interface, 27 Addresses	1.5 2	–25 to +85 –40 to +125	–55 to +127	9 to 12	2.7 to 5.5	50	MSOP-8, SOIC-8	$0.85
TMP75	Industry Standard Sensor with 2-Wire Interface, 8 Addresses	2	–25 to +85	–55 to +127	9 to 12	2.7 to 5.5	50	MSOP-8, SOIC-8	$0.70
SPI Interface									
TMP121	1.5°C Accurate Digital Temp Sensor with SPI Interface	1.5 2	–25 to +85 –40 to +125	–55 to +150	12	2.7 to 5.5	35	SOT-23-6	$0.90
TMP122	1.5°C Accurate Programmable Temp Sensor with SPI Interface	1.5 2	–25 to +85 –40 to +125	–55 to +150	9 to 12	2.7 to 5.5	50	SOT-23-6	$0.99
TMP123	1.5°C Accurate Digital Temp Sensor with SPI Interface	1.5 2	–25 to +85 –55 to +125	–55 to +150	12	2.7 to 5.5	35	SOT-23-6	$0.90
TMP124	1.5°C Accurate Programmable Temp Sensor with SPI Interface	1.5 2	–25 to +85 –40 to +125	–55 to +150	9 to 12	2.7 to 5.5	50	SOIC-8	$0.70
TMP125	2°C Accurate Digital Temp. Sensor with SPI Interface	2 2.5	–25 to +85 –40 to +125	–55 to +125	10	2.7 to 5.5	36	SOT23-6	$0.80
Single-Wire, SensorPath Interface									
TMP141	Digital Temp Sensor with Single-Wire SensorPath Bus	2 3	–25 to +85 –40 to +125	–55 to +127	10	2.7 to 5.5	110	SOT23-6, MSOP-8	$0.80

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue**.*

Temperature Switch

Device	Description	Trip Point Accuracy (°C) (typ)	Output (mV/°C)	Specified Temp Range (°C)	Operating Temp Range (°C)	Supply Voltage (V)	I_Q (µA) (max)	Package(s)	Price*
TMP300	Comparator-Output Temperature Switch w/Additional Analog Output	±2	10	–40 to +125	–40 to +150	1.8 to 18	110	SC70-6, SOT23-6	$0.70

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Fan Controller

Device	Description	Accuracy (°C) (typ)	Input	Fan Control Modes	Output	I_Q (mA)	Supply Voltage (V)	Interface	Package(s)	Price*
AMC6821	±1°C Remote and Local Temp Sensors with Integrated Fan Controller	±1	1 Local and 1 Remote Temp	Programmable, Automatic, and Fixed RPM	Programmable PWM Frequency and Duty Cycle	2 (active)	2.7 to 5.5	I²C/SM-Bus	SOP-16 4mm x 5mm	$1.95

**Suggested resale price in U.S. dollars in quantities of 1,000.*

ADC Selection Guide

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
ADS1281	32	4	Delta-Sigma	1 Diff	—	130	–123	0.00006	—	31	Ext	Serial, SPI	2	4.75, 5.25	1.65, 3.6	12	$28.95
ADS1282	32	4	Delta-Sigma	2w Diff	—	105	–123	0.00006	—	31	Ext	Serial	2	4.75, 5.25	1.65, 3.6	350	$11.75
ADS1672	24	625	Delta-Sigma	1 Diff	—	105	115	2	1	24	Ext	SPI, LVDS	2	4.75, 5.25	1.65, 3.6	350	$11.75
ADS1258	24	125	Delta-Sigma	16 SE/8 Diff	—	—	—	0.0015	1	24	Ext	Serial, SPI	2	4.75, 5.25	1.8, 3.6	40	$7.95
ADS1278	24	128	Delta-Sigma	8 Diff Simultaneous	—	111	108	0.001	1	24	Ext	Serial, SPI w/ FSYNC	2	4.75, 5.25	2.5, 3.6	60-600	$23.95
ADS1274	24	125	Delta-Sigma	4 Diff Simultaneous	—	111	108	0.001	1	24	Ext	Serial, SPI w/ FSYNC	2	4.75, 5.25	2.5, 3.6	30-300	$13.95
ADS1271	24	105	Delta-Sigma	1 Diff	—	109	108	0.0015	1	24	Ext	Serial, SPI w/ FSYNC	2	4.75, 5.25	2.5, 3.6	35-100	$5.90
ADS1252	24	41	Delta-Sigma	1 SE/1 Diff	—	—	—	0.0015	1	24	Ext	Serial	1	4.75, 5.25	4.75, 5.25	40	$6.45
ADS1256	24	30	Delta-Sigma	8 SE/4 Diff	—	—	—	0.001	1	24	Ext	Serial, SPI	2	4.75, 5.25	1.8, 3.6	35	$6.95
ADS1255	24	30	Delta-Sigma	2 SE/1 Diff	—	—	—	0.001	1	24	Ext	Serial, SPI	2	4.75, 5.25	1.8, 3.6	35	$6.50
ADS1253	24	20	Delta-Sigma	4 SE/4 Diff	—	—	—	0.0015	1	24	Ext	Serial	1	4.75, 5.25	4.75, 5.25	7.5	$6.70
ADS1254	24	20	Delta-Sigma	4 SE/4 Diff	—	—	—	0.0015	1	24	Ext	Serial	2	4.75, 5.25	1.8, 3.6	4	$6.70
ADS1251	24	20	Delta-Sigma	1 SE/1 Diff	—	—	—	0.0015	1	24	Ext	Serial	1	4.75, 5.25	4.75, 5.25	7.5	$5.60
ADS1201	24	4	Modulator	1 Diff	—	—	—	0.0015	1	24	Int/Ext	Bit Stream	1	4.75, 5.25	4.75, 5.25	40	$6.15
ADS1246	24	2	Delta-Sigma	1 Diff	—	—	—	0.0003	1	24	Ext	Serial, SPI	3	2.5, 5.8	2.5, 5.8	2.56	$3.45
ADS1247	24	2	Delta-Sigma	3 SE/2 Diff	—	—	—	0.0003	1	24	Int/Ext	Serial, SPI	3	2.5, 5.8	2.5, 5.8	2.56	$4.45
ADS1248	24	2	Delta-Sigma	7 SE/4 Diff	—	—	—	0.0003	1	24	Int/Ext	Serial, SPI	3	2.5, 5.8	2.5, 5.8	2.56	$4.95
ADS1216	24	0.78	Delta-Sigma	8 SE/8 Diff	—	—	—	0.0015	1	24	Int/Ext	Serial, SPI	2	2.7, 5.25	2.7, 5.25	0.6	$5.00
ADS1217	24	0.78	Delta-Sigma	8 SE/8 Diff	—	—	—	0.0012	1	24	Int/Ext	Serial, SPI	2	2.7, 5.25	2.7, 5.25	0.8	$5.00
ADS1218	24	0.78	Delta-Sigma	8 SE/8 Diff	—	—	—	0.0015	1	24	Int/Ext	Serial, SPI	2	2.7, 5.25	2.7, 5.25	0.8	$5.50
ADS1224	24	0.24	Delta-Sigma	4 SE/4 Diff	—	—	—	0.0015	1	24	Ext	Serial	2	2.7, 5.5	2.7, 5.5	0.5	$3.25
ADS1222	24	0.24	Delta-Sigma	2 SE/2Diff	—	—	—	0.0015	1	24	Ext	Serial	2	2.7, 5.25	2.7, 5.25	0.5	$2.95
ADS1234	24	0.08	Delta-Sigma	4 SE/4Diff	—	—	—	0.0015	1	24	Ext	Serial	2	2.7, 5.25	2.7, 5.25	3	$4.50
ADS1232	24	0.08	Delta-Sigma	2 SE/2Diff	—	—	—	0.0015	1	24	Ext	Serial	2	2.7, 5.25	2.7, 5.25	3	$3.90
ADS1226	24	0.08	Delta-Sigma	2 Diff	—	—	—	0.0015	1	24	Ext	Serial	2	2.7, 5.25	2.7, 5.25	1.5	$2.95
ADS1225	24	0.08	Delta-Sigma	1 Diff	—	—	—	0.0015	1	24	Ext	Serial	2	2.7, 5.25	2.7, 5.25	1.5	$2.75
ADS1241	24	0.015	Delta-Sigma	8 SE/4 Diff	—	—	—	0.0015	1	24	Ext	Serial, SPI	2	2.7, 5.25	2.7, 5.25	0.5	$4.20
ADS1243	24	0.015	Delta-Sigma	8 SE/4 Diff	—	—	—	0.0015	1	24	Ext	Serial, SPI	1	2.7, 5.25	2.7, 5.25	0.6	$3.95
ADS1240	24	0.015	Delta-Sigma	4 SE/2 Diff	—	—	—	0.0015	1	24	Ext	Serial, SPI	2	2.7, 5.25	2.7, 5.25	0.6	$3.80
ADS1242	24	0.015	Delta-Sigma	4 SE/2 Diff	—	—	—	0.0015	1	24	Ext	Serial, SPI	1	2.7, 5.25	2.7, 5.25	0.6	$3.60
ADS1244	24	0.015	Delta-Sigma	1 SE/1 Diff	—	—	—	0.0008	1	24	Ext	Serial	2	2.5, 5.25	1.8, 3.6	0.3	$2.95
ADS1245	24	0.015	Delta-Sigma	1 SE/1 Diff	—	—	—	0.0015	1	24	Ext	Serial	2	2.5, 5.25	1.8, 3.6	0.5	$3.10

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red**. Preview products are listed in **bold blue***

ADC Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
ADS1250	20	25	Delta-Sigma	1 SE/1 Diff	—	—	—	0.003	1	20	Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	75	$6.95
DDC118	20	3	Delta-Sigma	8 SE IIN	—	—	—	0.025	1	20	Ext	Serial	2	4.75, 5.0	2.7, 5.25	110	$32.00
DDC114	20	3	Delta-Sigma	4 SE IIN	—	—	—	0.025	1	20	Ext	Serial	2	4.75, 5.0	2.7, 5.25	55	$18.00
DDC232	20	3	Delta-Sigma	32 SE IIN	—	—	—	0.025	1	20	Ext	Serial	2	4.75, 5.0	2.7, 5.25	224-320	$70.00
DDC112	20	3	Delta-Sigma	2 SE IIN	—	—	—	0.025	1	20	Ext	Serial	2	4.75, 5.25	4.75, 5.25	80	$12.10
ADS1230	20	0.08	Delta-Sigma	1 SE/1 Diff	—	—	—	0.003	1	20	Ext	Serial	2	2.7, 5.25	2.7, 5.25	3	$2.50
ADS1625	18	1,250	Delta-Sigma	1 Diff	91	93	103	0.0015	1	18	Int/Ext	P18	2	4.75, 5.25	2.7, 5.25	515	$14.95
ADS1626	18	1,250	Delta-Sigma	1 Diff	91	93	103	0.0015	1	18	Int/Ext	P18 w/FIFO	2	4.75, 5.25	4.75, 5.25	515	$15.50
ADS8484	18	1,250	SAR	1 Diff	98	99	120	0.0011	1	18	Int/Ext	P8/P16/P18	2	4.75, 5.25	2.7, 5.25	220	$22.50
ADS8481	18	1,000	SAR	1 SE/1 PDiff	93	94	112	0.0013	1	18	Int/Ext	P8/P16/P18	2	4.75, 5.25	2.7, 5.25	220	$19.80
ADS8482	18	1,000	SAR	1 Diff	98	99	120	0.0011	1	18	Int/Ext	P8/P16/P18	2	4.75, 5.25	2.7, 5.25	220	$20.25
ADS8285	18	1,000	SAR	8 SE	—	—	—	0.00095	—	18	Int/Ext	P8/P16/P18	4	4.75, 5.25	2.7, 5.25	270	$22.00
ADS8284	18	1,000	SAR	4 Diff	—	—	—	0.00095	—	18	Int/Ext	P8/P16/P18	4	4.75, 5.25	2.7, 5.25	270	$22.00
ADS8380	18	600	SAR	1 SE	90	91	112	0.0018	–1/+2	18	Int/ Ext	Serial, SPI	1	4.75, 5.25	2.7, 5.75	110	$16.50
ADS8382	18	600	SAR	1 Diff	95	96	112	0.0018	–1/+2	18	Int/Ext	Serial, SPI	1	4.75, 5.25	2.7, 5.75	110	$16.95
ADS8381	18	580	SAR	1 SE	88	88	112	0.0018	2.5	18	Ext	P8/P16/P18	2	4.75, 5.25	2.7, 5.25	115	$16.65
ADS8383	18	500	SAR	1 SE	85	87	112	0.006	2.5	18	Ext	P8/P16/P18	2	4.75, 5.25	2.95, 5.25	110	$15.75
ADS5485	16	200,000	Pipeline	1 Diff	73.7	75	87	0.015	1	16	Int/Ext	DDR LVDS	2	4.75, 5.25	3.0, 3.6	2160	$98.95
ADS5484	16	170,000	Pipeline	1 Diff	74.3	75.7	87	0.015	1	16	Int/Ext	DDR LVDS	2	4.75, 5.25	3, 3.6	2160	$78.95
ADS5483	16	135,000	Pipeline	1 Diff	77.8	79	97	0.0045	0.5	16	Int/Ext	DDR LVDS	2	4.75, 5.25	3.0, 3.6	2130	$65.00
ADS5482	16	105,000	Pipeline	1 Diff	79.3	80.5	98	0.0045	0.5	16	Int/Ext	DDR LVDS	2	4.75, 5.25	3, 3.6	2100	$56.65
ADS5481	16	80,000	Pipeline	1 Diff	79.3	80.6	98	0.0045	0.5	16	Int/Ext	DDR LVDS	2	4.75, 5.25	3, 3.6	2100	$48.33
ADS5562	16	80,000	Pipeline	1 Diff	80.5	84	85	0.013	0.95	16	Int/Ext	DDR LVDS/ CMOS, P8	2	0.3, 3.6	3, 3.6	865	$48.35
ADS5560	16	40,000	Pipeline	1 Diff	83.2	84.3	90	0.013	0.95	16	Int/Ext	DDR LVDS/ CMOS, P8	2	0.3, 3.6	3, 3.6	674	$31.80
ADS1610	16	10,000	Delta-Sigma	1 Diff	83	84	96	0.005	0.5	16	Ext	P16	2	4.75, 5.25	2.7, 5.25	960	$19.95
ADS1606	16	5,000	Delta-Sigma	1 Diff	86	88	101	0.0015	0.25	16	Int/Ext	P16 w/FIFO	2	4.75, 5.25	2.7, 5.25	570	$15.50
ADS8422	16	4,000	SAR	1 Diff	92.5	93	116	0.0023	–1, +1.5	16	Int/Ext	P8/P16	2	4.75, 5.25	2.7, 5.25	160	$23.95
ADS1602	16	2,500	Delta-Sigma	1 Diff	86	88	101	0.0015	0.25	16	Int/Ext	Serial	2	4.75, 5.25	2.7, 5.25	530	$12.50
ADS8410	16	2,000	SAR	1 SE/1 PDiff	87.5	87	101	0.0038	1	16	Int/Ext	Serial, LVDS	2	4.75, 5.25	2.7, 5.25	290	$23.00
ADS8411	16	2,000	SAR	1 SE	85	86	100	0.00375	2	16	Int/Ext	P8/P16	2	4.75, 5.25	2.95, 5.25	175	$22.00
ADS8413	16	2,000	SAR	1 Diff	92	92	113	0.0038	1	16	Int/Ext	Serial, LVDS	2	4.75, 5.25	2.7, 5.25	290	$24.05

*Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red**. Preview products are listed in **bold blue***

ADC Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
ADS8412	16	2,000	SAR	1 Diff	88	90	100	0.00375	2	16	Int	P8/P16	2	4.75, 5.25	2.95, 5.25	175	$23.05
ADS8405	16	1,250	SAR	1 SE/1 PDiff	85	86	105	0.003	–1, +1.5	16	Int/Ext	P8/P16	2	4.75, 5.25	2.7, 5.25	155	$14.10
ADS8401	16	1,250	SAR	1 SE	85	86	100	0.00534	2	16	Int	P8/P16	2	4.75, 5.25	2.95, 5.25	155	$12.55
ADS8402	16	1,250	SAR	1 Diff	88	90	100	0.00534	2	16	Int	P8/P16	2	4.75, 5.25	2.95, 5.25	155	$13.15
ADS1601	16	1,250	Delta-Sigma	1 Diff	86	88	101	0.0015	0.25	16	Int/Ext	Serial	2	4.75, 5.25	2.7, 5.25	350	$9.95
ADS8406	16	1,250	SAR	1 Diff	90	91	105	0.003	–1, +1.5	16	Int/Ext	P8/P16	2	4.75, 5.25	2.7, 5.25	155	$14.70
ADS8403	16	1,000	SAR	1 SE/1 PDiff	93.8	93.6	113	0.003	1	16	Ext	Serial, SPI	2	4.5, 5.5	2.375, 5.5	40	$15.00
ADS8471	16	1,000	SAR	1 SE/1 PDiff	93	93	114	0.003	0.75	16	Int	Serial, SPI	2	4.75, 5.25	2.7, 5.25	150	$14.75
ADS8330	16	1,000	SAR	2 SE	92	92	102	0.0027	1	16	Ext	Serial, SPI	2	2.7, 5.5	1.65, 5.5	20	$11.85
ADS8329	16	1,000	SAR	1 SE	92	88.5	102	0.0027	1	16	Ext	Serial, SPI	2	2.7, 5.5	1.65, 5.5	20	$11.25
ADS8472	16	1,000	SAR	1 Diff	95.2	95.3	123	0.00099	0.5	16	Int/Ext	P8/P16	2	2.7, 5.5	1.65, 5.5	225	$17.50
ADS8400	16	1,000	SAR	1 Diff	96	95.5	116	0.0023	0.75	16	Ext	Serial, SPI	2	4.5, 5.5	2.375, 5.5	40	$14.00
ADS8255	16	1,000	SAR	8 SE	—	—	—	0.0011	—	16	Int/Ext	P8/P16	4	4.75, 5.25	2.7, 5.25	270	$18.50
ADS8254	16	1,000	SAR	4 Diff	—	—	—	0.0011	—	16	Int/Ext	P8/P16	4	4.75, 5.5	2.7, 5.25	270	$18.50
ADS8556	16	800	SAR	1 x 6 Diff	90	92	95	0.0046	–1, +2	16	Int/Ext	SERIAL, SPI/P8, P16	4	4.5, 5.5	2.7, 5.5	160	$16.00
ADS8371	16	750	SAR	1 SE	87	87	100	0.0022	2	16	Ext	P8/P16	2	4.75, 5.25	2.95, 5.25	110	$12.00
ADS8370	16	600	SAR	1 SE/1 PDiff	90	90	109	0.0015	–1, +1.5	16	Int/Ext	Serial, SPI	2	4.75, 5.25	2.7, 5.25	110	$12.50
ADS8372	16	600	SAR	1 Diff	94	94	109	0.0011	1	16	Int/Ext	Serial, SPI	2	4.75, 5.25	2.7, 5.25	110	$13.00
ADS8361	16	500	SAR	2 x 2 Diff	83	83	94	0.00375	1.5	14	Int/Ext	Serial, SPI	2	4.75, 5.25	2.7, 5.5	150	$8.75
ADS8332	16	500	SAR	8 SE, 8 Diff	87.5	—	—	0.0031	—	16	Int/Ext	Serial, SPI	2	2.7, 5.5	2.65, 5.5	6.75	$15.00
ADS8361	16	500	SAR	2 x 2 Diff	83	83	94	0.00375	1.5	14	Int/Ext	Serial, SPI	2	4.75, 5.25	2.7, 5.5	150	$8.75
ADS8331	16	500	SAR	4 SE, 4 PDiff	87.5	—	—	0.0031	—	16	Int/Ext	Serial, SPI	2	2.7, 5.5	2.65, 5.5	6.75	$15.00
ADS8328	16	500	SAR	2 SE	88.5	91	101	0.00305	1	16	Ext	Serial, SPI	2	2.7, 5.5	1.65, 5.5	10.6	$9.30
ADS8327	16	500	SAR	1 SE	88.5	91	101	0.00305	1	16	Ext	Serial, SPI	2	2.7, 5.5	1.65, 5.5	10.6	$8.50
ADS8322	16	500	SAR	1 Diff	83	—	96	0.009	2	15	Int/Ext	P8/P16	1	4.75, 5.25	4.75, 5.25	85	$7.10
ADS8323	16	500	SAR	1 Diff	83	—	94	0.009	2	15	Int/Ext	P8/P16	1	4.75, 5.25	4.75, 5.25	85	$7.10
ADS8318	16	500	SAR	1 Diff	96	95.5	116	0.0015	0.75	16	Ext	Serial, SPI	2	4.5, 5.5	2.375, 5.5	18	$9.00
ADS8319	16	500	SAR	1 SE/1 Diff	93.8	93.6	113	0.0023	1	16	Ext	Serial, SPI	2	4.5, 5.5	2.375, 5.5	18	$8.00
ADS8342	16	250	SAR	4 Diff	85	87	92	0.006	2	16	Ext	P8/P16	2	4.75, 5.25	2.7, 5.5	200	$11.30
ADS8365	16	250	SAR	1 x 6 Diff	87	87	94	0.006	1.5	15	Int/Ext	P16	1	4.75, 5.25	4.75, 5.25	190	$16.25
ADS8364	16	250	SAR	1 x 6 Diff	82.5	83	94	0.009	3	14	Int/Ext	P16	1	4.75, 5.25	4.75, 5.25	413	$18.10
ADS8326	16	250	SAR	1 SE/1 Diff	91	91	108	0.0022	1	16	Ext	Serial, SPI	1	2.7, 5.25	2.7, 5.25	2.25	$5.00
ADS8519	16	250	SAR	1 SE	91	92	102	0.0022	1	16	Int/Ext	Serial, SPI	2	4.75, 5.25	1.65, 5.25	100	$12.95

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.** Preview products are listed in **bold blue***

ADC Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
ADS8515	16	250	SAR	1 SE	92	88	100	0.005	1	16	Int/Ext	P8/P16	1	4.75, 5.25	4.75, 5.25	70	$10.95
ADS8509	16	250	SAR	1 SE	86	88	100	0.003	1	16	Int/Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	70	$12.95
ADS8505	16	250	SAR	1 SE	86	88	100	0.0022	1	16	Int/Ext	P8/P16	1	4.75, 5.25	4.75, 5.25	70	$12.95
ADS8317	16	250	SAR	1 Diff	89.5	91.5	103	0.0022	1	16	Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	6	$5.90
ADS7811	16	250	SAR	1 SE	87	87	100	0.006	2	15	Int/Ext	P16	2	4.75, 5.25	4.75, 5.25	200	$36.15
ADS7815	16	250	SAR	1 SE	84	84	100	0.006	2	15	Int/Ext	P16	2	4.75, 5.25	4.75, 5.25	200	$21.30
ADS8517	16	200	SAR	1 SE	87	88	96	—	1.5	16	Int/Ext	Serial, SPI, P8	2	4.5, 5.5	1.65, 5.25	38	$13.00
ADS8317	16	200	SAR	1 Diff	88	88	108	0.0022	1	16	Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	5.7	$5.90
TLC4541	16	200	SAR	1 SE	84.5	85	95	0.0045	2	16	Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	17.5	$6.85
TLC4545	16	200	SAR	1 PDiff	84.5	85	95	0.0045	2	16	Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	17.5	$6.85
ADS8514	16	200	SAR	1 SE	89.7	89.9	102	0.0022	1	16	Int/Ext	Serial, SPI	2	4.5, 5.5	1.65, 5.25	24	$12.50
ADS1158	16	125	Delta-Sigma	16 SE/ 8 Diff	—	—	—	0.045	1	16	Ext	Serial, SPI	2	4.75, 5.5	2.5, 3.6	42	$5.95
ADS8344	16	100	SAR	8 SE/4 Diff	86	—	92	0.006	2	15	Ext	Serial, SPI	1	2.7, 5.25	2.7, 5.25	3.6	$8.00
ADS8345	16	100	SAR	8 SE/4 Diff	85	—	98	0.006	2	15	Ext	Serial, SPI	1	2.7, 5.25	2.7, 5.25	3.6	$8.00
ADS8341	16	100	SAR	4 SE/2 Diff	86	—	92	0.006	2	15	Ext	Serial, SPI	1	2.7, 5.25	2.7, 5.25	3.6	$7.40
ADS8343	16	100	SAR	4 SE/2 Diff	86	—	97	0.006	2	15	Ext	Serial, SPI	1	2.7, 5.25	2.7, 5.25	3.6	$7.45
ADS7805	16	100	SAR	1 SE	86	86	94	0.0045	1	16	Int/Ext	P8/P16	1	4.75, 5.25	4.75, 5.25	81.5	$25.00
ADS7809	16	100	SAR	1 SE	88	88	100	0.0045	1	16	Int/Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	81.5	$25.00
ADS8320	16	100	SAR	1 SE/1 Diff	84	92	86	0.012	2	15	Ext	Serial, SPI	1	2.7, 5.25	2.7, 5.25	1.95	$5.15
ADS8321	16	100	SAR	1 PDiff	84	87	86	0.012	2	15	Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	5.5	$5.15
ADS8325	16	100	SAR	1 SE/1 Diff	91	91	108	0.006	2	16	Ext	Serial, SPI	1	2.7, 5.25	2.7, 5.25	2.25	$5.90
DDC316	16	100	Delta-Sigma	16	—	—	—	0.0125	—	—	Ext	Serial	2	4.78, 5.25	2.7, 3.3	540	$48.25
AMC1210	16	90MHz Clock	Shunt	4 Dig Filters	—	—	—	—	—	—	—	Serial, P4	—	Digital Bit Stream	—	0.5MHz/ Ch	$1.55
ADS1174	16	52	Delta-Sigma	4	—	97	106	0.045	1	16	Ext	Serial, SPI w/FS	2	4.75, 5.25	2.5, 3.6	135	$9.95
ADS1178	16	52	Delta-Sigma	8	—	97	106	0.045	2	16	Ext	Serial, SPI w/FS	2	4.78, 5.25	2.5, 3.6	245	$15.95
ADS1204	16	40	Modulator[1]	4 SE/4 Diff	—	—	—	0.003	1	16	Int/Ext	Bit Stream	1	4.75, 5.25	4.75, 5.25	60	$6.75
ADS7825	16	40	SAR	4 SE	83	86	90	0.003	1	16	Int/Ext	Serial, SPI/P8	1	4.75, 5.25	4.75, 5.25	50	$29.55
ADS1205	16	40	Modulator[1]	2 SE/2 Diff	88.2	88.9	98	0.005	1	16	Int/Ext	Bit Stream	1	4.5, 5.5	2.7, 5.5	75	$3.95
ADS1208	16	40	Modulator[1]	1 SE/1 Diff	81.5	82	93	0.012	1	16	Int/Ext	Bit Stream	2	4.5, 5.5	2.7, 5.5	64	$2.95
ADS1202	16	40	Modulator[1]	1 SE/1 Diff	—	—	—	0.018	1	16	Int/Ext	Bit Stream	1	4.75, 5.25	4.75, 5.25	30	$2.50
ADS1203	16	40	Modulator[1]	1 SE/1 Diff	—	—	—	0.003	1	16	Int/Ext	Bit Stream	1	4.75, 5.25	4.75, 5.25	30	$2.70
ADS8507	16	40	SAR	1 SE	89.9	92	102	0.0022	1.5	16	Int/Ext	Serial, SPI/P8	1	4.75, 5.25	4.75, 5.25	28	$13.00
ADS7807	16	40	SAR	1 SE	88	88	100	0.0022	1.5	16	Int/Ext	Serial, SPI/P8	1	4.75, 5.25	4.75, 5.25	28	$32.30

[1] *The Data Rate is dependent on clock divided by Oversampling Ratio. *Suggested resale price in U.S. dollars in quantities of 1,000.*

ADC Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
ADS8513	16	40	SAR	1 SE	89.9	92	102	0.003	1	16	Int/Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	30	$12.00
ADS7813	16	40	SAR	1 SE	89	89	102	0.003	1	16	Int/Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	35	$24.70
AMC1203	16	12MHz Clock	Shunt	2 Diff	85	85	95	0.009	1	16	Int	Serial Isolated	2	4.78, 5.5	4.5, 5.5	80	$3.35
ADS1112	16	0.24	Delta-Sigma	3 SE/2 Diff	—	—	—	0.01	1	16	Int	Serial, I^2C	1	2.7, 5.5	2.7, 5.5	0.7	$2.65
ADS1110	16	0.24	Delta-Sigma	1 SE/1 Diff	—	—	—	0.01	1	16	Int	Serial, I^2C	1	2.7, 5.5	2.7, 5.5	0.7	$1.95
ADS1100	16	0.128	Delta-Sigma	1 SE/1 Diff	—	—	—	0.0125	1	16	Ext	Serial, I^2C	1	2.7, 5.5	2.7, 5.5	0.3	$1.80
ADS5474	14	400,000	Pipeline	1 Diff	68.2	70.2	86	0.005	0.7	14	Int/Ext	DDR LVDS	2	4.75, 5.25	3.0, 3.6	2500	$160.65
ADS6149	14	250,000	Pipeline	1 Diff	72.4	72.7	86	0.012	0.4	14	Int/Ext	DDR LVDS/CMOS, P8	2	3, 3.6	3.0, 3.6	687	$95.50
ADS61B49	14	250,000	Pipeline	1 Diff	71.8	72.4	86	0.012	.0.4	14	Int/Ext	DDR LVDS/CMOS, P8	2	3, 3.6	3.0, 3.6	780	$99.95
ADS6148	14	250,000	Pipeline	1 Diff	72.4	72.7	82	0.012	0.4	14	Int/Ext	DDR LVDS/CMOS, P8	2	3, 3.6	3.0, 3.6	687	$92.50
ADS5547	14	210,000	Pipeline	1 Diff	72.6	73.3	85	0.0625	0.5	14	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	1230	$82.50
ADS5546	14	190,000	Pipeline	1 Diff	72.8	73.2	84	0.018	0.5	14	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	1230	$72.50
ADS5545	14	170,000	Pipeline	1 Diff	73	73.5	85	0.018	0.5	14	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	1230	$62.50
ADS5500	14	125,000	Pipeline	1 Diff	70	70.5	82	0.03	0.75	14	Int	P14	1	3.0, 3.6	3.0, 3.6	780	$95.00
ADS5500-EP	14	125,000	Pipeline	1 Diff	70	70.5	82	0.03	+1.1	14	Int	P14	1	3.0, 3.6	3.0, 3.6	780	$190.00
ADS6145	14	125,000	Pipeline	1 Diff	72.7	74.1	84	0.03	0.6	14	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	417	$49.00
ADS6245	14	125,000	Pipeline	2 Diff	72.3	73.2	83	0.03	0.6	14	Int/Ext	Serial, LVDS	1	3.0, 3.6	3.0, 3.6	1000	$73.50
ADS62P45	14	125,000	Pipeline	2 Diff	73.2	73.8	85	0.046	0.8	14	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	792	$73.50
ADS6445	14	125,000	Pipeline	4 Diff	72.3	73.2	83	0.03	0.6	14	Int/Ext	Serial, LVDS	1	3.0, 3.6	3.0, 3.6	1000	$132.30
ADS5541	14	105,000	Pipeline	1 Diff	—	71	82	0.127	1	14	Int	P14	1	3.0, 3.6	3.3	710	$75.00
ADS5424	14	105,000	Pipeline	1 Diff	74	74	93	0.009	–0.95, 1.5	14	Int	P14	1	4.25, 5.25	3.0, 3.6	1900	$56.00
ADS6144	14	105,000	Pipeline	1 Diff	73.2	74	84	0.03	0.6	14	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	374	$41.00
ADS6244	14	105,000	Pipeline	2 Diff	72	73	81	0.03	0.6	14	Int/Ext	Serial, LVDS	1	3.0, 3.6	3.0, 3.6	1000	$61.50
ADS62P44	14	105,000	Pipeline	2 Diff	73.4	73.8	86	0.03	0.7	14	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	700	$61.50
ADS6444	14	105,000	Pipeline	4 Diff	72	73	81	0.03	0.6	14	Int/Ext	Serial, LVDS	1	3.0, 3.6	3.0, 3.6	1000	$110.70
ADS5542	14	80,000	Pipeline	1 Diff	—	72	85	—	—	14	Int	P14	1	3.0, 3.6	3.3	670	$30.00
ADS5423	14	80,000	Pipeline	1 Diff	74	74	94	0.009	–0.95, 1.5	14	Int	P14	1	4.75, 5.25	3.0, 3.6	1850	$40.00

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.***

ADC Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
ADS5433	14	80,000	Pipeline	1 Diff	74	74	—	0.009	–0.95, 1.5	14	Int	P14	1	4.75, 5.25	3, 3.6	1850	$48.00
ADS6143	14	80,000	Pipeline	1 Diff	74.3	74.4	89	0.02	0.5	14	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	318	$25.00
ADS6243	14	80,000	Pipeline	2 Diff	72	73.8	87.5	0.027	0.5	—	Int/Ext	Serial, LVDS	1	3.0, 3.6	3.0, 3.6	1000	$37.50
ADS62P43	14	80,000	Pipeline	2 Diff	73.6	74.3	88	0.012	0.5	14	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	587	$37.50
ADS6443	14	80,000	Pipeline	4 Diff	72	73.8	87.5	0.027	0.5	14	Int/Ext	Serial, LVDS	1	3.0, 3.6	3.0, 3.6	1000	$71.25
ADS6142	14	65,000	Pipeline	1 Diff	74.4	74.6	89	0.02	0.5	14	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	285	$18.65
ADS5553	14	65,000	Pipeline	2 Diff	73.4	74	84	0.015	0.6	14	Int	P14	1	3, 3.6	3, 3.6	890	$30.00
ADS6242	14	65,000	Pipeline	2 Diff	73.7	74	88	0.02	0.5	14	Int/Ext	Serial, LVDS	1	3.0, 3.6	3.0, 3.6	630	$35.00
ADS62P42	14	65,000	Pipeline	2 Diff	73.7	74.4	88	0.012	0.4	14	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	518	$35.00
ADS6442	14	65,000	Pipeline	2 Diff	73.7	74	88	0.02	0.5	14	Int/Et	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	1180	$61.50
ADS5422	14	62,000	Pipeline	1 Diff	72	72	85	—	1	14	Int/Ext	P14	2	4.75, 5.25	3, 5	1200	$30.45
ADS5421	14	40,000	Pipeline	1 Diff	75	75	83	—	1	14	Int/Ext	P14	2	4.75, 5.25	3, 5	900	$20.15
ADS850	14	10,000	Pipeline	1 SE/1 Diff	75	76	85	0.03	1	14	Int/Ext	P14	2	4.7, 5.3	2.7, 5.3	250	$16.80
THS1408	14	8,000	Pipeline	1 SE/1 Diff	70	72	80	0.03	1	—	Int/Ext	P14	1	3.0, 3.6	3.0, 3.6	270	$14.85
THS1408-EP	14	8,000	Pipeline	1 SE/1 Diff	70	72	80	0.03	1	—	Int/Ext	P14	1	3.0, 3.6	3.0, 3.6	270	$18.09
THS1403	14	3,000	Pipeline	1 SE/1 Diff	70	72	80	0.03	1	—	Int/Ext	P14	1	3.0, 3.6	3.0, 3.6	270	$11.05
THS14F03	14	3,000	Pipeline	1 SE/1 Diff	70	72	80	0.015	1	—	Int/Ext	P14	1	3.0, 3.6	3.0, 3.6	270	$12.60
THS1403-EP	14	3,000	Pipeline	1 SE/1 Diff	70	72	80	0.03	1	—	Int/Ext	P14	1	3.0, 3.6	3.0, 3.6	270	$25.39
ADS7891	14	3,000	SAR	1 SE	78	77.5	88	0.009	+1.5/–1	14	Int	P8/P14	2	4.75, 5.25	2.7, 5.25	85	$10.50
ADS7890	14	1,250	SAR	1 SE	77	77.5	100	0.009	+1.5/–1	14	Int	Serial, SPI	2	4.75, 5.25	2.7, 5.25	45	$10.50
THS1401	14	1,000	Pipeline	1 SE/1 Diff	70	72	80	0.03	1	—	Int/Ext	P14	1	3.0, 3.6	3.0, 3.6	270	$8.90
THS14F01	14	1,000	Pipeline	1 SE/1 Diff	70	72	105.3	0.015	1	—	Int/Ext	P14	1	3.0, 3.6	3.0, 3.6	270	$9.65
ADS7280	14	1,000	SAR	2 SE	85.7	81	105.3	0.0061	1	14	Ext	Serial, SPI	1 or 2	2.7, 5.5	1.65, 5.5	13.7	$4.50
ADS7279	14	1,000	SAR	1 SE	85.7	81	105.3	0.0061	1	14	Ext	Serial, SPI	1 or 2	2.7, 5.5	1.65, 5.5	13.7	$4.20
THS1401-EP	14	1,000	Pipeline	1 SE/1 Diff	70	72	80	0.03	1	—	Int/Ext	P14	1	3.0, 3.6	3.0, 3.6	270	$20.48
ADS8557	14	800	SAR	1 x 6 Diff	82	—	—	0.0061	1	14	Int/Ext	Serial, SPI/P14/P8	4	4.5, 5.5	2.7, 5.5	160	$12.00
TLC3548	14	200	SAR	8 SE	81	81	97	0.006	1	14	Int/Ext	Serial, SPI	2	4.5, 5.5	2.7, 5.5	20	$6.40
TLC3578	14	200	SAR	8 SE	79	80	83	0.006	1	14	Ext	Serial, SPI	2	4.5, 5.5	2.7, 5.5	29	$8.65
TLC3544	14	200	SAR	4 SE	81	81	97	0.006	1	14	Int/Ext	Serial, SPI	2	4.5, 5.5	2.7, 5.5	20	$6.00
TLC3574	14	200	SAR	4 SE	79	80	84	0.006	1	14	Ext	Serial, SPI	2	4.5, 5.5	2.7, 5.5	29	$6.85

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.** Preview products are listed in **bold blue***

ADC Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
TLC3541	14	200	SAR	1 SE	81.5	82	95	0.006	1	14	Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	17.5	$5.00
TLC3545	14	200	SAR	1 Diff	81.5	82	95	0.006	1	14	Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	17.5	$5.00
ADS5546	14	190	Pipeline	1 Diff	72.5	73.2	84	—	0.5	14	Int/Ext	P14, LVDS	2	3.0, 3.6	3.0, 3.6	1130	$72.50
ADS5545	14	170	Pipeline	1 Diff	73	73.5	85	—	0.5	14	Int/Ext	P14, LVDS	2	3.0, 3.6	3.0, 3.6	1100	$62.50
ADS8324	14	50	SAR	1 Diff	78	78	85	0.012	2	14	Ext	Serial, SPI	1	1.8, 3.6	1.8, 3.6	2.5	$4.15
ADS7871	14	48	MUX SAR, PGA	8 SE/4 Diff	—	—	—	0.03	0.5	13	Int	Serial, SPI	1	2.7, 5.25	2.7, 5.25	6	$5.00
ADS5444	13	250,000	Pipeline	1 SE/1 Diff	66.2	68.7	71	—	—	13	Int	LVDS	2	4.75, 5.25	3.0, 3.6	2100	$95.00
ADS5440	13	210,000	Pipeline	1 SE/1 Diff	68	69	76	0.026	1	13	Int	LVDS	2	4.75, 5.25	3.0, 3.6	2100	$65.00
ADS54RF63	12	550,000	Pipeline	1 Diff	61.3	62.6	76	0.061	0.95	12	Int/Ext	DDR LVDS, P12	2	4.75, 5.25	3.0, 3.6	2250	$174.95
ADS5463	12	500,000	Pipeline	1 Diff	64.1	65.2	84	0.03	1	12	Int/Ext	DDR LVDS, P12	2	4.75, 5.25	3.0, 3.6	2200	$125.00
ADS6129	12	250,000	Pipeline	1 Diff	70.4	70.5	86	0.024	0.2	12	Int/Ext	DDR LVDS/CMOS, P6	2	3.0, 3.6	1.7, 1.9	687	$59.00
ADS6128	12	210,000	Pipeline	1 Diff	70.4	70.5	82	0.024	0.2	12	Int/Ext	DDR LVDS/CMOS, P6	2	3.0, 3.6	1.7, 1.9	628	$45.00
ADS5527	12	210,000	Pipeline	1 Diff	70.2	69	81	—	0.5	12	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	1100	$45.00
ADS5525	12	170,000	Pipeline	1 Diff	69.8	70.5	84	0.072	0.5	12	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	1100	$35.00
ADS5520	12	125,000	Pipeline	1 Diff	69.9	69	82	—	0.25	12	Int	P12	1	3.0, 3.6	3.0, 3.6	740	$33.90
ADS6125	12	125,000	Pipeline	1 Diff	70.6	71.3	84	0.043	0.6	12	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	471	$27.50
ADS6225	12	125,000	Pipeline	2 Diff	70	70.3	83	0.043	2.5	12	Int/Ext	Serial, LVDS	1	3.0, 3.6	3.0, 3.6	1000	$41.25
ADS62P25	12	125,000	Pipeline	2 diff	70.2	70.8	85	0.0625	0.8	12	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	792	$41.25
ADS6425	12	125,000	Pipeline	4 Diff	70	70.3	83	0.043	2.5	12	Int/Ext	Serial, LVDS	1	3.0, 3.6	3.0, 3.6	1650	$74.25
ADS5521	12	105,000	Pipeline	1 Diff	70	69	85	—	0.25	12	Int	P12	1	3.0, 3.6	3.0, 3.6	700	$29.90
ADS6124	12	105,000	Pipeline	1 Diff	70.6	71.3	84	0.027	0.5	12	Int	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	374	$23.00
ADS6224	12	105,000	Pipeline	2 Diff	70	70.6	81	0.122	0.5	12	Int/Ext	Serial/LVDS	1	3.0, 3.6	3.0, 3.6	900	$34.50
ADS62P24	12	105,000	Pipeline	2 Diff	70.2	71	86	0.043	0.8	12	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	792	$41.25
ADS6424	12	105,000	Pipeline	4 Diff	70	70.6	81	0.122	0.5	12	Int/Ext	Serial/LVDS	1	3.0, 3.6	3.0, 3.6	1350	$62.10
ADS5410	12	80,000	Pipeline	1SE/1 Diff	66	65	76	0.048	1	14	Int/Ext	P12	2	3.0, 3.6	1.6, 2	360	$19.00
ADS809	12	80,000	Pipeline	1 SE/1 Diff	64	63	67	0.144	1.7	12	Int/Ext	P12	2	4.75, 5.25	3, 5	905	$24.95
ADS6123	12	80,000	Pipeline	1 Diff	71.3	71.5	89	0.027	0.5	12	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	317	$16.70
ADS61B23	12	80,000	Pipeline	1 Diff	69.7	70	82	0.027	0.5	12	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	351	$19.50
ADS6223	12	80,000	Pipeline	2 Diff	70.9	70.9	87	0.11	2	12	Int/Ext	Serial/LVDS	1	3.0, 3.6	3.0, 3.6	760	$25.05

*Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red.** Preview products are listed in **bold blue***

ADC Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
ADS62P23	12	80,000	Pipeline	2 Diff	70.8	71.2	88	0.122	2.5	12	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	587	$25.05
ADS6423	12	80,000	Pipeline	4 Diff	70.9	70.9	87	0.11	2	12	Int/Ext	Serial/LVDS	1	3.0, 3.6	3.0, 3.6	1180	$47.60
ADS5522	12	80,000	Piepline	1 Diff	69.9	70	82	—	0.25	12	Int	P12	1	3.0, 3.6	3.0, 3.6	660	$16.70
ADS5273	12	70,000	Pipeline	8 Diff	70.8	71	90	0.072	+1.2/ –0.99	12	Int/Ext	LVDS	1	3.0, 3.6	3.3	1003	$121.00
ADS808	12	70,000	Pipeline	1 SE/1 Diff	64	64	68	0.168	1.7	12	Int/Ext	P12	2	4.75, 5.25	3.0, 5.0	720	$19.50
ADS5221	12	65,000	Pipeline	1 SE/1 Diff	69	70	90	0.036	1	12	Int/Ext	P12	1	3.0, 3.6	2.5, 3.3	285	$13.95
ADS6122	12	65,000	Pipeline	1 Diff	71.5	71.6	89	0.027	0.5	12	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	318	$12.00
ADS5232	12	65,000	Pipeline	2 Diff	69	69.5	85	0.06	0.9	12	Int/Ext	P12	1	3.0, 3.6	3.0, 3.6	340	$18.15
ADS6222	12	65,000	Pipeline	2 Diff	71	71.2	89	0.0277	0.4	12	Int/Ext	Serial/LVDS	1	3.0, 3.6	3.0, 3.6	760	$18.10
ADS62P22	12	65,000	Pipeline	2 Diff	70.8	71.3	88	0.015	0.4	12	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	518	$18.10
ADS5242	12	65,000	Pipeline	4 Diff	70.8	71	85	0.06	+1/ –0.95	12	Int/Ext	LVDS	1	3.0, 3.6	3.3	660	$36.00
ADS6422	12	65,000	Pipeline	4 Diff	71	71.2	88	0.027	0.4	12	Int/Ext	Serial/LVDS	1	3.0, 3.6	3.0, 3.6	1180	$36.85
ADS5282	12	65,000	Pipeline	8 Diff	69.7	70	85	0.015	0.3	12	Int/Ext	Serial/LVDS	2	3.0, 3.6	1.65, 2.0	616	$54.85
ADS5272	12	65,000	Pipeline	8 Diff	71	71.1	89	0.06	+1/ –0.95	12	Int/Ext	LVDS	1	3.0, 3.6	3.3	984	$54.85
ADS5413	12	65,000	Pipeline	1 Diff	67.6	68.5	77.5	0.048	1	12	Int/Ext	P12	1	3.0, 3.6	3.3	400	$15.50
ADS807	12	53,000	Pipeline	1 SE/1 Diff	69	69	82	0.096	1	12	Int/Ext	P12	2	4.75, 5.25	3.0, 5.0	335	$11.30
ADS2807	12	50,000	Pipeline	2 SE/2 Diff	68	65	70	0.12	1	12	Int/Ext	P12	2	4.75, 5.25	3.0, 5.0	720	$18.05
ADS5281	12	50,000	Pipeline	8 Diff	69.7	70	85	0.015	0.3	12	Int/Ext	Serial/LVDS	2	3.0, 3.6	1.65, 2.0	510	$48.00
ADS5240	12	40,000	Pipeline	4 Diff	70	70.5	85	0.048	0.9	12	Int/Ext	LVDS	1	3.0, 3.6	3.3	584	$25.00
ADS5231	12	40,000	Pipeline	2 Diff	70	70.7	86	0.048	0.9	12	Int/Ext	Dual P12	1	3.0, 3.6	3.3	285	$11.75
ADS5220	12	40,000	Pipeline	1 SE/1 Diff	69	70	90	0.036	1	12	Int/Ext	P12	1	3.0, 3.6	2.5, 3.3	195	$9.85
ADS800	12	40,000	Pipeline	1 SE/1 Diff	64	62	61	—	1	12	Int/Ext	P12	1	4.75, 5.25	4.75, 5.25	390	$30.85
ADS2806	12	32,000	Pipeline	2 SE/2 Diff	69	66	73	0.096	1	12	Int/Ext	P12	2	4.75, 5.25	3.0, 5.0	430	$14.10
THS1230	12	30,000	Pipeline	1 SE/1 Diff	67.4	67.7	74.6	0.06	1	12	Int/Ext	P12	1	3.0, 3.6	3.0, 3.6	168	$10.50
ADS801	12	25,000	Pipeline	1 SE/1 Diff	66	64	61	—	1	12	Int/Ext	P12	1	4.75, 5.25	4.75, 5.25	270	$12.55
ADS805	12	20,000	Pipeline	1 SE/1 Diff	66	68	74	0.048	0.75	12	Int/Ext	P12	2	4.75, 5.25	3.0, 5.0	300	$9.90
THS1215	12	15,000	Pipeline	1 SE/1 Diff	68.6	68.9	81.7	0.036	0.9	12	Int/Ext	P12	1	3.0, 3.6	3.0, 3.6	148	$9.85
ADS804	12	10,000	Pipeline	1 SE/1 Diff	68	69	80	0.048	0.75	12	Int/Ext	P12	2	4.7, 5.3	3.0, 5.0	180	$9.20
ADS802	12	10,000	Pipeline	1 SE/1 Diff	66	66	66	0.066	1	12	Int/Ext	P12	1	4.75, 5.25	4.75, 5.25	260	$12.60
THS12082	12	8,000	Pipeline	2 SE/1 Diff	65	69	71	0.036	1	12	Int/Ext	P12	2	4.75, 5.25	3, 5.25	186	$8.40

Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red.** Preview products are listed in **bold blue***

ADC Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
THS1209	12	8,000	Pipeline	2 SE/1 Diff	65	69	71	0.036	1	12	Int/Ext	P12	2	4.75, 5.25	4.75, 5.25	186	$7.90
THS1206	12	6,000	Pipeline	4 SE/2 Diff	65	69	71	0.043	1	12	Int/Ext	P12	2	4.75, 5.25	3.0, 5.25	186	$7.80
THS1207	12	6,000	Pipeline	4 SE/2 Diff	64	69	71	0.036	1	12	Int/Ext	P12	2	4.75, 5.25	4.75, 5.25	186	$7.25
THS1206-EP	12	6,000	Pipeline	4 SE/2 Diff	65	69	71	0.043	1	12	Int/Ext	P12	2	4.75, 5.25	3,5.25	186	$17.61
ADS803	12	5,000	Pipeline	1 SE/1 Diff	68	69	82	0.018	2	12	Int/Ext	P12	2	4.7, 5.3	4.7, 5.3	115	$7.03
ADS7881	12	4,000	SAR	1 SE	71.5	71.5	90	0.024	1	12	Int	P8/P12	2	4.75, 5.25	2.7, 5.25	95	$7.35
ADS7883	12	3,000	SAR	1 SE	72	—	86	0.03	0.5	12	Ext	Serial, SPI	1	2.7, 5.5	—	15	$2.80
ADS7863	12	2,000	SAR	2 x 2 Diff	70	71.5	84	0.024	1	12	Int/Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	35.5	$4.90
ADS7865	12	2,000	SAR	2 x 2 Diff	71.3	71	88	0.003	1	12	Int/Ext	P12	2	2.7, 5.5	2.7, 5.5	30	$4.70
ADS7869	12	1,000	SAR	12 Diff	70	71	—	0.048	0.65	11	Int/Ext	Serial, SPI, P12	2	4.5, 5.5	2.7, 5.5	175	$14.60
ADS7886	12	1,000	SAR	1 SE	71.2	71.5	85.5	0.03	1	12	Ext	Serial, SPI	1	2.5, 5.75	2.5, 5.75	7.5	$1.70
ADS7230	12	1,000	SAR	2 SE	73.7	73.9	93.4	0.0122	0.5	12	Ext	Serial, SPI	1 or 2	2.7, 5.5	1.65, 5.5	13.7	$2.50
ADS7229	12	1,000	SAR	1 SE	73.7	73.9	93.4	0.0122	0.5	12	Ext	Serial, SPI	1 or 2	2.7, 5.5	1.65, 5.5	13.7	$2.30
ADS7953	12	1,000	SAR	16 SE	71.3	71.7	84	0.0244	1	12	Ext	Serial, SPI	2	2.7, 5.25	1.7, 5.25	12.5	$4.90
ADS7952	12	1,000	SAR	12 SE	71.3	71.7	84	0.0244	1	12	Ext	Serial, SPI	2	2.7, 5.25	1.7, 5.25	12.5	$4.10
ADS7951	12	1,000	SAR	8 SE	71.3	71.7	84	0.0244	1	12	Ext	Serial, SPI	2	2.7, 5.25	1.7, 5.25	12.5	$3.30
ADS7950	12	1,000	SAR	459	71.3	71.7	84	0.0244	1	12	Ext	Serial, SPI	2	2.7, 5.25	1.7, 5.25	12.5	$2.50
ADS804	12	10,000	Pipeline	1 SE/1 Diff	68	69	80	0.048	0.75	12	Int/Ext	P12	2	4.7, 5.3	3.0, 5.0	180	$9.20
ADS802	12	10,000	Pipeline	1 SE/1 Diff	66	66	66	0.066	1	12	Int/Ext	P12	1	4.75, 5.25	4.75, 5.25	260	$12.60
ADS8558	12	800	SAR	1 x 6 Diff	72	—	—	0.0121	1	12	—	—	4	4.5, 5.5	2.7, 5.5	160	$12.00
ADS7810	12	800	SAR	1 SE	71	71	82	0.018	1	12	Int/Ext	P12	2	4.75, 5.25	4.75, 5.25	225	$27.80
ADS7852	12	500	SAR	8 SE	70	72	74	0.024	1	12	Int/Ext	P12	1	4.75, 5.25	4.75, 5.25	13	$3.40
ADS7864	12	500	SAR	3 x 2 Diff	71	71	78	0.024	1	12	Int/Ext	P12	1	4.75, 5.25	4.75, 5.25	52.5	$6.65
ADS7861	12	500	SAR	2 x 2 Diff	70	71	72	0.024	1	12	Int/Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	25	$4.05
ADS7862	12	500	SAR	2 x 2 Diff	71	71	78	0.024	1	12	Int/Ext	P12	1	4.75, 5.25	4.75, 5.25	25	$5.70
ADS7818	12	500	SAR	1 PDiff	70	72	78	0.024	1	12	Int	Serial, SPI	1	4.75, 5.25	4.75, 5.25	11	$2.50
ADS7834	12	500	SAR	1 PDiff	70	72	78	0.024	1	12	Int	Serial, SPI	1	4.75, 5.25	4.75, 5.25	11	$2.45
ADS7835	12	500	SAR	1 SE	72	72	78	0.024	1	12	Int	Serial, SPI	1	4.75, 5.25	4.75, 5.25	17.5	$2.75
TLC2558	12	400	SAR	8 SE	71	—	84	0.024	1	12	Int/Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	9.5	$5.30
TLC2554	12	400	SAR	4 SE	71	—	84	0.024	1	12	Int/Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	9.5	$5.30
TLC2552	12	400	SAR	2 SE	72	—	84	0.024	1	12	Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	15	$3.95
TLC2551	12	400	SAR	1 SE	72	—	84	0.024	1	12	Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	15	$3.95
TLC2555	12	400	SAR	1 Diff	72	—	84	0.024	1	12	Int	Serial, SPI	1	4.5, 5.5	4.5, 5.5	15	$3.95

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.** Preview products are listed in **bold blue***

ADC Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
ADS7800	12	333	SAR	1 SE	72	71	77	0.012	0.75	12	Int	P8/P12	3	4.75, 5.25	4.75, 5.25	135	$30.50
ADS8504	12	250	SAR	1 SE	72	70	80	0.011	0.45	12	Int/Ext	P8/P12	1	4.75, 5.25	4.75, 5.25	70	$10.50
ADS8508	12	250	SAR	1 SE	73	73	90	0.011	0.45	12	Int/Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	70	$10.50
ADS7866	12	200	SAR	1 SE, 1 PDiff	70	71	85	0.024	±1.5/–1	12	Ext	Serial, SPI	1	1.2, 3.6	1.2, 3.6	0.25	$1.85
ADS7844	12	200	SAR	8 SE/4 Diff	72	72	78	0.024	1	12	Ext	Serial, SPI	1	2.7, 5.25	2.7, 5.25	0.84	$2.90
TLC2578	12	200	SAR	8 SE	79	80	84	0.024	0.5	12	Ext	Serial, SPI	2	4.75, 5.5	2.7, 5.5	29	$5.80
TLV2548	12	200	SAR	8 SE	70	—	84	0.024	1	12	Int/Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	3.3	$4.85
TLV2548M	12	200	SAR	8 SE	71	—	75	0.029	1	12	Int/Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	3.3	$151.89
TLV2545	12	200	SAR	1 PDiff	72	—	84	0.024	1	12	Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	2.8	$3.85
TLV2541	12	200	SAR	1 SE	72	—	84	0.024	1	12	Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	2.8	$3.85
ADS7841	12	200	SAR	4 SE/2 Diff	72	72	79	0.024	1	12	Ext	Serial, SPI	1	2.7, 5.25	2.7, 5.25	0.84	$2.50
ADS7842	12	200	SAR	4 SE	72	72	79	0.024	1	12	Ext	P12	1	2.7, 5.25	2.7, 5.25	0.84	$3.10
ADS7822	12	200	SAR	1 PDiff	71	—	86	0.018	0.75	12	Ex	Serial, SPI	1	2.7, 5.25	2.7, 5.25	0.6	$1.55
ADS7816	12	200	SAR	1 PDiff	72	—	86	0.024	0.75	12	Ext	Serial, SPI	1	4.5, 5.25	4.75, 5.25	1.9	$1.95
ADS7817	12	200	SAR	1	71	—	86	0.0121	1	12	Ext	Seial, SPI	1	4.75, 5.25	4.75, 5.5	2.3	$1.95
TLC2574	12	200	SAR	4 SE	79	80	84	0.024	0.5	12	Ext	Serial, SPI	2	4.75, 5.5	2.7, 5.5	29	$5.30
TLV2544	12	200	SAR	4 SE	70	—	84	0.024	1	12	Int/Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	3.3	$4.20
TLV2542	12	200	SAR	2 SE	72	—	84	0.024	1	12	Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	2.8	$3.85
AMC7823	12	200	SAR, DAS	1x8 SE I/O DAS	74	74	—	0.024	1	12	Int/Ext	Serial, SPI	2	2.7, 5.5	2.7, 5.5	100	$9.75
ADS7829	12	125	SAR	1 PDiff	71	72	86	0.018	0.75	12	Ext	Serial, SPI	1	2.0, 5.5	2.7, 5.25	0.6	$1.50
AMC7820	12	100	SAR, DAS	—	—	—	—	—	—	—	Int/Ext	Serial, SPI	—	5.0, 5.0	5.0, 10.0	—	$4.05
TLV2543	12	66	SAR	11 SE	—	—	—	—	1	12	Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	5	$4.45
ADS7823	12	50	SAR	1 SE	71	72	86	0.024	1	12	Ext	Serial, I²C	1	2.7, 5.25	2.7, 5.25	0.75	$2.85
ADS7828	12	50	SAR	8 SE/4 Diff	71	72	86	0.024	1	12	Ext	Serial, I²C	1	2.7, 5.25	2.7. 5.25	0.675	$3.35
ADS7870	12	50	SAR	8 SE	72	—	—	0.06	0.5	12	Int	Serial, SPI	1	2.7, 5.25	2.7. 5.25	4.6	$4.15
ADS8512	12	40	SAR	1 SE	74	74	98	0.011	0.5	12	Int/Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	24	$7.00
ADS8506	12	40	SAR	1 SE	73	74	98	0.011	0.45	12	Int/Ext	Serial, SPI/P8	1	4.75, 5.25	4.75, 5.25	24	$7.00
ADS7824	12	40	SAR	4 SE	73	73	90	0.012	0.5	12	Int/Ext	Serial, SPI/P8	1	4.75, 5.25	4.75, 5.25	50	$13.10
ADS7806	12	40	SAR	1 SE	73	73	90	0.011	0.45	12	Int/Ext	Serial, SPI/P8	1	4.75, 5.25	4.75, 5.25	28	$15.05
ADS7812	12	40	SAR	1 SE	74	74	98	0.012	0.5	12	Int/Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	35	$11.80
ADS1286	12	37	SAR	1 PDiff	72	—	90	0.024	0.75	12	Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	1	$2.80
ADS1000	12	0.128	Delta-Sigma	1 SE/1 Diff	—	—	—	0.001	1	12	Ext	Serial, I²C	1	4.75, 5.25	4.75, 5.25	0.3	$0.99
ADS5517	11	200,000	Pipeline	1 Diff	66	66.9	84	0.018	0.3	11	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	1230	$32.95

*Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red.***

ADC Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
ADS5510	11	125,000	Pipeline	1 Diff	66.3	66.8	83	0.24	1.1	11	Ext	P11	1	3.0, 3.6	3.0, 3.6	780	$14.20
ADS62C15	11	125,000	Pipeline	2 Diff	66.9	67	82	0.1	0.4	11	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	740	$41.25
ADS62P15	11	125,000	Pipeline	2 Diff	66.9	67.1	85	0.1	0.4	11	Int/Ext	DDR LVDS/CMOS, P8	1	3.0, 3.6	3.0, 3.6	740	$18.00
ADS5411	11	105,000	Pipeline	1 Diff	66.3	66.4	90	0.012	0.5	11	Ext	P11	1	4.75, 5.25	4.75, 5.25	1900	$25.50
ADS5413-11	11	65,000	Pipeline	1 Diff	65	65	77	0.048	0.75	11	Int/Ext	Serial	2	3.0, 3.6	1.6, 2.0	400	$14.75
ADS828	10	75,000	Pipeline	1 SE/1 Diff	57	57	68	0.29	1	10	Int/Ext	P10	2	4.75, 5.25	3.0,5.0	340	$8.70
ADS5287	10	65,000	Pipeline	8 Diff	61.3	61.7	85	1	0.1	10	Int/Ext	Serial/LVDS	2	3.0, 3.6	1.65, 2.0	616	$32.00
ADS5277	10	65,000	Pipeline	8 Diff	61.7	61.7	80	0.2	0.9	10	Int/Ext	Serial/LVDS	1	3.0, 3.6	3.3	911	$40.00
ADS5237	10	65,000	Pipeline	2 Diff	61.6	61.7	85	0.1	0.1	10	Int/Ext	P10	1	3.0, 3.6	3.0, 3.6	330	$7.50
ADS5122	10	65,000	Pipeline	8 Diff	58	59	72	0.24	1	10	Int/Ext	P10	2	1.65, 2.0	1.65, 3.6	733	$42.85
ADS5102	10	65,000	Pipeline	1 Diff	58	57	71	0.24	1	10	Int/Ext	P10	1	1.65, 2.0	1.65, 2.0	160	$7.10
ADS826/823	10	60,000	Pipeline	1 SE/1 Diff	58	59/60	73	0.24	1	10	Int/Ext	P10	2	4.75, 5.25	3.0, 5.0	295	$8.40
ADS5121	10	40,000	Pipeline	8 Diff	59	60	74	0.15	1	10	Int/Ext	P10	2	1.65, 2.0	1.65, 3.6	500	$38.85
ADS5120	10	40,000	Pipeline	8 Diff	57	58	72	0.15	1	10	Int/Ext	P10	1	1.65, 2.0	1.65, 2.0	794	$36.15
ADS5204	10	40,000	Pipeline	2 SE/2 Diff, PGA	60	60.5	73	0.15	1	10	Int/Ext	P10	1	3.0, 3.6	3.0, 3.6	275	$11.05
ADS5203	10	40,000	Pipeline	2 SE/2 Diff	60	60.5	73	0.15	1	10	Int/Ext	P10	1	3.0, 3.6	3.0, 3.6	240	$9.65
ADS822/825	10	40,000	Pipeline	1 SE/1 Diff	59	60	65	0.24	1	10	Int/Ext	P10	2	4.75, 5.25	3.0, 5.0	200	$5.25
ADS821	10	40,000	Pipeline	1 SE/1 Diff	58	58	62	0.24	1	10	Int/Ext	P10	1	4.75, 5.25	4.75, 5.25	390	$13.05
THS1040	10	40,000	Pipeline	1 SE/1 Diff	60	57	70	0.15	0.9	10	Int/Ext	P10	2	3.0, 3.6	3.0, 3.6	100	$5.10
THS1041	10	40,000	Pipeline	1 SE/1 Diff	60	57	70	0.15	1	10	Int/Ext	P10	2	3.0, 3.6	3.0, 3.6	103	$5.45
ADS5103	10	40,000	Pipeline	1 Diff	58	58	66	0.15	0.8	10	Int/Ext	P10	1	1.65, 2.0	1.65, 2.0	105	$5.25
THS1030	10	30,000	Pipeline	1 SE/1 Diff	48.6	49.4	53	0.24	1	10	Int/Ext	P10	2	3.0, 5.5	3.0, 5.5	150	$3.75
THS1031	10	30,000	Pipeline	1 SE/1 Diff	56	49.3	52.4	0.24	1	10	Int/Ext	P10	2	3.0, 5.5	3.0, 5.5	160	$4.10
ADS820	10	20,000	Pipeline	1 SE/1 Diff	60	60	62	0.24	1	10	Int/Ext	P10	1	4.75, 5.25	4.75, 5.25	200	$6.75
ADS900	10	20,000	Pipeline	1 SE/1 Diff	48	49	53	—	1	10	Int	P10	1	2.7, 3.7	3.0, 3.0	49	$3.55
ADS901	10	20,000	Pipeline	1 SE/1 Diff	50	53	49	—	1	10	Ext	P10	1	2.7, 3.7	3.0, 3.0	54	$3.40
THS10082	10	8,000	Pipeline	2 SE/1 Diff	59	61	65	0.1	1	10	Int/Ext	P10	2	4.75, 5.25	3.0, 5.25	186	$3.70
THS1009	10	8,000	Pipeline	2 SE/1 Diff	59	61	65	0.1	1	10	Int/Ext	P10	2	4.75, 5.25	4.75, 5.25	186	$3.20
THS10064	10	6,000	Pipeline	4 SE/2 Diff	59	61	65	0.1	1	10	Int/Ext	P10	2	4.75, 5.25	3.0, 5.25	186	$4.15
THS1007	10	6,000	Pipeline	4 SE/2 Diff	59	61	65	0.1	1	10	Int/Ext	P10	2	4.75, 5.25	4.75, 5.25	186	$3.70
ADS7884	10	3,000	SAR	1 SE	61.7	61.8	81	0.781	0.8	10	Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	15	$1.60
TLV1562	10	2,000	Pipeline	4 SE/2 Diff	58	58	70.3	0.15	1.5	10	Int/Ext	P10	2	2.7, 5.5	2.7, 5.5	15	$4.15

*Suggested resale price in U.S. dollars in quantities of 1,000.

New products are listed in ***bold red.***

ADC Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
TLV1570	10	1,250	SAR	8 SE	60	61	63	0.1	1	10	Int/Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	9	$3.80
TLV1578	10	1,250	SAR	8 SE	60	60	63	0.1	1	10	Ext	P10	1	2.7, 5.5	2.7, 5.5	12	$3.85
TLV1571	10	1,250	SAR	1 SE	60	60	63	0.1	1	10	Ext	P10	1	2.7, 5.5	2.7, 5.5	12	$3.70
TLV1572	10	1,250	SAR	1 SE	60	—	62	0.1	1	10	Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	8.1	$3.30
ADS7887	10	1,250	SAR	1 SE	61	60	—	0.05	1	10	Ext	Serial, SPI	1	2.5, 5.25	2.5, 5.25	8	$1.50
ADS7957	10	1,000	SAR	16 SE	60	60	82	0.0488	0.5	10	Ext	Serial, SPI	2	2.75, 5.25	1.7, 5.25	5.4	$3.90
ADS7956	10	1,000	SAR	12 SE	60	60	82	0.0488	0.5	10	Ext	Serial, SPI	2	2.75, 5.25	1.7, 5.25	5.4	$3.30
ADS7955	10	1,000	SAR	8 SE	60	60	82	0.0488	0.5	10	Ext	Serial, SPI	2	2.75, 5.25	1.7, 5.25	5.4	$2.70
ADS7954	10	1,000	SAR	4 SE	60	60	82	0.0488	0.5	10	Ext	Serial, SPI	2	2.75, 5.25	1.7, 5.25	5.4	$2.10
TLC1518	10	400	SAR	8 SE/7 Diff	60	—	82	0.012	0.5	10	Int/Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	10	$3.45
TLC1514	10	400	SAR	4 SE/3 Diff	60	—	82	0.012	0.5	10	Int/Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	10	$2.90
TLV1508	10	200	SAR	8 SE	60	—	83	0.05	0.5	10	Int/Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	3.3	$3.15
TLV1504	10	200	SAR	4 SE	60	—	83	0.05	0.05	10	Int/Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	3.3	$2.65
ADS7867	10	200	SAR	1 SE	61	60	—	0.05	±1	10	Ext	Serial, SPI	1	1.2, 3.6	1.2, 3.6	0.25	$1.40
ADS7826	10	200	SAR	1 Diff	62	—	—	0.0048	1	10	Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	0.6	$1.25
TLC1550	10	164	SAR	1 SE	—	—	—	0.05	0.05	10	Ext	P10	1	4.75, 5.5	4.75, 5.5	10	$3.90
TLC1551	10	164	SAR	1 SE	—	—	—	0.1	1	10	Ext	P10	1	4.75, 5.5	4.75, 5.5	10	$3.35
TLV1548	10	85	SAR	8 SE	—	—	—	0.1	1	10	Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	1.05	$2.30
TLV1548-EP	10	85	SAR	8 SE	—	—	—	0.1	1	10	Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	1.05	$4.36
TLV1544	10	85	SAR	4 SE	—	—	—	0.1	1	10	Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	1.05	$1.95
TLC1542	10	38	SAR	11 SE	—	—	—	0.05	0.05	10	Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	4	$2.50
TLC1543	10	38	SAR	11 SE	—	—	—	0.1	1	10	Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	4	$1.90
TLC1543-EP	10	38	SAR	11 SE	—	—	—	0.1	1	10	Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	4	$3.89
TLC1549	10	38	SAR	1 SE	—	—	—	0.1	1	10	Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	4	$1.71
TLC1541	10	32	SAR	11 SE	—	—	—	0.1	1	10	Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	6	$3.20
ADS831	8	80,000	Pipeline	1 SE/1 Diff	49	49	65	0.78	1	8	Int/Ext	P8	2	4.75, 5.25	3.0, 5.0	310	$3.15
ADS830	8	60,000	Pipeline	1 SE/1 Diff	48	49.5	65	0.58	1	8	Int/Ext	P8	2	4.75, 5.25	3.0, 5.0	215	$2.75
THS0842	8	40,000	Pipeline	2 SE/2 Diff	—	42.7	52	0.86	2	8	Int/Ext	P8	1	3.0, 3.6	3.0, 3.6	320	$5.05
TLC5540	8	40,000	Flash	1 SE	—	44	42	0.39	1	—	Int/Ext	P8	1	4.75, 5.25	4.75, 5.25	85	$2.40
TLV5535	8	35,000	Pipeline	1 SE	46	46.5	58	0.94	1.3	—	Int/Ext	P8	1	3.0, 3.6	3.0, 3.6	106	$2.40
ADS931	8	30,000	Pipeline	1 SE/1 Diff	45	48	49	0.98	1	8	Ext	P8	2	2.7, 5.25	3.0, 5.0	154	$2.20
ADS930	8	30,000	Pipeline	1 SE/1 Diff	45	46	50	0.98	1	8	Int	P8	2	2.7, 5.25	3.0, 5.0	168	$2.30
TLC5510	8	20,000	Pipeline	1 SE	—	46	42	0.39	0.75	—	Ext	P8	1	4.75, 5.25	4.75, 5.25	127.5	$2.35

*Suggested resale price in U.S. dollars in quantities of 1,000.

New products are listed in **bold red.**

ADC Selection Guide (continued)

Device	Res. (Bits)	Sample Rate (kSPS)	Architecture	No. of Input Channels	SINAD (dB)	SNR (dB)	SFDR (dB)	INL (%)	DNL (±LSB)	NMC	V_{REF}	Interface	No. of Supplies	Analog Supply	Logic Supply	Power (mW)	Price*
TLC5510A	8	20,000	Pipeline	1 SE	—	46	42	0.39	0.75	—	Ext	P8	1	4.75, 5.25	4.75, 5.25	150	$2.35
ADS7885	8	3,000	SAR	1 SE	49.8	—	74	0.0391	0.4	8	Ext	Serial, SPI	1	2.7, 5.25	2.7, 5.5	15	$0.95
TLV571	8	1,250	SAR	1 SE	49	49	51	0.5	0.5	8	Ext	P8	2	2.7, 5.25	2.7, 5.25	12	$2.35
ADS7888	8	1,250	SAR	1 SE	49.5	—	65	0.3	0.3	8	Ext	Serial, SPI	1	2.5, 5.25	2.5, 5.25	8	$0.85
ADS7961	8	1,000	SAR	16 SE	49	49	78	0.1172	0.3	8	Ext	Serial, SPI	2	2.7, 5.25	1.7, 5.25	5.4	$2.45
ADS7960	8	1,000	SAR	12 SE	49	49	78	0.1172	0.3	8	Ext	Serial, SPI	2	2.7, 5.25	1.7, 5.25	5.4	$2.05
ADS7959	8	1,000	SAR	8 SE	49	49	78	0.1172	0.3	8	Ext	Serial, SPI	2	2.7, 5.25	1.7, 5.25	5.4	$1.65
ADS7958	8	1,000	SAR	4 SE	49	49	78	0.1172	0.3	8	Ext	Serial, SPI	2	2.7, 5.25	1.7, 5.25	5.4	$1.25
TLC0820A	8	392	SAR	1 SE	—	—	—	0.2	0.5	8	Ext	P8	1	4.5, 8.0	4.5, 8	37.5	$1.90
ADS7827	8	250	SAR	1 Diff	48	—	—	0.2	1	8	Ext	Serial, SPI	1	2.7, 5.5	2.7, 5.5	0.6	$1.00
ADS7868	8	200	SAR	1 SE/1PDiff	50	49	66	0.5	0.5	8	Ext	Serial, SPI	1	1.2, 3.6	1.2, 3.6	0.25	$0.80
TLC545	8	76	SAR	19 SE	—	—	—	0.2	0.5	8	Ext	Serial, SPI	1	4.75, 5.25	4.75, 5.25	6	$3.10
ADS7830	8	75	SAR	8 SE/4 Diff	50	50	68	0.19	0.5	8	Int/Ext	Serial, I^2C	1	2.7, 5.25	2.7, 5.25	0.675	$1.40
TLV0831	8	49	SAR	1 SE	—	—	—	0.2	0.5	8	Ext	Serial, SPI	1	2.7, 3.6	2.7, 3.6	0.66	$1.40
TLC548	8	45.5	SAR	1 SE	—	—	—	0.2	0.5	8	Ext	Serial, SPI	1	3.0, 6.0	3.0, 6.0	9	$1.20
TLV0832	8	44.7	SAR	2 SE/1 Diff	—	—	—	0.2	0.5	8	Ext	Serial, SPI	1	2.7, 3.6	2.7, 3.6	5	$1.40
TLV0834	8	41	SAR	4 SE/2 Diff	—	—	—	0.2	0.5	8	Ext	Serial, SPI	1	2.7, 3.6	2.7, 3.6	0.66	$1.45
TLC541	8	40	SAR	11 SE	—	—	—	0.2	0.5	8	Ext	Serial, SPI	1	4.75, 5.5	4.5, 5.5	6	$1.50
TLC549	8	40	SAR	1 SE	—	—	—	0.2	0.5	8	Ext	Serial, SPI	1	3.0, 6.0	3.0, 6.0	9	$0.95
TLV0838	8	37.9	SAR	8 SE/4 Diff	—	—	—	0.2	0.5	8	Ext	Serial, SPI	1	2.7, 3.6	2.7, 3.6	0.66	$1.45
TLC0831	8	31	SAR	1 Diff	—	—	—	0.2	0.4	8	Ext	Serial, SPI	1	4.5, 5.5	4.5, 5.5	3	$1.40

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New products are listed in **bold red.***

DAC Selection Guide

Device	Resolution (Bits)	Settling Time (µs) (max)	Architecture	Number of Output Channels	Update Rate (MSPS)	Output (V)	DNL	INL (%) Max	Mono-tonic (Bits)	Interface	V_{REF}	Supply Voltage (V)	Power (mW) (typ)	Price*
DAC1220	20	15000	Delta-Sigma	1	—	5	1	0.0015	20	Serial, SPI	Ext	+ 4.75 to 5.25	2.5	$6.33
DAC9881	18	5	R-2R	1	—	5	1	0.008	18	Serial, SPI	Ext	+4.75 to 5.50	6	$24.95
DAC5688	16	0.011	I-Steering	1	800	20mA	2	0.003	—	Parallel	Int/Ext	+3 to 3.6	1750	$25.00
DAC5687	16	0.0104	I-Steering	2	500	20mA	4	0.006	—	2 x P16	Int/Ext	1.8/3.3	1410	$22.50
DAC5687-EP	16	0.0104	I-Steering	2	500	20mA	5	0.006	—	2 x P16	Int/Ext	1.8/3.3	1410	$43.99
DAC5681	16	0.0104	I-Steering	1	1000	20mA	2	0.006	—	Parallel LVDS	Int/Ext	+3 to 3.6	650	$27.50
DAC5681Z	16	0.0104	I-Steering	1	1000	20mA	2	0.006	—	Parallel LVDS	Int/Ext	+3 to 3.6	800	$30.95
DAC5682Z	16	0.0104	I-Steering	2	1000	20mA	2	0.006	—	Parallel LVDS	Int/Ext	+3 to 3.6	1300	$31.95
DAC5686	16	0.012	I-Steering	2	500	—	9	0.018	—	2 x P16	Int/Ext	1.8/3.3	400	$19.75
DAC8822	16	0.5	R-2R MDAC	2	—	$\pm V_{REF}$ (Req. OPA)	1	0.0015	16	P16	Ext	2.75 to 5.25	0.027	$8.65
DAC8812	16	0.5	R-2R MDAC	2	—	$\pm V_{REF}$ (Req. OPA)	1	0.0015	16	Serial, SPI	Ext	2.75 to 5.25	0.027	$8.40
DAC8811	16	0.5	R-2R MDAC	1	—	$\pm V_{REF}$ (Req. OPA)	1	0.0015	16	Serial, SPI	Ext	2.75 to 5.25	0.027	$7.15
DAC8820	16	0.5	R-2R MDAC	1	—	$\pm V_{REF}$ (Req. OPA)	1	0.0015	16	P16	Ext	2.75 to 5.25	0.027	$8.50
DAC8580	16	0.65	String	1	—	$\pm V_{REF}$	1	0.0987	16	Serial, SPI	Ext	2.75 to 5.25	200	$3.00
DAC8581	16	0.65	String	1	—	$\pm V_{REF}$	1	0.0987	16	Serial, SPI	Ext	2.75 to 5.25	200	$3.00
DAC8814	16	1	R-2R MDAC	4	—	$\pm V_{REF}$ (Req. OPA)	1	0.0015	16	Serial, SPI	Ext	2.75 to 5.25	0.027	$16.95
DAC8830	16	1	R-2R	1	—	Ext	1	0.0015	16	Serial, SPI	Ext	2.75 to 5.25	0.015	$7.95
DAC8830-EP	16	1	R-2R	1	—	Ext	1	0.0015	16	Serial, SPI	Ext	2.75 to 5.25	0.015	$17.11
DAC8831	16	1	R-2R	1	—	$\pm V_{REF}$	1	0.0015	16	Serial, SPI	Ext	2.75 to 5.25	0.015	$7.95
DAC8831-EP	16	1	R-2R	1	—	$\pm V_{REF}$	1	0.004	16	Serial, SPI	Ext	2.75 to 5.25	0.015	$17.11
DAC8832	16	1	R-2R	1	—	$\pm V_{REF}$	1	0.0015	16	Serial, SPI	Ext	2.75 to 5.25	0.015	$7.95
DAC8881	16	2	R-2R	1	—	$\pm V_{REF}$	1	0.0015	16	Serial, SPI	Ext	2.75 to 5.25	6	$8.00
DAC8871	16	5	R-2R	1	—	±10	1	0.0015	16	Serial, SPI	Ext	± or + 14.25 to 15.75	0.015	$8.00
DAC7731	16	5	R-2R	1	—	$+V_{REF}$ (+10, ±10)	1	0.0015	16	Serial, SPI	Int/Ext	± 14.25 to 15.75	100	$8.20
DAC7741	16	5	R-2R	1	—	±10	1	0.0015	16	P16	Int/Ext	± 14.25 to 15.75	100	$8.30
DAC7742	16	5	R-2R	1	—	$+V_{REF}$ (+10, ±10)	1	0.0015	16	P16	Int/Ext	± 14.25 to 15.75	100	$8.70
DAC8734	16	8	R-2R	4	—	±15	1	0.0015	16	Serial, SPI	Ext	4.75 to 24	420	$33.60
DAC8571	16	10	R-String	1	—	$+V_{REF}$	1	0.098	16	Serial, I^2C	Ext	+2.7 to 5.5	0.4	$2.95
DAC8568	16	10	String	8	—	Ext	1	0.012	16	Serial, SPI	Ext	+2.7 to 5.5	1.8	$13.20
DAC8564	16	10	R-String	4	—	$+V_{REF}$ (+2.5)	1	0.012	16	Serial, SPI	Int/Ext	+2.75 to 5.5	2.6	$10.45
DAC8565	16	10	R-String	4	—	$+V_{REF}$ (+2.5	1	0.012	16	Serial, SPI	Int/Ext	+2.75 to 5.5	2.6	$10.45
DAC8554	16	10	String	4	—	Ext	1	0.012	16	Serial, SPI	Ext	2.75 to 5.25	1.6	$10.40
DAC8555	16	10	String	4	—	Ext	1	0.012	16	Serial, SPI	Ext	2.75 to 5.25	1.6	$10.40

Suggested resale price in U.S. dollars in quantities of 1,000.

New products are listed in ***bold red.*** *Preview products are listed in* ***bold blue***

DAC Selection Guide (continued)

Device	Resolution (Bits)	Settling Time (µs) (max)	Architecture	Number of Output Channels	Update Rate (MSPS)	Output (V)	DNL	INL (%) (max)	Mono-tonic (Bits)	Interface	V_{REF}	Supply Voltage (V)	Power (mW) (typ)	Price*
DAC8544	16	10	String	4	—	Ext	1	0.0987	16	P16	Ext	2.75 to 5.25	2.6	$9.75
DAC8541	16	10	String	1	—	$+V_{REF}$	1	0.096	16	P16	Ext	+ 2.7 to 5.5	0.6	$3.00
DAC7634	16	10	R-2R	4	—	$+V_{REF}, \pm V_{REF}$	2	0.0015	15	Serial, SPI	Ext	± or + 4.75 to 5.25	7.5	$19.95
DAC7644	16	10	R-2R	4	—	$+V_{REF}, \pm V_{REF}$	2	0.0015	15	P16	Ext	± or + 4.75 to 5.25	7.5	$19.95
DAC7734	16	10	R-2R	4	—	$+V_{REF}, \pm V_{REF}$	1	0.0015	16	Serial, SPI	Ext	± or + 14.25 to 15.75	50	$31.45
DAC7744	16	10	R-2R	4	—	$+V_{REF}, \pm V_{REF}$	1	0.0015	16	P16	Ext	± or + 14.25 to 15.75	50	$31.45
DAC8534	16	10	String	4	—	Ext	1	0.0987	16	Serial, SPI	Ext	+ 2.7 to 5.5	2.7	$8.75
DAC8574	16	10	String	4	—	Ext	1	0.0987	16	Serial, I^2C	Ext	+ 2.7 to 5.5	2.4	$10.25
DAC8552	16	10	String	2	—	Ext	1	0.012	16	Serial, SPI	Ext	2.75 to 5.25	0.8	$5.25
DAC8550	16	10	String	1	—	$+V_{REF}$	1	0.012	16	Serial, SPI	Ext	2.75 to 5.25	0.4	$2.65
DAC8551	16	10	String	1	—	$+V_{REF}$	1	0.012	16	Serial, SPI	Ext	2.75 to 5.25	0.4	$2.65
DAC7632	16	10	R-2R	2	—	$+V_{REF}, \pm V_{REF}$	2	0.0015	15	Serial, SPI	Ext	± or + 4.75 to 5.25	2.5	$10.45
DAC7641	16	10	R-2R	1	—	+VREF, ±VREF	2	0.0015	15	P16	Ext	± or + 4.75 to 5.25	1.8	$6.30
DAC7642	16	10	R-2R	2	—	$+V_{REF}, \pm V_{REF}$	2	0.0015	15	P16	Ext	± or + 4.75 to 5.25	2.5	$10.55
DAC7643	16	10	R-2R	2	—	$+V_{REF}, \pm V_{REF}$	2	0.0015	15	P16	Ext	± or + 4.75 to 5.25	2.5	$10.55
DAC7631	16	10	R-2R	1	—	$+V_{REF}, \pm V_{REF}$	2	0.0015	15	Serial, SPI	Ext	± or + 4.75 to 5.25	1.8	$5.85
DAC8532	16	10	String	2	—	Ext	1	0.0987	16	Serial, SPI	Ext	+ 2.7 to 5.5	1.35	$5.35
DAC8501	16	10	String MDAC	1	—	$+V_{REF}$/MDAC	1	0.0987	16	Serial, SPI	Ext	+ 2.7 to 5.5	0.6	$3.00
DAC8531	16	10	String	1	—	$+V_{REF}$	1	0.0987	16	Serial, SPI	Ext	+ 2.7 to 5.5	0.6	$3.00
DAC8411	16	10	String	1	—	$+V_{DD}$	1	0.003	16	Serial, SPI	Ext	+ 1.8 to 5.5	0.1	$3.20
DAC712	16	10	R-2R	1	—	±10	1	0.003	15	P16	Int	± 11.4 to 16.5	525	$14.50
DAC714	16	10	R-2R	1	—	±10	1	0.0015	16	Serial, SPI	Int	± 11.4 to 16.5	525	$14.50
DAC715	16	10	R-2R	1	—	10	1	0.003	16	P16	Int	± 11.4 to 16.5	525	$15.85
DAC716	16	10	R-2R	1	—	10	2	0.003	16	Serial, SPI	Int	± 11.4 to 16.5	525	$15.85
DAC8501	16	10	String MDAC	1	—	$+V_{REF}$/MDAC	1	0.0987	16	Serial, SPI	Ext	+ 2.7 to 5.5	0.6	$3.00
DAC8531	16	10	String	1	—	$+V_{REF}$	1	0.0987	16	Serial, SPI	Ext	+ 2.7 to 5.5	0.6	$3.00
DAC5675	14	0.005	I-Steering	1	400	20mA	2	0.006	—	LVDS/P14	Int/Ext	3.0	820	$29.45
DAC5675-EP	14	0.005	I-Steering	1	400	20mA	2	0.024	—	LVDS/P14	Int/Ext	+ 3.15 to 3.6	820	$50.00
DAC5672	14	0.02	I-Steering	2	200	20mA	3	0.024	—	2 x P14	Int	3.0 to 5.25	330	$13.25
DAC5672-EP	14	0.02	I-Steering	2	200	20mA	3	0.024	—	2 x P14	Int	3.0 to 5.25	330	$25.91
DAC2904	14	0.03	I-Steering	2	125	20mA	4	0.03	—	2 x P14	Int/Ext	+ 3.0 to 5.5	310	$13.25
DAC904	14	0.03	I-Steering	1	165	20mA	1.75	0.015	—	P14	Int/Ext	+ 3.0 to 5.5	170	$6.25
DAC8803	14	0.5	R-2R MDAC	4	—	$\pm V_{REF}$ (Req. OPA)	1	0.0061	14	Serial, SPI	Ext	2.75 to 5.25	0.027	$12.65

Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red.***

DAC Selection Guide (continued)

Device	Resolution (Bits)	Settling Time (µs) (max)	Architecture	Number of Output Channels	Update Rate (MSPS)	Output (V)	DNL	INL (%) (max)	Mono-tonic (Bits)	Interface	V_{REF}	Supply Voltage (V)	Power (mW) (typ)	Price*
DAC8718	16	20	String	8	—	±16.5	1	0.012	16	Serial, SPI	Ext	+ 4.5 to 18	165	$22.90
DAC8728	16	20	String	8	—	±16.5	1	0.012	16	P16	Ext	+ 4.5 to 18	165	$22.90
DAC8802	14	0.5	R-2R MDAC	2	—	$\pm V_{REF}$ (Req. OPA)	1	0.0061 0.0061	14	Serial, SPI	Ext	2.75 to 5.25	0.027	$6.10
DAC8805	14	0.5	R-2R MDAC	2	—	$\pm V_{REF}$ (Req. OPA)	1	0.0061 0.0061	16	P14	Ext	2.75 to 5.25	0.027	$6.15
DAC8801	14	0.5	R-2R MDAC	1	—	$\pm V_{REF}$ (Req. OPA)	1	0.0061 0.0061	14	Serial, SPI	Ext	2.75 to 5.25	0.027	$4.60
DAC8806	14	0.5	R-2R MDAC	1	—	$\pm V_{REF}$ (Req. OPA)	1	0.0061 0.0061	16	P14	Ext	2.75 to 5.25	0.027	$5.50
DAC8234	14	8	R-2R	4	—	±15	1	0.0061 0.0061	14	Serial, SPI	Ext	+4.75 to 24	420	$24.90
DAC8311	14	10	String	1	—	$+V_{DD}$	1	0.012	14	Serial, SPI	Ext	+1.8 to 5.5	0.1	$2.00
DAC8168	14	10	String	8	—	$+V_{REF}$	1	0.024	14	Serial, SPI	Ext	+2.7 to 5.5	1.8	$10.20
DAC8218	14	20	String	8	—	±16.5	1	0.006	14	Serial, SPI	Ext	+ 4.5 to 18	165	$19.90
DAC2932	12	0.025	I-Steering	2	40	2mA	0.5	0.0488	—	P12	Int/Ext	+2.7 to 3.3	29	$8.35
DAC2902	12	0.03	I-Steering	2	125	20mA	2.5	0.0732	—	2 x P12	Int/Ext	+3.0 to 5.25	310	$15.41
DAC902	12	0.03	I-Steering	1	165	20mA	1.75	0.061	—	P12	Int/Ext	+3.0 to 5.25	170	$6.25
THS5661A	12	0.035	I-Steering	1	125	20mA	2	0.0976	—	P12	Int/Ext	+3.0 to 5.25	175	$6.25
DAC5662A	12	0.02	I-Steering	2	275	—	2	—	—	Parallel	Ext	+3.0 to 3.6	3.30	$11.55
DAC7822	12	0.5	R-2R MDAC	2	—	$\pm V_{REF}$ (Req. OPA)	1	0.0244	12	P12	Ext	2.75 to 5.25	0.027	$3.80
DAC7811	12	0.5	R-2R MDAC	1	—	$\pm V_{REF}$ (Req. OPA)	1	0.0244	12	Serial, SPI	Ext	2.75 to 5.25	0.025	$2.55
DAC7821	12	0.5	R-2R MDAC	1	—	$\pm V_{REF}$ (Req. OPA)	1	0.0244	12	P12	Ext	2.75 to 5.25	0.027	$2.60
DAC7800	12	0.8	R-2R	2	—	1mA	1	0.012	12	Serial, SPI	Ext	+ 4.5 to 5.5	1	$13.55
DAC7801	12	0.8	R-2R	2	—	1mA	1	0.012	12	P(8+4)	Ext	+ 4.5 to 5.5	1	$17.95
DAC7802	12	0.8	R-2R	2	—	1mA	1	0.012	12	P12	Ext	+ 4.5 to 5.5	1	$14.00
TLV5630	12	1	String	8	—	$+V_{REF}$	1	0.4	12	Serial, SPI	Int/Ext	+ 2.7 to 5.5	18	$8.85
TLV5638	12	1	String	2	—	$+V_{REF}$ (+2, 4)	1	0.1	12	Serial, SPI	Int/Ext	+ 2.7 to 5.25	4.5	$3.25
TLV5638-EP	12	1	String	2	—	$+V_{REF}$ (+2, 4)	1	0.1	12	Serial, SPI	Int/Ext	+ 2.7 to 5.25	4.5	$9.34
TLV5638M	12	1	String	2	—	$+V_{REF}$ (+2, 4)	1	0.1	12	Serial, SPI	Int/Ext	+ 2.7 to 5.25	4.5	$32.50
DAC7541	12	1	R-2R MDAC	1	—	$\pm V_{REF}$ (Req. OPA)	0.5	0.012	12	P12	Ext	+ 5.0 to 16.0	30	$6.70
DAC8043	12	1	R-2R MDAC	1	—	$\pm V_{REF}$ (Req. OPA)	1	0.012	12	Serial, SPI	Ext	+ 4.75 to 5.25	2.5	$3.60
TLV5613	12	1	String	1	—	$+V_{REF}$	1	0.1	12	P8	Ext	+ 2.7 to 5.5	1.2	$2.60
TLV5619	12	1	String	1	—	$+V_{REF}$	1	0.08	12	P12	Ext	+ 2.7 to 5.5	4.3	$2.60
TLV5633	12	1	String	1	—	$+V_{REF}$ (+2, 4)	0.5	0.08	12	P8	Int/Ext	+ 2.7 to 5.5	2.7	$4.70

Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red.***

DAC Selection Guide (continued)

Device	Resolution (Bits)	Settling Time (µs) (max)	Architecture	Number of Output Channels	Update Rate (MSPS)	Output (V)	DNL	INL (%) (max)	Mono-tonic (Bits)	Interface	V_{REF}	Supply Voltage (V)	Power (mW) (typ)	Price*
TLV5636	12	1	String	1	—	$+V_{REF}$ (+2, 4)	1	0.1	12	Serial, SPI	Int/Ext	+ 2.7 to 5.25	4.5	$3.65
TLV5639	12	1	String	1	—	$+V_{REF}$ (+2, 4)	0.5	0.1	12	P12	Int/Ext	+ 2.7 to 5.25	2.7	$3.45
TLV5619-EP	12	1	String	1	—	$+V_{REF}$	1	0.08	12	P12	Ext	+ 2.7 to 5.5	4.3	$7.91
DAC7545	12	2	R-2R MDAC	1	—	$\pm V_{REF}$ (Req. OPA)	1	0.012	12	P12	Ext	+ 5.0 to 16.0	30	$5.25
TLV5618A	12	2.5	String	2	—	$+V_{REF}$	1	0.08	12	Serial, SPI	Ext	+ 2.7 to 5.5	1.8	$4.75
TLV5618A-EP	12	2.5	String	2	—	$+V_{REF}$	1	0.08	12	Serial, SPI	Ext	+ 2.7 to 5.5	1.8	$11.78
TLV5614	12	3	String	4	—	$+V_{REF}$	1	0.1	12	Serial, SPI	Ext	+ 2.7 to 5.5	3.6	$7.45
TLV5618AM	12	3	String	2	—	$+V_{REF}$	1	0.1	12	Serial, SPI	Ext	+ 2.7 to 5.5	1.8	$28.23
TLV5616	12	3	String	1	—	$+V_{REF}$	1	0.1	12	Serial, SPI	Ext	+ 2.7 to 5.5	0.9	$2.60
DAC811	12	4	R-2R	1	—	+10, ±5, 10	0.5	0.006	12	P12	Int	± or + 11.4 to 16.5	625	$11.00
DAC813	12	4	R-2R	1	—	$+V_{REF}$ (+10, ±5, 10)	0.5	0.006	12	P12	Int/Ext	± or + 11.4 to 16.5	270	$12.60
DAC7558	12	5	String	8	—	$+V_{REF}$	1	0.012	12	Serial, SPI	Ext	2.75 to 5.25	2.7	$7.50
DAC7554	12	5	String	4	—	$+V_{REF}$	1	0.012	12	Serial, SPI	Ext	2.75 to 5.25	1.5	$4.80
DAC7552	12	5	String	2	—	$+V_{REF}$	1	0.024	12	Serial, SPI	Ext	2.75 to 5.25	0.675	$2.35
DAC7553	12	5	String	2	—	$+V_{REF}$	1	0.024	12	Serial, SPI	Ext	2.75 to 5.25	0.675	$2.35
DAC7551	12	5	String	1	—	$+V_{REF}$	1	0.024	12	Serial, SPI	Ext	2.75 to 5.25	0.27	$1.40
DAC7716	12	8	R-2R	4	—	±15	1	0.024	12	Serial, SPI	Ext	4.75 to 24	420	$14.90
DAC7568	12	10	String	8	—	$+V_{REF}$	1	0.024	12	Serial, SPI	Ext	2.7 to 5.5	1.8	$8.20
DAC7573	12	10	String	4	—	$+V_{REF}$	1	0.096	12	Serial, I^2C	Ext	2.75 to 5.25	1.8	$6.15
DAC7574	12	10	String	4	—	$+V_{REF}$	—	0.096	12	Serial, I^2C	Ext	+ 2.7 to 5.5	1.8	$6.15
DAC7613	12	10	R-2R	1	—	$+V_{REF}$, $\pm V_{REF}$	1	0.012	12	P12	Ext	± or + 4.75 to 5.25	1.8	$2.50
DAC7614	12	10	R-2R	4	—	$+V_{REF}$, $\pm V_{REF}$	1	0.012	12	Serial, SPI	Ext	± or + 4.75 to 5.25	15	$6.70
DAC7615	12	10	R-2R	4	—	$+V_{REF}$, $\pm V_{REF}$	1	0.012	12	Serial, SPI	Ext	± or + 4.75 to 5.25	15	$6.70
DAC7616	12	10	R-2R	4	—	$+V_{REF}$, $\pm V_{REF}$	1	0.012	12	Serial, SPI	Ext	+ 3.0 to 3.6	2.4	$5.40
DAC7617	12	10	R-2R	4	—	$+V_{REF}$, $\pm V_{REF}$	1	0.012	12	Serial, SPI	Ext	+ 3.0 to 3.6	2.4	$5.40
DAC7624	12	10	R-2R	4	—	$\pm V_{REF}$	1	0.012	12	P12	Ext	± or + 4.75 to 5.25	15	$10.25
DAC7625	12	10	R-2R	4	—	$\pm V_{REF}$	1	0.012	12	P12	Ext	± or + 4.75 to 5.25	15	$10.25
DAC7714	12	10	R-2R	4	—	$\pm V_{REF}$	1	0.012	12	Serial, SPI	Ext	± or + 14.25 to 15.75	45	$11.45
DAC7715	12	10	R-2R	4	—	$\pm V_{REF}$	1	0.012	12	Serial, SPI	Ext	± or + 14.25 to 15.75	45	$11.45
DAC7724	12	10	R-2R	4	—	$\pm V_{REF}$	1	0.012	12	P12	Ext	± or + 14.25 to 15.75	45	$11.85
DAC7725	12	10	R-2R	4	—	$\pm V_{REF}$	1	0.012	12	P12	Ext	± or + 14.25 to 15.75	45	$11.85
DAC7612	12	10	R-2R	2	—	4.096	1	0.012	12	Serial, SPI	Int	+ 4.75 to 5.25	3.5	$3.10
DAC7311	12	10	String	1	—	$+V_{REF}$	1	0.024	12	Serial, SPI	Ext	+ 1.8 to 5.5	0.2	$1.20
DAC7512	12	10	String	1	—	$+V_{REF}$	1	0.38	12	Serial, SPI	Ext	+ 2.7 to 5.5	0.345	$1.45
DAC7513	12	10	String	1	—	Ext	1	0.38	12	Serial, SPI	Ext	+ 2.7 to 5.5	0.3	$1.65

Suggested resale price in U.S. dollars in quantities of 1,000.

*New products are listed in **bold red.***

DAC Selection Guide (continued)

Device	Resolution (Bits)	Settling Time (µs) (max)	Architecture	Number of Output Channels	Update Rate (MSPS)	Output (V)	DNL	INL (%) (max)	Mono-tonic (Bits)	Interface	V_{REF}	Supply Voltage (V)	Power (mW) (typ)	Price*
DAC7571	12	10	String	1	—	$+V_{REF}$	—	0.096	12	Serial, I^2C	Ext	+ 2.7 to 5.5	0.85	$1.55
DAC7611	12	10	R-2R	1	—	4.096	1	0.012	12	Serial, SPI	Int	+ 4.75 to 5.25	2.5	$2.55
DAC7613	12	10	R-2R	1	—	$+V_{REF}$, $\pm V_{REF}$	1	0.012	12	P12	Ext	± or + 4.75 to 5.25	1.8	$2.50
DAC7621	12	10	R-2R	1	—	4.096	1	0.012	12	P12	Int	+ 4.75 to 5.25	2.5	$2.75
DAC7718	12	20	String	8	—	±16.5	1	0.024	12	Serial, SPI	Ext	+5.0 to 18	165	$16.90
DAC5652	10	0.02	I-Steering	2	275	20mA	1	0.0488	12	Serial	Int/Ext	3.0 to 3.6	290	$7.60
DAC5652-EP	10	0.02	I-Steering	2	275	20mA	1	0.0488	12	Serial	Int/Ext	3.0 to 3.6	290	$14.86
DAC2900	10	0.03	I-Steering	2	125	20mA	1	0.0976	—	2 x P10	Int/Ext	+3.0 to 5.25	310	$6.00
DAC900	10	0.03	I-Steering	1	165	20mA	0.5	0.0976	10	P10	Int/Ext	+3.0 to 5.25	170	$4.25
THS5651A	10	0.035	I-Steering	1	125	20mA	0.5	0.0976	—	P10	Int/Ext	+ 3.0 to 5.5	175	$4.25
TLV5637	10	0.8	String	2	—	+2, 4	0.5	0.1	10	Serial, SPI	Int/Ext	+ 2.7 to 5.25	4.2	$3.20
TLV5608	10	1	String	8	—	$+V_{REF}$	1	0.4	10	Serial, SPI	Ext	+ 2.7 to 5.5	18	$4.90
TLV5631	10	1	String	8	—	$+V_{REF}$	1	0.4	10	Serial, SPI	Int/Ext	+ 2.7 to 5.5	18	$5.60
TLV5617A	10	2.5	String	2	—	$+V_{REF}$	0.5	0.1	10	Serial, SPI	Ext	+ 2.7 to 5.5	1.8	$2.25
TLV5604	10	3	String	4	—	$+V_{REF}$	1	0.05	10	Serial, SPI	Ext	+ 2.7 to 5.5	3	$3.70
TLV5606	10	3	String	1	—	$+V_{REF}$	1	0.15	10	Serial, SPI	Ext	+ 2.7 to 5.5	0.9	$1.30
DAC6573	10	9	String	4	—	$+V_{REF}$	0.5	0.195	10	Serial, I^2C	Ext	2.75 to 5.25	1.5	$3.05
DAC6574	10	9	String	4	—	$+V_{REF}$	0.5	0.195	10	Serial, I^2C	Ext	2.7 to 5.5	1.5	$3.05
DAC6571	10	9	String	1	—	$+V_{DD}$	0.5	0.195	10	Serial, I^2C	Ext	2.75 to 5.25	0.5	$1.40
DAC6311	10	10	String	1	—	$+V_{DD}$	1	0.029	10	Serial, SPI	Ext	1.8 to 5.5	0.2	$1.10
TLC5615	10	12.5	String	1	—	$+V_{REF}$	0.5	0.1	10	Serial, SPI	Ext	+ 4.5 to 5.5	0.75	$1.90
DAC908	8	0.03	I-Steering	1	165	20mA	0.5	0.2	—	P8	Ext	+3.0 to 5.25	170	$2.90
TLC5602	8	0.03	I-Steering	1	30	20mA	0.5	0.2	—	P8	Ext	+4.75 to 5.25	80	$1.55
THS5641A	8	0.035	I-Steering	1	100	20mA	0.5	0.4	—	P8	Ext	+3.0 to 5.25	100	$2.90
TLC7528	8	0.1	R-2R	2	—	1 mA	0.5	0.2	8	P8	Ext	+ 4.75 to 15.75	7.5	$1.55
TLC7628	8	0.1	R-2R	2	—	2 mA	0.5	0.2	8	P8	Ext	+ 10.8 to 15.75	20	$1.45
TLC7524	8	0.1	R-2R	1	—	1 mA	0.5	0.2	8	P8	Ext	+ 4.75 to 5.25	5	$1.45
TLV5626	8	0.8	String	2	—	$+V_{REF}$ (+2, 4)	0.5	0.4	8	Serial, SPI	Int/Ext	+ 2.7 to 5.5	4.2	$1.90
TLV5629	8	1	String	8	—	—	1	0.4	8	Serial, SPI	Ext	+ 2.7 to 5.5	18	$3.15
TLV5632	8	1	String	8	—	$+V_{REF}$ (+2, 4)	1	0.4	8	Serial, SPI	Int/Ext	+ 2.7 to 5.5	18	$3.35
TLV5624	8	1	String	1	—	$+V_{REF}$ (+2, 4)	0.2	0.2	8	Serial, SPI	Int/Ext	+ 2.7 to 5.5	0.9	$1.60
TLV5627	8	2.5	String	4	—	$+V_{REF}$	0.5	0.2	8	Serial, SPI	Ext	+ 2.7 to 5.5	3	$2.05
TLV5625	8	3	String	2	—	$+V_{REF}$	0.2	0.2	8	Serial, SPI	Ext	+ 2.7 to 5.5	2.4	$1.70
TLV5623	8	3	String	1	—	$+V_{REF}$	0.2	0.2	8	Serial, SPI	Ext	+ 2.7 to 5.5	2.1	$0.99

Suggested resale price in U.S. dollars in quantities of 1,000.

*Preview products are listed in **bold blue.***

DAC Selection Guide (continued)

Device	Resolution (Bits)	Settling Time (µs) (max)	Architecture	Number of Output Channels	Update Rate (MSPS)	Output (V)	DNL	INL (%) (max)	Mono-tonic (Bits)	Interface	V_{REF}	Supply Voltage (V)	Power (mW) (typ)	Price*
TLC7225	8	5	R-2R	4	—	$+V_{REF}$	1	0.4	8	P8	Ext	± or + 11.4 to 16.5	75	$2.35
TLC7226	8	5	R-2R	4	—	$+V_{REF}$	1	0.4	8	P8	Ext	± or + 11.4 to 16.5	90	$2.15
TLC7226M	8	5	R-2R	4	—	$+V_{REF}$	1	0.4	8	P8	Ext	± or + 11.4 to 16.5	90	$78.98
DAC5573	8	8	String	4	—	$+V_{REF}$	0.25	0.195	8	Serial, I^2C	Ext	2.75 to 5.25	1.5	$2.55
DAC5574	8	8	String	4	—	$+V_{REF}$	0.25	0.195	8	Serial, I^2C	Ext	2.7 to 5.5	1.5	$2.55
DAC5571	8	8	String	1	—	$+V_{DD}$	0.25	0.195	8	Serial, I^2C	Int	2.75 to 5.25	0.5	$0.90
DAC5311	8	10	String	1	—	$+V_{DD}$	1	0.39	8	Serial, SPI	Ext	1.8 to 5.5	0.2	$0.90
TLC5628	8	10	String	8	—	$+V_{REF}$	0.9	0.4	8	Serial, SPI	Ext	+ 4.75 to 5.25	15	$2.45
TLV5628	8	10	String	8	—	$+V_{REF}$	0.9	0.4	8	Serial, SPI	Ext	+ 2.7 to 5.25	12	$2.20
TLV5620	8	10	R-2R	4	—	$+V_{REF}$	0.9	0.2	8	Serial, SPI	Ext	+ 2.7 to 5.5	6	$1.00
TLV5621	8	10	R-2R	4	—	$+V_{REF}$	0.9	0.4	8	Serial, SPI	Ext	+ 2.7 to 5.5	3.6	$1.65
TLC5620	8	10	String	4	—	$+V_{REF}$	0.9	0.4	8	Serial, SPI	Ext	+ 4.75 to 5.25	8	$1.75

Suggested resale price in U.S. dollars in quantities of 1,000.

Audio Data Converters

Audio ADCs

Device	Description	Portable Focus	Dynamic Range (dB)	No. of Inputs/ No. of Outputs	Sampling Rate (kHz) (max)	Audio Data Format	Power Supply (V)	Package(s)	Price*
PCM4222	2-Channel, High-Performance ΔΣ ADC	—	124	2/0	216	6-Bit Modulator, DSD, Normal, I²S, TDM	+3.3 and +4	TQFP-48	$14.95
PCM4220	2-Channel, High-Performance ΔΣ ADC	—	123	2/0	216	Normal, I²S, TDM	+3.3 and +4	TQFP-48	$9.95
PCM4204	4-Channel, High-Performance ΔΣ ADC, PCM or DSD, High Pass Filter	—	118	4/0	216	Normal, I²S, DSD, TDM	+3.3 and +5	TQFP-64	$7.95
PCM4202	Stereo, High-Performance ΔΣ ADC, PCM or DSD, High Pass Filter	—	118	2/0	216	Normal, I²S, DSD	+3.3 and +5	SSOP-28	$4.95
PCM4201	Mono, High-Performance ΔΣ ADC, PCM or DSD, High Pass Filter, Wide Digital Supply Range, Low Power Dissipation	—	112	1/0	108	Normal, DSP	+3.3 and +5	TSSOP-16	$2.50
PCM1804	Stereo ADC, Fully Differential, High Pass Filter	—	112	2/0	192	Normal, I²S, DSD	+3.3 and +5	SSOP-28	$3.95
PCM1802	Stereo ADC, SE Input	—	105	2/0	96	Normal, I²S	+3.3 and +5	SSOP-20	$3.35
PCM1803A	Stereo ADC, SE Input, High Pass Filter	—	103	2/0	96	Normal, I²S	+3.5 and +5	SSOP-20	$1.10
PCM1850/1	Stereo ADC w/2 x 6 Input MUX and PGA, SPI (1850) and I²C (1851) Control	—	101	2/0	96	Normal, I²S	+3.3 and +5	TQFP-32	$4.80
PCM1807/8	Stereo ADC, SE Input, Mute w/Fade, SPI Control, S/W (1807) H/W, (1808) Controlled	—	101	2/0	96	I²S, L	+3.5 and +5	TSSOP-14	$1.00
PCM1870	Stereo ADC, SE Input, Digital Filter, Very Low Power Consumption	✔	90	2/0	50	Normal, I²S, DSP	+2.4 and +3.6	QFN-24	$1.80
TLV320ADC3001	Low-Power Stereo Audio ADC with Internal PLL and Highly Flexible Digital Filtering; 3 Inputs	✔	92	3	96	I²S, L, R, DSP, TDM	+2.7 to 3.6	WCSP	1.60
TLV320ADC3101	Low-Power Stereo Audio ADC with Internal PLL and Highly Flexible Digital Filtering; 6 Inputs	✔	92	6	96	I²S, L, R, DSP, TDM	+2.7 to 3.6	QFN-24	1.75

Audio DACs

Device	Description	Portable Focus	Dynamic Range (dB)	No. of Inputs/ No. of Outputs	Sampling Rate (kHz) (max)	Audio Data Format	Power Supply (V)	Package(s)	Price*
PCM1792A	Stereo, Optional DSD Format, External Filter and DSP Interface, SPI/I²C, Differential Current Output: 7.8mA p-p	—	132	0/2	192	Standard, I²S, L	+3.3 and +5	SSOP-28	$9.95
PCM1796/8	Stereo Advanced Segment, 123dB Dynamic Range, TDMCA Serial Interface (1798)	—	123	0/2	192	Standard, I²S, L	+3.5 and +5	SSOP-28	$2.95
PCM4104	4-Channel, High Performance, Sampling Rate up to 216kHz, H/W or S/W Controlled	—	118	0/4	216	Normal, I²S, TDM	+3.3 and +5	TQFP-48	$4.95
PCM1738/30	Stereo Advanced Segment DAC, Soft Mute (1730), 2 Optional Operation Modes (1738): Ext Filter and DSD Decoder for SACD Playback and Digital Attenuation	—	117	0/2	192	Normal, I²S, DSD	+3.3 and +5	SSOP-28	$5.25/ $5.00
PCM1791A	Stereo Advanced Segment DAC, Optional DSD Format, External Filter and DSP Interface, SPI/I²C Differential Current Output: 3.2mAp-p	—	113	0/2	192	Normal, I²S, TDMCA	+3.3 and +5	SSOP-28	$2.10
PCM1793	Stereo Advanced Segment DAC, Balanced Voltage Outputs, Improved Clock Jitter	—	113	0/2	192	Normal, I²S, Left Justified	+3.3 and +5	SSOP-28	$2.10
DSD1608	8-Channel, Enhanced Multiformat ΔΣ DAC, Supports DSD with TDMCA	—	108	0/8	192	Normal, I²S, DSD	+3.3 and +5	TQFP-52	$5.96
PCM1780/81/82	Stereo with Volume Control, Software (1780/82) and Hardware (1781), Open-Drain Output Zero Flag (1782), Improved Jitter Performance	—	106	0/2	192	Normal, I²S	+5	SSOP-16	$1.10
PCM1753/54/55	Stereo w/Volume Control, Software (1753/55) and Hardware (1754), Open-Drain Output Zero Flag (1755)	—	106	0/2	192	Normal, I²S	+5	SSOP-16	$1.03
PCM1608	8-Channel, Highly Integrated DAC, Higher SNR	—	105	0/8	192	Normal, I²S	+3.3 and +5	LQFP-48	$4.29
PCM1606	6-Channel, Low Cost CMOS, Multilevel	—	103	0/6	192	Normal, I²S	+5	SSOP-20	$2.00
PCM1680	8-Channel, Low Cost DAC, Improved Jitter Performance, Pin Compatible with PCM1780	—	103	0/8	192	Normal, I²S	+5	SSOP-24	$1.50
TLV320DAC23	I²C and SPI Control with Headphone Amp, P_{diss} = 23mW	✔	100	0/2	96	Normal, I²S, DSP	+1.5 to +3.3	VFBGA-80	$2.00
PCM1770/1	Stereo with Integrated Headphone Driver, Software (1770) and Hardware, (1771) Controlled	✔	98	0/2	48	Normal, I²S	+1.6 to +3.6	QFN-28, TSSOP-16, QFN-20	$1.25

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Audio DACs and ADCs

Audio DACs (continued)

Device	Description	Portable Focus	Dynamic Range (dB)	No. of Inputs/ No. of Outputs	Sampling Rate (kHz) (max)	Audio Data Format	Power Supply (V)	Package(s)	Price*
PCM1772/3	Stereo with Integrated Line Out, Software (1772) and Hardware (1773) Controlled	✔	98	0/2	48	Normal, I²S	+1.6 to +3.6	TSSOP-16, QFN-20	$1.25
TLV320DAC26	Integrated PLL, SPI Control, Speaker/ Headphone Amp, P_{diss} = 11mW	✔	97	0/2	53	Normal, I²S, DSP	+2.7 to +3.6	QFN-32	$2.95
TLV320DAC32	Low-Power Stereo DAC with PLL and Stereo HP/Speaker Amplifiers	✔	95	0/2	96	Normal, I²S, DSP, TDM	+2.7 to +3.6	QFN-32	$2.75
PCM1789	Stereo, Differential Output DAC, SPI/I²C or H/W Control	—	112	0/2	192	I²S, Left and Right Justified	+3.3 and +5	TSSOP-24	TBD
PCM1690	Octal DAC, Differential Outputs, SPI/I²C or H/W Control	—	113	0/8	192	I²S TDM, Left and Right Justified	+3.3 and +5	HTSSOP-48	TBD
PCM1691	Octal DAC, Single-Ended Outputs, SPI/I²C or H/W Control	—	110	0/8	192	I²S TDM, Left and Right Justified	+3.3 and +5	HTSSOP-48	TBD
PCM1774	Low-Power Stereo DAC with HP Amplifier, Sound Effect	✔	93	0/2	50	LJ, RJ, I²S, DSP	+3.3	QFN-20	1.50

Audio Codecs

Device	Description	Portable Focus	Dynamic Range (dB)	Sampling Rate (kHz) (max)	Audio Data Format	Power Supply (V)	Package(s)	Price*
PCM3168	High-Performance, 6 In/8 Out-Audio Codec	—	112	96	Normal, I²S, DSP, TDM	3.3 to 5	HTQFP-64	TBD
TLV320AIC34	Low-Power Quad Stereo (4-Channel) Codec, 12 Inputs (Mic/Line), 14 Outputs (Line, Headphone/Speaker), 2 PLLs and Audio Serial Buses Allow Fully Asynchronous Simultaneous Codec Operation	4	102	96	Normal, I²S, DSP, TDM	+2.7 to 3.6	BGA-87	$5.95
TLV320AIC3101	Low-Power Stereo Codec, Integrated PLL, 6 Inputs (Mic/ Line), 6 Outputs (Line, Headphone/Speaker), Notch Filtering, Low-Power Analog Bypass	4	102	96	Normal, I²S, DSP, TDM	+2.7 to 3.6	QFN-32	$3.55
TLV320AIC3104	Low-Power Stereo Codec, Integrated PLL, 6 Inputs (MicLine), 6 Outputs (Line, Headphone), Notch Filtering, Low-Power Analog Bypass	4	102	96	Normal, I²S, DSP, TDM	+2.7 to 3.6	QFN-32	$3.25
TLV320AIC3105	Low-Power Stereo Codec, Integrated PLL, 6 SE Inputs (Mic/Line), 6 Outputs (Line, Headphone), Notch Filtering, Low-Power Analog Bypass	4	102	96	Normal, I²S, DSP, TDM	+2.7 to 3.6	QFN-32	$3.25
TLV320AIC3106	Low-Power Stereo Codec, Integrated PLL, 10 Inputs (Mic/ Line), 7 Outputs (Line, Headphone), Notch Filtering, Low Power Analog Bypass	4	102	96	Normal, I²S, DSP, TDM	+2.7 to 3.6	QFN-32, BGA-80	$3.85
TLV320AIC3107	Low-Power Stereo Codec, Integrated PLL, 10 Inputs (Mic/Line), 7 Outputs (Line, Headphone, Mono Integrated Class-D Amp)	4	102	96	Normal, I²S, DSP, TDM	+2.7 to 3.6	QFN	TBD
TLV320AIC33	Low-Power Stereo Codec, Integrated PLL, 6 Inputs, 3 Line Out and Speaker/HP Outputs	4	102	96	Normal, I²S, DSP, TDM	+2.7 to 3.6	QFN-48, BGA-80	$3.95
TLV320AIC31/32	Low-Power Stereo Codec, Integrated PLL, 6 Inputs (AIC32-6 Single-Ended, AIC31-2 Differential and 2 Single Ended) 2 Line Out and Speaker/HP Outputs	4	100	96	Normal, I²S, DSP, TDM	+2.7 to 3.6	QFN-32	$3.45
TLV320AIC23B	Low-Power, Lower Cost, Stereo Codec with Headphone Amps	4	100	96	I²S, L, R	+2.7 to 3.3	VFBGA-80, TSSOP-28, QFN-28	$3.00
TLV320AIC28/29	Low-Power, Stereo DAC, Mono ADC, Integrated PLL, Speaker/HP Amp, Additional Inputs and Outputs (AIC29 – Differential)	4	95	53	Normal, I²S, DSP	+2.7 to 3.6	QFN-48	$3.95/ $3.45
TLV320AIC26	Low-Power, Lower Cost, Stereo DAC, Mono ADC, Integrated PLL, Speaker/HP Amp	4	97	53	Normal, I²S, DSP	+2.7 to 3.6	QFN-32	$3.25
PCM3000	Stereo Audio Codec 18-Bits, Serial Interface, Software Controlled	4	98	48	Normal, I²S, DSP	+4.5 to 5.5	SSOP-28	$3.45
PCM3001	Stereo Audio Codec 18-Bits, Serial Interface, Hardware Controlled	4	98	48	Normal, I²S, DSP	+4.5 to 5.5	SSOP-28	$3.45
PCM3006	Low-Power, 3V Supply, Stereo Codec, Hardware Controlled	4	93	48	Normal	+2.7 to 3.6	SSOP-24	$3.45
PCM3008	Low-Power, 2.4V Single Supply, Stereo Codec, Low-Cost, Hardware Controlled	4	88	48	Normal, I²S	+2.1 to 3.6	TSSOP-16	$3.10
PCM3793A	Ultra-Low-Power Stereo Codec, 6 Inputs (Mic/Line), 3 Outputs (Line/HP/Class-D Speaker)	4	93	48	Normal, I²S, DSP	+2.4 to 3.6	QFN-32	$4.50
PCM3794A	Ultra-Low-Power Stereo Codec, 6 Inputs (Mic/Line), 5 Outputs (Line/HP)	4	93	48	Normal, I²S, DSP	+2.4 to 3.6	QFN-32	$4.25

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*Preview products are listed in **bold blue.***

Audio DACs and ADCs and Touch Screen Controllers

Voiceband Codecs

Device	Description	Sample Rate (kHz)	Number of Input Channel(s)	SNR (dB)	Interface	Analog Supply (V)	Logic Supply (V)	Power Supply (mW)	Package	Price*
TLV320AIC12K	Low Power, Mono Codec, 16-Bit, 26ksps Voiceband Codec with 8W Driver	26	1	90	I^2C, S^2C, DSP	1.65 to 1.95/2.7 to 3.6	1.1 to 3.6	10	TSSOP-30	$1.70
PCM3052	Stereo Codec with Integrated Mic Preamp and S/PDIF Output	—	105	96	Left Justified	+3.3 and +5	3 to 3.6	228	VQFN-32	$2.60
PCM3060	Asynchronous Stereo Codec	—	104	192	I^2S, L, R	+3.3 and +5	+2.7 to 3.6	160	TSSOP-28	$2.10
TLV320AIC3204	Low-Power Stereo Codec, Integrated PLL, Integrated LDO, Power Tune Technology, 6 SE/3 Differential Inputs, 4 Outputs (Stereo Line Out and Stereo HP), Effects Processing	✔	100	192	I^2S, L, R, DSP, TDM	1.5 to 3.6	1.26 to 3.6	5	QFN-32	$3.45
TLV320AIC3254	Low-Power Stereo Codec, Integrated PLL, Integrated LDO, Power TuneTechnology, 6 SE/3 Differential Inputs, 4 Outputs (Stereo Line Out and Stereo HP), Integrated miniDSP for Enhanced Custom Audio Processing	✔	100	192	I^2S, L, R, DSP, TDM	1.5 to 3.6	1.26 to 3.6	5	QFN-32	$5.45
TLV320AIC14K	Low Power, Mono Codec, 16-Bit, 26ksps Voiceband Codec	26	1	90	I^2C, S^2C, DSP	1.65 to 1.95/2.7 to 3.6	1.1 to 3.6	10	TSSOP-30	$1.50
TLV320AIC20K	Low Power, Stereo Codec, 16-Bit, 26ksps Voiceband Codec with 8W Driver	26	2	90	I^2C, S^2C, DSP	1.65 to 1.95/2.7 to 3.6	1.1 to 3.6	20	TQFP-48	$2.50
TLV320AIC24K	Low Power, Stereo Codec, 16-Bit, 26ksps Voiceband Codec	26	2	90	I^2C, S^2C, DSP	1.65 to 1.95/2.7 to 3.6	1.1 to 3.6	20	TQFP-48	$2.30

Audio Converters with Integrated Touch-Screen Controller

Device	Description	Resolution (Bits) (max)	Dynamic Range (dB)	Sampling Rate (kHz) (max)	Configuration	Audio Data Format	Power Supply (V)	Package(s)	Price*
TSC2100	4-Wire Touch-Screen Interface, Low Power, Lower Cost, Stereo DAC, Mono ADC, Integrated PLL, Speaker/HP Amp	24	97	53	Mono/Stereo	Normal, I^2S, DSP	+2.7 to 3.6	QFN-32, TSSOP-32	$3.95
TSC2111	4-Wire Touch-Screen Interface, Low Power, Stereo DAC, Mono ADC, Integrated PLL, Speaker/HP Amp, Additional Inputs and Outputs (TSC2111 – Differential)	24	95	53	Mono/Stereo	Normal, I^2S, DSP	+2.7 to 3.6	QFN-48	$4.95
TSC2102	4-Wire Touch-Screen Interface, Low Power, Stereo DAC, Integrated PLL, Speaker/HP Amp, Low Cost	24	97	53	Stereo	Normal, I^2S, DSP	+2.7 to 3.6	TSSOP-32	$3.70
TSC2300	4-Wire Touch-Screen Interface, Low Power, Stereo DAC, Mono ADC, Integrated PLL	20	98	48	Mono/Stereo	Normal, I^2S	+2.7 to 3.6	TQFP-64	$4.75
TSC2301	4-Wire Touch-Screen Interface, Low Power, Stereo DAC, Stereo ADC, Integrated PLL, HP Amp, 4 x 4 Keypad Interface	20	98	48	Stereo/Stereo	Normal, I^2S	+2.7 to 3.6	TQFP-64, BGA-120	$4.95
TSC2302	4-Wire Touch-Screen Interface, Low Power, Stereo DAC, Stereo ADC, Integrated PLL, HP Amp	20	98	48	Stereo/Stereo	Normal, I^2S	+2.7 to 3.6	QFN-48	$4.50

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*Preview products are listed in **bold blue.***

Interface and Non-Audio Touch Screen Controllers

Interface and Sample Rate Convertersgrated Sample Rate Converters and S/PDIF – AES/EBU Transceivers

Device	Description	# SRC Channels	THD+N (dB)	Sample Rate (max)	Digital Audio Interface	Control Interface	Dynamic Range (dB)	AES Receive	AES Transmit	Power Supply (V)	Package	Price*
SRC4392	High-End Combo Sample Rate Converter	2	–140	216	AES/EBU, S/PDIF, I^2S, R, L	I^2S, SPI	144	Yes	Yes	1.8, 3.3	TQFP-48	$9.95
SRC4382	Combo Sample Rate Converter	2	–125	216	AES/EBU, S/PDIF, I^2S, R, L	I^2S, SPI	128	Yes	Yes	1.8, 3.3	TQFP-48	$7.50
Standalone Sample Rate Converters												
SRC4184	4-Channel, Asynchronous Sample Rate Converter	4	–125	212	I^2S, R, L, TDM	SPI	128	—	—	1.8, 3.3	TQFP-64	$7.50
SRC4190	192kHz Stereo, Asynchronous Sample Rate Converters	2	–125	212	I^2S, R, L, TDM	H/W	128	—	—	3.3	SSOP-28	$4.50
SRC4192	High-End Sample Rate Converter	2	–140	212	I^2S, R, L, TDM	H/W	144	—	—	3.3	SSOP-28	$7.50
SRC4193	High-End Sample Rate Converter	2	–140	212	I^2S, R, L, TDM	SPI	144	—	—	3.3	SSOP-28	$8.50
SRC4194	4-Channel, Asynchronous Sample Rate Converter	4	–140	212	I^2S, R, L, TDM	SPI	144	—	—	1.8, 3.3	TQFP-64	$12.50
Standalone S/PDIF and AES/EBU Interfaces												
DIX4192	Digital Audio Interface Transceiver	0	—	216	AES/EBU, S/PDIF, I^2S, R, L	I^2S, SPI	—	Yes	Yes	1.8, 3.3	TQFP-48	$4.95
DIT4192	192kHz Digital Audio Transmitter	0	—	192	AES/EBU, S/PDIF, I^2S, R, L	H/W, SPI	—	No	Yes	3.3, 5.0	TSSOP-28	$2.05
DIT4096	96kHz Digital Audio Transmitter	0	—	96	AES/EBU, S/PDIF, I^2S, R, L	H/W, SPI	—	No	Yes	3.3, 5.0	TSSOP-28	$1.55
DIR9001	96kHz Digital Audio Receiver	0	—	96	AES/EBU, S/PDIF, I^2S, R, L	H/W	—	Yes	No	3.3	TSSOP-28	$1.95

Suggested resale price in U.S. dollars in quantities of 1,000.

Non-Audio Touch Screen Controllers

Device	Touch Panel	Res. (Bits)	Interface	Features	ESD	V_{REF}	Supply Voltage (V)	Power Consumption (mW)	Package(s)	Price*
ADS7843	4-Wire	12(8)	Serial, SPI	X, Y, AUX	2kV	Ext	2.7 to 5.25	1.8	SSOP-16	$1.70
ADS7845	5-Wire	12(8)	Serial, SPI	X, Y, AUX	2kV	Ext	2.7 to 5.25	1.8	SSOP-16	$4.20
ADS7846	4-Wire	12(8)	Serial, SPI	X, Y, Pressure, V_{BAT}, Temp, AUX	2kV	Int	2.7 to 5.25	1.8	SSOP-16, QFN-16 TSSOP-16, BGA-48	$2.05
TSC2000	4-Wire	8, 10, 12	Serial, SPI	Processor, X, Y, Pressure, V_{BAT}, Temp, AUX, DAC	2kV	Int	2.7 to 3.6	6.2	TSSOP-16, QFN-16, BGA-48	$2.35
TSC2003	4-Wire	12(8)	Serial, I^2C	X, Y, Pressure, V_{BAT}, Temp, AUX	2kV A , 2kV C	Int	2.7 to 5.25	1.8	TSSOP-16	$2.25
TSC2004	4-Wire	12(10)	Serial, I^2C	Processor, X, Y, Pressure, Temp, AUX	18kV A, 15kV C	Ext	Analog: 1.2 to 3.6, VI/O: 1.2 to 3.6	0.075 (typ) Std 0.6, (typ) Enhanced	2.5x2.5 WCSP-18, QFN-20	$2.10
TSC2005	4-Wire	12(10)	Serial, SPI	Processor, X, Y, Pressure, Temp, AUX	18kV A, 15kV C	Ext	Analog: 1.6 to 3.6 , VI/O: 1.2 to 3.6	0.075 (typ) Std 0.6, (typ) Enhanced	2.5x3.0 WCSP-18	$2.20
TSC2006	4-Wire	12(10)	Serial, SPI	Processor, X, Y, Pressure, Temp, AUX	18kV A, 15kV C	Ext	Analog: 1.2 to 3.6, VI/O: 1.2 to 3.6	0.075 (typ) Std 0.6, (typ) Enhanced	QFN-20	$2.00
TSC2007	4-Wire	12(8)	Serial, I^2C	Processor, X, Y, Pressure, Temp, AUX	25kV A, 15kV C	V_{DD}	1.2 to 3.6	0.04 (typ)	1.5x2.0 WCSP-12, TSSOP-16	$1.75
TSC2008	4-Wire	12(8)	Serial, SPI	Processor, X, Y, Pressure, Temp, AUX	25kV A, 15kV C	V_{DD}	1.2 to 3.6	0.04 (typ)	1.5x2.0 WCSP, QFN-16	TBD
TSC2046	4-Wire	12(8)	Serial, SPI	X, Y, Pressure, V_{BAT}, Temp, AUX	2kV A, 2kV C	Int	Analog: 2.2 to 5.25, VI/O: 1.5 to 5.25	1.8	TSSOP-16, QFN-16, BGA-48	$1.80
TSC2046E	4-Wire	12(8)	Serial, SPI	X, Y, Pressure, V_{BAT}, Temp, AUX	18kV A, 15kV C	Int	Analog: 2.2 to 5.25 VI/O: 1.5 to 5.25	0.7	TSSOP-16, QFN-16, BGA-48	$1.95
TSC2200	4-Wire	8, 10, 12	Serial, SPI	Processor, X, Y, Pressure, V_{BAT}, Temp, KP, AUX, DAC	2kV	Int	2.7 to 3.6	6.2	TSSOP-16, QFN-16, BGA-48	$2.40

Suggested resale price in U.S. dollars in quantities of 1,000.

*Preview products are listed in **bold blue.***

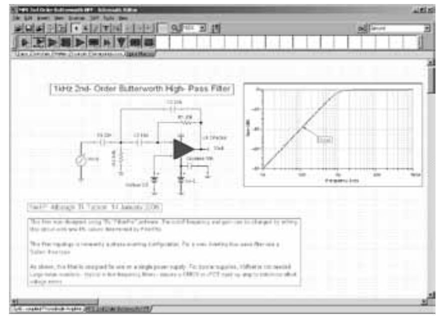
TINA-SPICE Module

TINA-SPICE Simulation Tool:

Based on a SPICE engine, TINA-TI™ Version 7.0 provides all the conventional DC, transient and frequency domain analysis of SPICE and much more. TINA has extensive post-processing capability that allows you to format results the way you want them. Virtual instruments allow you to select input waveforms and probe circuit nodes voltages and waveforms "real time". TINA's schematic capture is truly intuitive-a real "quickstart." TINA-TI Version 7.0 offers no limitation on the number of nodes or number of SPICE macromodels in the circuit. AC, DC, transient, noise, and fourier analysis are available.

TINA-TI SPICE Program

- Intuitive schematic editor
- TI macromodels** installed & ready-to-use
- Test circuit examples for each macromodel
- Over 150+ application schematics
- Easy-to-use virtual instruments
- Unlimited nodes and macromodels per schematic
- DC, AC, noise, transient, fourier analysis
- Post-processing of data results
- Easy metafile copy/paste of schematics and plots
- Enhanced convergence engine for switching power supply simulation



For advanced features consider purchasing a full version of the TINA-SPICE simulator through Designsoft at **www.designsoftware.com**

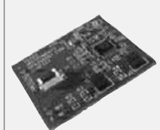
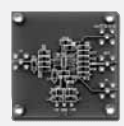
*** For conventional SPICE macromodels consult individual product folders.*

http://www.ti.com/analogelab

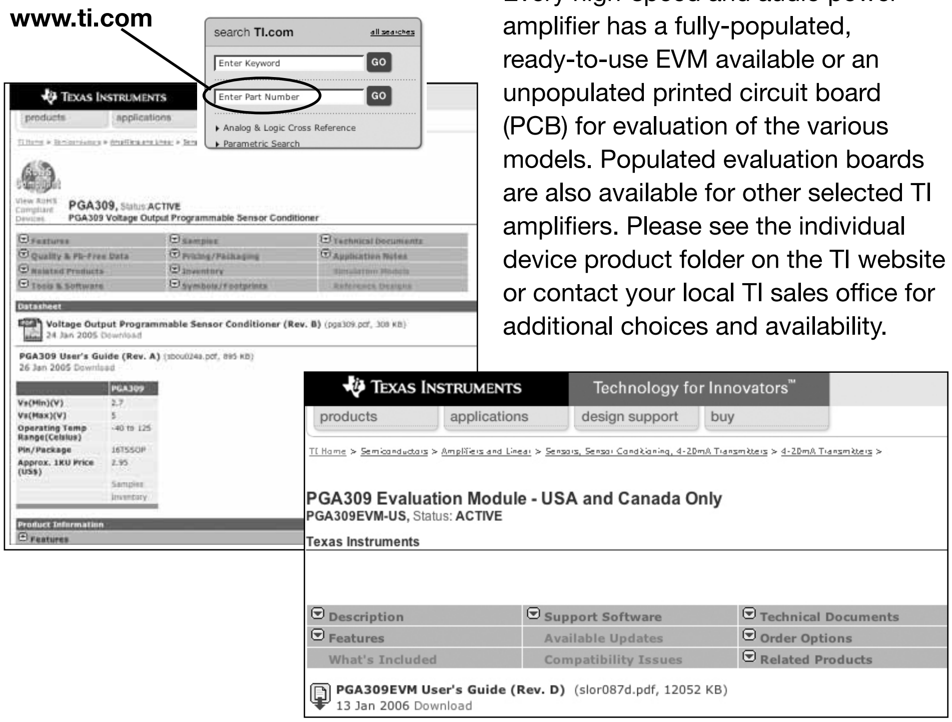
Amplifier Evaluation Modules

To ease and speed the design process, TI offers evaluation modules (EVMs) for many amplifiers and other analog products. EVMs contain an evaluation board, product data sheet and user's guide.

To find specific EVMs, enter the product number at the TI website then visit the Development Tools section of any individual product folder.

Device	High-Speed Operational Amplifiers		Audio Power Operational Amplifiers	Amplifiers
Hardware Tools				
Development Boards/EVMs	✓ Fully-Populated Ready-to-Use 	✓ Unpopulated 	✓ Universal Amplifier Boards 	✓ Fully-Populated Ready-to-use 

www.ti.com



Every high-speed and audio power amplifier has a fully-populated, ready-to-use EVM available or an unpopulated printed circuit board (PCB) for evaluation of the various models. Populated evaluation boards are also available for other selected TI amplifiers. Please see the individual device product folder on the TI website or contact your local TI sales office for additional choices and availability.

Universal op amp EVMs are unpopulated printed circuit boards that eliminate the need for dual in-line samples in the evaluation of TI amplifiers. These boards feature:

- Various packages and shutdown
- The ability to evaluate single, dual, or quad amps on several eval spaces per board
- Detachable circuit board development areas for improved portability
- User manuals with complete board schematic, board layout and numerous standard example circuits

To order your universal op amp EVMs, contact the nearest Product Information Center (PIC) listed on the back page of the guide.

Digitally Calibrated Sensor Signal Condition and 4-20mA EVMs

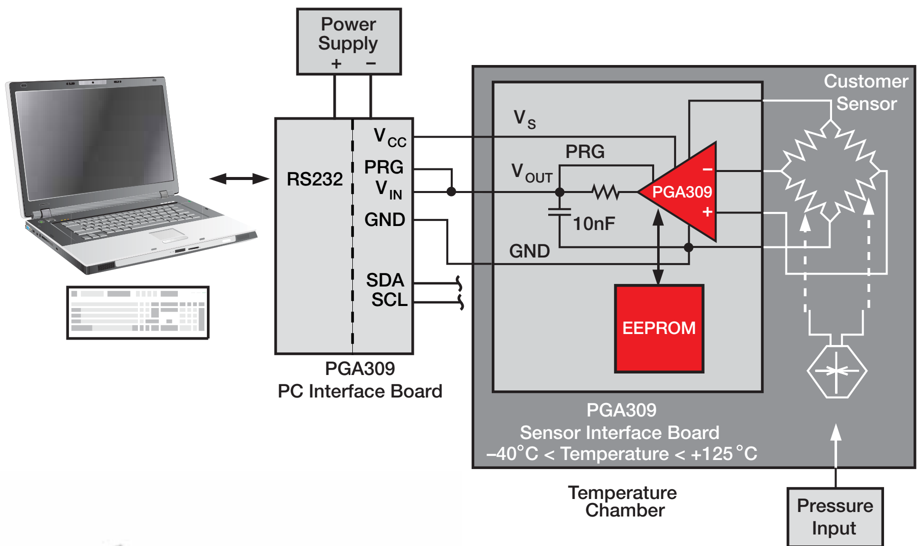
Digitally Calibrated Sensor Signal Condition and 4-20mA Evaluation Modules (EVMs)

These EVMs feature hardware and/or software tools that allow for a quick start development cycle from first conceptual test drive, through first prototype, and all the way to the first production shipment.

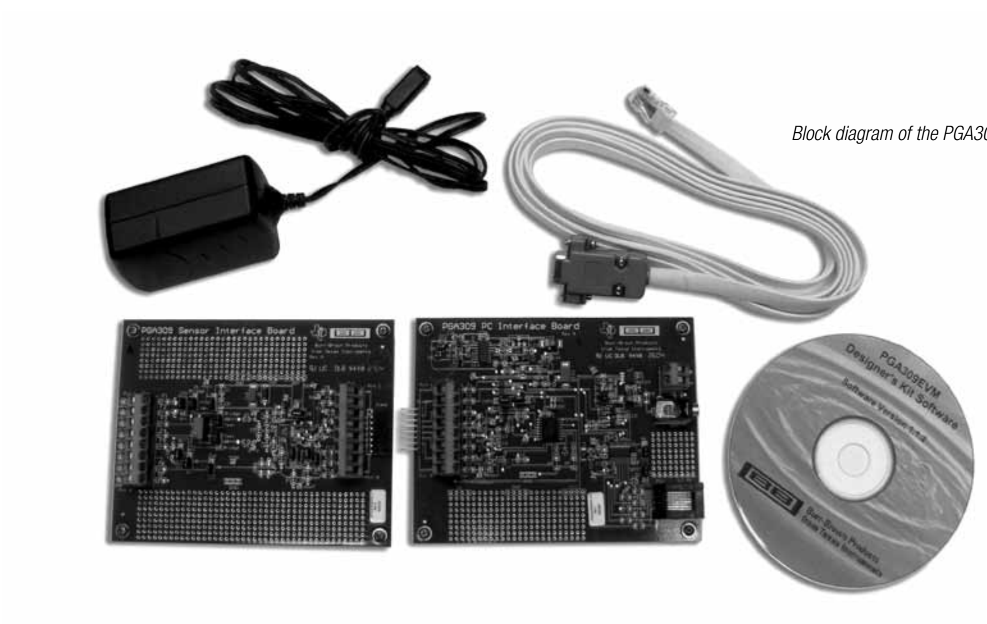
EVM Part No.	IC Part No.	Hardware	Software	EVM Description
PGA308EVM	PGA308	X	X	Resistive bridge sensor signal conditioner. Calibration to 0.1% FSR over temperature. Hardware and software for full temperature calibration. On-board real world sensor emulation feature.
PGA309EVM	PGA309	X	X	Resistive bridge sensor signal conditioner. Calibration to 0.1% FSR over temperature. Hardware and software for full temperature calibration.
XTR108EVM	XTR108	X	X	RTD signal conditioner from 10Ω to 10kΩ RTDs. Calibration to 0.1% FSR error over RTD input range. Hardware and software for 0-5V voltage output or 4-20mA output.
SensorEmulatorEVM		X	—	Complete emulation of a resistive/bridge sensor over 3 temperature ranges and over 11 strain ranges (0%, 50%, 100% - Cold, 0%, 25% 50%, 75%, 100% - Room, 0%, 50%,100% - Hot). Also complete emulation of bridge or absolute temperature sensor – Cold, Room, Hot).
XTR300EVM	XTR300	X	—	Surface mount part assembled plus default scaling values and ease of real world I/O interface.
XTR111EVM	XTR111	X	—	Surface mount part assembled plus default scaling values and ease of real world I/O interface

PGA309EVM + Sensor Emulator EVM =

Complete Bridge Sensor Conditioning Development System



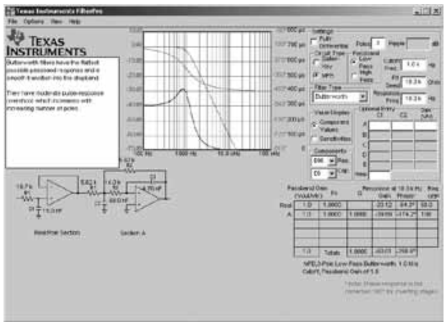
Block diagram of the PGA309EVM module.



Digitally Calibrated Sensor Signal Condition and 4-20mA EVMs

FilterPro: Active Filter Design Application:

FilterPro™ Multiple Feedback (MFB) and Sallen-Key Design Program is a Windows application. This application designs MFB and Sallen-Key low-pass and high-pass filters using Voltage Feedback Op Amps, resistors and capacitors. It also supports a fully-differential version of the MFB circuit. This program includes Bessel, Butterworth, Chebychev, and linear phase filter types and can be used to design filters from 1 to 10 poles. The capacitor values in each stage can be either selected by the computer or entered by the designer. An "always on" prompt window provides context-sensitive help information to the user. The response of the filter is displayed on a graph, showing gain, phase and group delay over frequency.

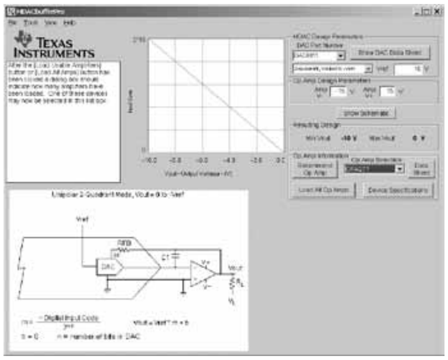


FilterPro

- Low-Pass, multi-section, active filter synthesis
- High-Pass, multi-section, active filter synthesis
- Multiple Feedback (MFB) topologies - 2^{nd} order to 10^{th} order
- Sallen-Key topologies - 2^{nd} order to 10^{th} order
- Filter Types:
  - Butterworth, Bessel, Chebychev, Linear, Phase, Gaussian, Custom
- Manual/automatic capacitor value entry
- Resistive seed value option
- Schematic and final filter values display
- Gain, phase, group delay response display

MDACBufferPro

MDACBufferPro is a Multiplying Digital to Analog Converter (MDAC) design utility that allows the designer to enter the design parameters including power supply voltage(s), output voltage range, desired MDAC device and other circuit parameters resulting in MDACBufferPro displaying the appropriate circuit configuration. With the entry of the designer's tolerance for errors, the program can then select an appropriate op amp.



MDACBufferPro

- Library supports most output buffer options.
- Enter desired output characteristics
- Guidance provided based on circuit topology and output performance required
- Unipolar and Bipolar (four quadrant multiplying) options

http://www.ti.com/analogelab

Evaluation Boards and ADCPro™ Software Make ADC Testing Easire

When you consider an analog-to-digital converter (ADC) for a new design, you can get a rapid assessment of the device with an evaluation board (EVM). If you intend to view collected time-domain, histogram, or FFT data, a new tool from TI, ADCPro, will assist in performing these tests.

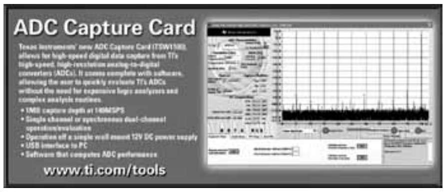
IEEE Std 1241-2000 defines how these standard tests are to be performed. There are DC and AC parameters for ADCs – and the IEEE standard describes several different possible ways of testing these parameters. The simplest method is to use a sine wave signal source and look at the resulting data record in several ways. These include time domain plots, histograms, and FFT tests. Using these three methods together will give us a good indication of what the ADC transfer characteristics are.

At TI, our ADC evaluation boards (EVMs) are produced in a modular format. This small card provides the minimal circuitry needed to make the ADC operate — in some cases a reference voltage, or a clock source (oscillator) is needed. By itself, it provides a means for customers to connect the ADC into their own system or test platform. Using our modular EVM interface boards, these EVMs can be connected to TI processors for use in code development and hardware prototyping.

To assist evaluation of the converters, we provide complete evaluation kits (identified by ending in "EVM-PDK" example ADS1258EVM-PDK). These "PDKs" consist of the modular EVM, plus a suitable motherboard to plug them into — this provides the means to collect data from the device and communicate that data to a computer, usually through a USB connection. In addition, analog-to-digital converter PDKs will include some software to help control the device under evaluation and analyze the data collected. This data analysis software is called ADCPro. Like the EVMs, ADCPro is designed in a modular fashion, using the concept of plug-ins to support different devices and different tests and analyses.

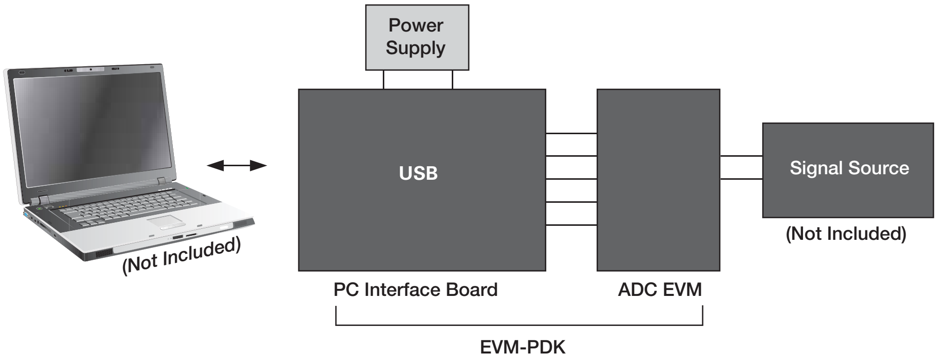
When you run ADCPro, you really use three programs: a shell program that loads plug-ins, a plug-in program that can communicate with the hardware of an EVM, and a test plug-in that analyzes data coming from the EVM plug-in. This modular design allows ADCPro to be used with a number of different data capture cards or motherboards that may ship in the EVM-PDK. Data files saved from ADCPro can be reloaded for further analysis using an EVM plug-in that simply reads files.

When considering an analog-to-digital converter for a new design, using an evaluation kit and ADCPro software can help you quickly determine the performance level of the converter to see if it meets your needs. Following the IEEE1241-2000 standard, you can use a simple sine wave input and view collected time-domain, histogram, or FFT data, and get a sense of how the ADC will perform in your application.



ADCPro

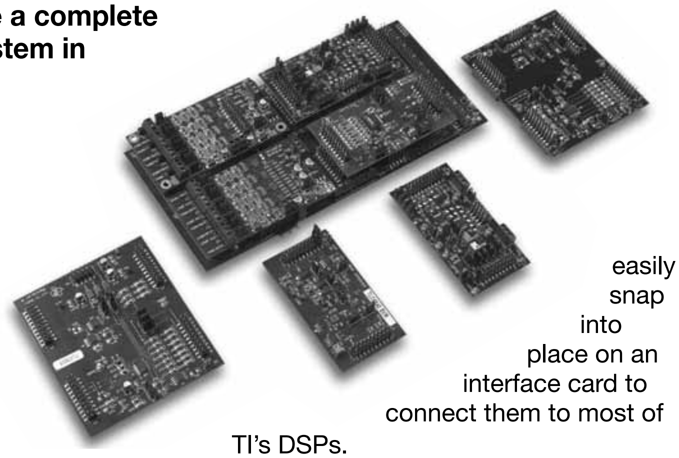
- Easy-to-use ADC evaluation software for Microsoft Windows®
- Data collection to ASCII text file
- Compatible with TI Modular EVM System
- Built-in analysis tools including scope, FFT, histogram displays
- Complete control of EVM board settings
- Easily expandable with new analysis Plug-in Tools provided by TI



Signal Chain Prototyping System

Use modular Evaluation Modules (EVMs) to prototype a complete data acquisition system in minutes!

Imagine being able to prototype your entire signal chain—input signal conditioning, A/D conversion, processor, D/A conversion and output signal conditioning–with simple building blocks. Imagine not having to lay out a printed circuit board just to evaluate a system signal processing idea.



With TI's modular EVM building blocks, you can put together a complete data acquisition system featuring signal conditioning, an A/D converter and a processor—all in just a few minutes. For a more complete system you can add on from there—a D/A converter, or more output signal conditioning. With modular EVM boards that go together easily, thanks to standardized connectors, you can quickly build a complete hardware prototype and get to writing your application code faster.

You can also build your own modules to fit this system, to accommodate circuits that may not be available directly from TI. Refer to the links at the end of this guide to find out how the system is defined. For more information:

Modular EVM Design Guidelines at:

http://www-s.ti.com/sc/psheets/slaa185/slaa185.pdf

www.ti.com/analogelab

Start with the Processor

The processor is the heart of your system. Do you need the power of a DSP, or the features of a microcontroller? You're free to choose and explore these options with the modular EVM system. The signal chain building blocks have the ability to easily snap into place on an interface card to connect them to most of TI's DSPs.

Don't need a DSP? TI's ultra-low-power MSP430 microcontroller products and MicroSystem Controllers feature built-in analog functionality. In many systems, external data conversion components may be needed to complement the built-in functions. For those cases, our broad range of data conversion products can be used with these microcontrollers.

Using FPGAs instead of a processor? Some distributors of FPGAs have developed interface boards that allow the signal chain building blocks to connect to their FPGA development systems.

If you just want to evaluate the device on the EVM using standard lab equipment, or want to try wiring the board into your existing system, the modular EVMs will allow for that as well, no processor needed. You have access to all the essential interface pins on the device through the standardized connectors. So no matter how you process the data, we've got a way to help you develop your system.

Ready to Get Started?

If you've decided to use a DSP in your system, an interface card may be required to connect your DSP Starter Kit (DSK) to the modular EVMs. Refer to the table at the end of this article to see which interface is required for your DSK. A listing of EVMs compatible with our DSKs can be found on the TI eStore. ***www.ti-estore.com***

If the TMS470 microcontroller is what you are using, the TMS470 System Development Board was designed to fit on the HPA-MCU Interface Board.

Developing with Modular EVMs

Developing software with the modular EVMs is easy. If you're using a DSP, our free Data Converter Support Plug-In for Code Composer Studio™ integrated development environment (IDE) can help you set up the DSP to interface with the data converters.

If you are developing TMS470 code with IAR Embedded Workbench, you can use the Jlink USB-JTAG Debugger to download programs to the TMS470R1B1M.

Code Examples

Code for use with the modular EVMs on the different platforms can be found in the tool folder for the EVM. Look for the Related Software section in Related Documents in the tool folder. Very often, this code is a simple project that runs on the processor used; in some cases, complete software to evaluate data converters that runs on your PC is included as well.

The data converter support plug-in residing in TI's Code Composer Studio IDE makes it easier than ever to design with TI data converter products along with TI's TMS320™ digital signal processors (DSPs).

Using the free tool in the Code Composer Studio IDE reduces the time required to configure data converters by up to 90 percent. The plug-in software module generates initialization data and interface software for the user's data converter/DSP combination using a graphical user interface, along with the necessary data structures. For many data converter EVMs and DSP Starter Kit (DSK) combinations, complete software examples containing source code and pre-coded executables to run the data converter are available. The software examples show how to design with the data converter by using the interface software generated by the

Signal Chain Prototyping System

run the data converter are available. The software examples show how to design with the data converter by using the interface software generated by the data converter plug-in module (DCP).

Software Saves Configuration Time

Today, state-of-the-art data converters are highly integrated, requiring configuration for input channel selection, filters, interfaces, adjustable gain control, offset cancellation, integrated first-in-first-out (FIFO) memory and other features. Creating data converter interface software can complicate the development effort. TI data converters and the interface software simplify the software development task, reducing time-to-market for applications using TI DSPs.

The DCP is a component of TI's industry-leading Code Composer Studio IDE and offers easy-to-use windows for "point-and-click" configuration, preventing illegal combinations of settings. The DCP automatically creates the interface software as the C source code necessary to use the data converter, then inserts the code into the existing user project. The created files contain the functions necessary to initialize the data converter, read/write sample values and to perform special functions (like power-down).

Innovations in Design Support

TI merges DSP hardware, DSP software and data converters to simplify the design process with a comprehensive DSP solution that includes peripherals.

Support is available for data converters used with TI's microcontroller generations.

The easy-to-use support software benefits developers of wireless data networking, portable audio, voice-over-packet, digital imaging, speech, motor control and a wide range of other advanced DSP-based applications.

The software has been fully tested in conjunction with the DSK and the data converter EVMs. Help files are included along with the data converter information in the plug-in module. These features minimize risk and ease the learning curve so the DSP designers can start system development quickly, concentrating their efforts in areas of product innovation to improve the value of their intellectual property and get the greatest return of investment.

Using TI's Data Converter

Interface Software

TI is committed to complementing its DSPs with a full range of data converters. Interface software for new DSP-optimized TI data converter products is planned, including DACs and ADCs, as well as codecs and selected special function devices.

The DCP module and the already available data converter software for more than 125 data converters is included with the Code Composer Studio IDE. To order Code Composer Studio IDE, visit our web page at ***dspvillage.ti.com***

As new interface software is developed, it will be made available as part of the DCP module. The new versions can be downloaded and installed in the Code Composer Studio IDE, versions 2.0 and higher.

Updates to the DCP module can be downloaded free of charge from ***www.ti.com/dcplug-in***

Data Converter Plug-In (DCP) for Code Composer Studio™ IDE

TI's Data Converter Plug-In (DCP) is a free development tool that allows the creation of initialization data and configuration software for TI data converters from within the Integrated Development Environment (IDE) of Code Composer Studio™. It provides easy-to-use windows for "point-and-click" data converter configuration from within the IDE, preventing illegal combinations of settings. The DCP dialog allows the user to select all the different settings for the data converter from a single screen and to automatically generate the interface software with a single mouse click. The generated well-documented C source files contain all functions necessary to talk to the external data converter and to set up all of the registers internal to this device. The minimum function set includes read/write functions (single words and blocks of data), initialization functions and data structures and some device-specific functions like power down.

The generated code is to a great extent hardware independent, so it can be used together with the analog evaluation modules (EVMs) from our modular EVM system, our DSP Starter Kits (DSKs) or with your own custom board.

To download your free 3.70 version of the Data Converter Plug-In for Code Composer Studio IDE, please go to: ***www.ti.com/dcplug-in***

New devices are added to the tool on a regular basis.

Data Converter Support Tool (DCP) for Code Composer Studio™ IDE

Supported Devices in Version 3.70

Device	Description	C28x™	C54x™	C55x™	C6000™	C64x™
Analog-to-Digital Converters						
ADS1216	24-bit, 8-channel, 0.78kSPS, 5V		✔	✔	✔	
ADS1217	24-bit, 8-channel, 0.78kSPS, 3.3V		✔	✔	✔	
ADS1218	24-bit, 8-channel, 0.78kSPS, with flash		✔	✔	✔	
ADS1240	24-bit, 4-channel, 15SPS		✔		✔	
ADS1241	24-bit, 8-channel, 15SPS		✔		✔	
ADS1251	24-bit, 1-channel (diff), 20kSPS		✔	✔	✔	
ADS1252	24-bit, 1-channel (diff), 40kSPS		✔	✔	✔	
ADS1253	24-bit, 4-channel (diff), 20kSPS, 1.8-3.6V		✔		✔	
ADS1254	24-bit, 4-channel (diff), 40kSPS, 5V		✔		✔	
ADS1258	24-bit, 16-channel, 125kSPS, fast channel cycling			✔[1]	✔[1]	✔[1]
ADS1271	24-bit, 1-channel, 105kSPS				✔[1]	
ADS1601	16-bit, 1-channel, 1.25MSPS			✔[1]	✔[1]	✔[1]
ADS1602	16-bit, 1-channel, 2.5MSPS			✔[1]	✔[1]	✔[1]
ADS1605	16-bit, 1-channel (diff), 5MSPS, 3.3V I/O, 5V analog			✔[1]	✔[1]	✔[1]
ADS1606	16-bit, 1-channel (diff), 5MSPS, 16 word FIFO			✔[1]	✔[1]	✔[1]
ADS1610	16-bit, 1-channel (diff), 10MSPS, 3.3V I/O, 5V analog			✔[1]	✔[1]	✔[1]
ADS1625	18-bit, 1-channel (diff), 1.25MSPS, 3.3V I/O, 5V analog			✔[1]	✔[1]	✔[1]
ADS1626	18-bit, 1-channel (diff), 1.25MSPS, 16 word FIFO			✔[1]	✔[1]	✔[1]
ADS7804	12-bit, 1-channel, 100kSPS, ±10V input range	✔		✔[1]	✔[1]	✔[1]
ADS7805	16-bit, 1-channel, 100kSPS, ±10V input range	✔		✔[1]	✔[1]	✔[1]
ADS7816	12-bit, 1-channel, 200kSPS	✔		✔[1]	✔[1]	✔[1]
ADS7817	12-bit, 1-channel, 200kSPS	✔		✔[1]	✔[1]	✔[1]
ADS7818	12-bit, 1-channel, 500kSPS	✔		✔[1]	✔[1]	✔[1]
ADS7822	12-bit, 1-channel, 200kSPS	✔		✔[1]	✔[1]	✔[1]
ADS7826	10-bit, 1-channel, 200kSPS	✔		✔[1]	✔[1]	✔[1]
ADS7827	8-bit, 1-channel, 250kSPS	✔		✔[1]	✔[1]	✔[1]
ADS7829	12-bit, 1-channel, 125kSPS, 2.7V microPower	✔		✔[1]	✔[1]	✔[1]
ADS7841	12-bit, 4-channel, 200kSPS		✔1	✔[1]	✔[1]	✔[1]
ADS7861	12-bit, 2+2-channel, 500kSPS, simultaneous sampling	✔	✔	✔	✔	✔
ADS7864	12-bit, 3x2-channels, 500kSPS, simultaneous sampling				✔[1]	✔[1]
ADS7881	12-bit, 1-channel, 4MSPS , internal reference			✔[1]	✔[1]	✔[1]
ADS7891	14-bit, 1-channel, 3MSPS, internal reference			✔[1]	✔[1]	✔[1]
ADS7886	12-bit, 1-channel, 1MSPS, internal reference	✔		✔[1]	✔[1]	✔[1]
ADS7891	14-bit, 1-channel, 3MSPS, internal reference			✔[1]	✔[1]	✔[1]
ADS803	12-bit, 1-channel, 5MSPS			✔[1]	✔[1]	✔[1]

[1] *With (E)DMA support device description*

Data Converter Plug-In (DCP) for Code Composer Studio™ IDE

Device	Description	C28x™	C54x™	C55x™	C6000™	C64x™
Analog-to-Digital Converters (continued)						
ADS804	12-bit, 1-channel, 10MSPS			✔[1]	✔[1]	✔[1]
ADS805	12-bit, 1-channel, 20MSPS			✔[1]	✔[1]	✔[1]
ADS8317	16-bit, 1-channel, 250kSPS, 2.7-5.5V, microPower			✔[1]		
ADS8318	12-bit, 1-channel, 500kSPS			✔[1]		
ADS8320	16-bit, 1-channel, 100kSPS, 2.7-5.25V			✔[1]	✔[1]	✔[1]
ADS8321	16-bit, 1-channel, 100kSPS, 4.75-5.25V			✔[1]	✔[1]	✔[1]
ADS8322	16-bit, 1-channel (diff), 500kSPS, 5V			✔[1]	✔[1]	✔[1]
ADS8323	16-bit, 1-channel (diff), 500kSPS, 5V			✔[1]	✔[1]	✔[1]
ADS8324	14-bit, 1-channel, 50kSPS, 1.8-3.6V			✔[1]	✔[1]	✔[1]
ADS8325	16-bit, 1-channel, 100kSPS, 2.7-5.5V			✔[1]	✔[1]	✔[1]
ADS8327	16-bIT, 1-channel, 500KSPS, 2.7-5.5V			✔[1]		
ADS8328	16-bIT, 2-channel, 500KSPS			✔[1]		
ADS8329	16-bIT, 1-channel, 1MSPS, 2.7-5.5V			✔[1]		
ADS8330	16-bIT, 2-channel, 1MSPS			✔[1]		
ADS8361	16-bit, 2+2-channel, 500kSPS, simultaneous sampling	✔	✔	✔	✔	✔
ADS8364	16-bit, 6-channel, 250kSPS	✔		✔	✔[1]	✔[1]
ADS8365	16-Bit, 6-channel, 250kSPS	✔		✔[1]	✔[1]	✔[1]
ADS8370	16-bit, 1-channel, 600kSPS, unipolar pseudo diff, internal reference			✔[1]	✔[1]	✔[1]
ADS8371	16-bit, 1-channel, 750kSPS, unipolar input, micro power			✔[1]	✔[1]	✔[1]
ADS8372	16-bit, 1-channel (diff), 600kSPS, pseudo bipolar, internal reference			✔[1]	✔[1]	✔[1]
ADS8380	18-bit, 1-channel, 600kSPS, unipolar pseudo diff, internal reference			✔[1]	✔[1]	✔[1]
ADS8381	18-bit, 1-channel, 580kSPS			✔[1]	✔[1]	✔[1]
ADS8382	18-bit, 1-channel (diff), 600kSPS, pseudo bipolar, internal reference			✔[1]	✔[1]	✔[1]
ADS8383	18-bit, 1-channel, 500kSPS			✔[1]	✔[1]	✔[1]
ADS8401	16-bit, 1-channel, 1.25MSPS, unipolar input	✔		✔[1]	✔[1]	✔[1]
ADS8402	16-bit, 1-channel, 1.25MSPS, bipolar input	✔		✔[1]	✔[1]	✔[1]
ADS8405	16-bit, 1-channel, 1.25MSPS, unipolar input	✔		✔[1]	✔[1]	✔[1]
ADS8406	16-bit, 1-channel, 1.25MSPS, bipolar input	✔		✔[1]	✔[1]	✔[1]
ADS8411	16-bit, 1-channel, 2MSPS, unipolar input			✔[1]	✔[1]	✔[1]
ADS8412	16-bit, 1-channel, 2MSPS, bipolar input			✔[1]	✔[1]	✔[1]
ADS8422	16-bit, 1-channel, 4MSPS, pseudo bipolar, differential input			✔[1]	✔[1]	✔[1]
ADS8472	16-Bit, 1-channel, 1MSPS, pseudo-bipolar, differential input			✔[1]	✔[1]	✔[1]
ADS8481	18-bit, 1-channel, 1MSPS, pseudo differential, unipolar input			✔[1]	✔[1]	✔[1]
ADS8482	18-bit, 1-channel, 1MSPS, pseudo bipolar, fully differential			✔[1]	✔[1]	✔[1]
ADS8504	12-bit, 1-channel, 250kSPS, ±10V input range	✔		✔[1]	✔[1]	✔[1]
ADS8505	16-bit, 1-channel, 250kSPS, ±10V input range	✔		✔[1]	✔[1]	✔[1]
PCM1804	24-bit, stereo, 192kHz, audio ADC		✔	✔	✔[1]	✔[1]
PCM4202	24-bit, stereo, 192kHz, audio ADC		✔	✔	✔[1]	✔[1]
PCM4204	24-bit, 4-channel, 216kHz, audio ADC				✔[1]	
THS10064	10-bit, 4-channel, 6MSPS, 16 word FIFO	✔	✔	✔[1]	✔[1]	✔[1]
THS1007	10-bit, 4-channel, 8MSPS					
THS10082	10-bit, 2-channel, 8MSPS, 16 word FIFO	✔	✔	✔[1]	✔[1]	✔[1]
THS1009	10-bit, 2-channel, 8MSPS					
THS1206	12-bit, 4-channel, 6MSPS, 16 word FIFO	✔	✔	✔[1]	✔[1]	✔[1]
THS1207	12-bit, 4-channel, 8MSPS					
THS12082	12-bit, 2-channel, 8MSPS, 16 word FIFO	✔	✔	✔[1]	✔[1]	✔[1]
THS1209	12-bit, 2-channel, 8MSPS	✔	✔	✔[1]	✔[1]	✔[1]

[1] *With (E)DMA support device description*

Remarks

C28x: *A check-mark in this column indicates that the data converter support tool generates a full driver for the TMS320C2800 family, which not only configures the data converter, but also the peripheral the device is connected to (e.g. the serial port or the memory interface). If no check-mark is present, only the register settings, but no interface functions are generated.*

C54x: *A check-mark in this column indicates that the data converter support tool generates a full driver for the TMS320C5400 family, which not only configures the data converter, but also the peripheral the device is connected to (e.g. the serial port or the memory interface). If no check-mark is present, only the register settings, but no interface functions are generated.*

C55x: *A check-mark in this column indicates that the data converter support tool generates a full driver for the TMS320C5500 family, which not only configures the data converter, but also the peripheral the device is connected to (e.g. the serial port or the memory interface). If no check-mark is present, only the register settings, but no interface functions are generated.*

C6000: *A check-mark in this column indicates that the data converter support tool generates a full driver for the TMS320C6200/C6700 family, which not only configures the data converter, but also the peripheral the device is connected to (e.g. the serial port or the memory interface). If no check-mark is present, only the register settings, but no interface functions are generated.*

C64x: *A check-mark in this column indicates that the data converter support tool generates a full driver for the TMS320C6400 family, which not only configures the data converter, but also the peripheral the device is connected to (e.g. the serial port or the memory interface). If no check-mark is present, only the register settings, but no interface functions are generated.*

The online version of this table can be found at: www.ti.com/dcplug-in

Data Converter Plug-In (DCP) for Code Composer Studio™ IDE

Device	Description	C28x™	C54✔x™	C55x™	C6000™	C64✔x™
Analog-to-Digital Converters (Continued):						
THS1401	14-bit, 1-channel, 1MSPS					
THS1403	14-bit, 1-channel, 3MSPS					
THS1408	14-bit, 1-channel, 8MSPS					
THS14F01	14-bit, 1-channel, 1MSPS, 32 word FIFO					
THS14F03	14-bit, 1-channel, 3MSPS, 32 word FIFO					
TLC1514	10-bit, 4-channel, 400kSPS					
TLC1518	10-bit, 8-channel, 400kSPS					
TLC2551	12-bit, 1-channel, 400kSPS, 5V		✔			
TLC2552	12-bit, 2-channel, 175kSPS, 5V		✔			
TLC2554	12-bit, 4-channel, 400kSPS					
TLC2555	12-bit, 1-channel, 175kSPS, 5V		✔			
TLC2558	12-bit, 8-channel, 400kSPS					
TLC2574	12-bit, 4-channel, 200kSPS, 5V		✔			
TLC2578	12-bit, 8-channel, 200kSPS, 5V		✔			
TLC3541	14-bit, 1-channel, 200kSPS, 5V		✔		✔	
TLC3544	14-bit, 4-channel, 200kSPS, 5V		✔			
TLC3545	14-bit, 1-channel (diff), 200kSPS, 5V		✔		✔	
TLC3548	14-bit, 8-channel, 200kSPS, 5V		✔			
TLC3574	14-bit, 4-channel, 200kSPS, 5V		✔			
TLC3578	14-bit, 8-channel, 200kSPS, 5V		✔			
TLC4541	16-bit, 1-channel, 200kSPS, 5V		✔		✔	
TLC4545	16-bit, 1-channel (diff), 200kSPS, 5V		✔		✔	
TLV1504	10-bit, 4-channel, 200kSPS		✔		✔	
TLV1508	10-bit, 8-channel, 200kSPS		✔		✔	
TLV1570	10-bit, 8-channel, 1.25MSPS		✔			
TLV1571	10-bit, 1-channel, 1.25MSPS		✔		✔[1]	
TLV1572	10-bit, 1-channel, 1.25MSPS, 2.5-5.5V		✔			
TLV1578	10-bit, 8-channel, 1.25MSPS		✔		✔[1]	
TLV2541	12-bit, 1-channel, 200kSPS, 2.7-5.5V		✔			
TLV2542	12-bit, 2-channel, 140-200kSPS, 2.7-5.5V		✔			
TLV2544	12-bit, 4-channel, 200kSPS		✔		✔[1]	
TLV2545	12-bit, 1-channel, 140-200kSPS, 2.7-5.5V		✔			
TLV2548	12-bit, 8-channel, 200kSPS		✔		✔[1]	
TLV2553	12-bit, 11-channel, 200kSPS, 2.7-5V	✔	✔	✔	✔	✔
TLV2556	12-bit, 11-channel, 200kSPS, 2.7-5V, internal reference	✔	✔	✔	✔	✔
Digital-to-Analog Converters						
DAC1220	16-bit, 1-channel, 2ms					
DAC1221	16-bit, 1-channel, 2ms					
DAC7512	12-bit, 1-channel, 10µs, 2.7-5.5V, internal reference					
DAC7513	12-bit, 1-channel, 10µs, 2.7-5.5V					
DAC7551	12-bit, 1-channel, 5µs, ultra-low glitch, voltage output	✔		✔[1]	✔[1]	✔[1]
DAC7552	12-bit, 2-channel, 5µs, ultra-low glitch, voltage output	✔		✔[1]	✔[1]	✔[1]
DAC7554	12-bit, 4-channel, 5µs, 2.7-5.5V	✔	✔[1]	✔[1]	✔[1]	✔[1]
DAC8501	16-bit, 1-channel, 10µs, 2.7-5.5V, MDAC	✔		✔[1]	✔[1]	✔[1]
DAC8531	16-bit, 1-channel, 10µs, 2.7-5.5V	✔		✔[1]	✔[1]	✔[1]
DAC8532	16-bit, 2-channel, 10µs, 2.7-5.5V	✔	✔	✔[1]	✔[1]	✔[1]
DAC8534	16-bit, 4-channel, 10µs, 2.7-5.5V	✔		✔[1]	✔[1]	✔[1]
DAC8551	16-bit, 1-channel, 5µs, ultra-low glitch, voltage output	✔		✔[1]	✔[1]	✔[1]
DAC8552	16-bit, 2-channel, 10µs, ultra-low glitch, voltage output	✔		✔[1]	✔[1]	✔[1]
DAC8554	12-bit, 4-channel, 5µs, ultra-low glitch, voltage output	✔		✔1	✔[1]	✔[1]
DAC8560	16-bit, 1-channel, 200kSPS, voltage output	✔		✔[1]	✔[1]	✔[1]
DAC8580	16-bit, 1-channel, 1µs			✔[1]	✔[1]	✔[1]
DAC8581	16-bit, 1-channel, 2MSPS, voltage output	✔		✔[1]	✔[1]	✔[1]
DAC8805	14-bit, 20channel, 0.5µs, multiplying DAC			✔[1]	✔[1]	✔[1]
DAC8806	14-bit, 1-channel, 0.µs, multiplying DAC			✔[1]	✔[1]	✔[1]
DAC8814	16-bit, 4-channel, 2MSPS	✔		✔	✔[1]	✔[1]
DAC8820	16-bit, 1-channel, 0.5µs, multiplying DAC			✔	✔[1]	✔[1]
TLC5618A	12-bit, 2-channel, 2.5µs, 5V		✔		✔[2]	
DAC8534	16-bit, 4-channel, 10µs, 2.7-5.5V	✔	✔	✔[1]	✔[1]	✔[1]
DAC8551	16-bit, 1-channel, 5µs, ultra-low glitch, voltage output	✔		✔[1]	✔[1]	✔[1]

[1]With (E)DMA support [2]These DACs share the same driver, so an additional alignment might be necessary.

Data Converter Plug-In (DCP) for Code Composer Studio™ IDE

Device	Description	C28x™	C44x™	C55x™	C6000™	C64x™
Digital-to-Analog Converters (Continued):						
TLV320DAC23	24-bit, stereo, 96kHz, audio DAC					
TLV5604	10-bit, 4-channel, 3µs, 2.7-5.5V					
TLV5606	10-bit, 1-channel, 3µs, 2.7-5.5V		✔		✔[2]	
TLV5608	10-bit, 8-channel, 1µs, 2.7-5.5V					
TLV5610	12-bit, 8-channel, 1µs, 2.7-5.5V					
TLV5614	12-bit, 4-channel, 3µs, 2.7-5.5V					
TLV5616	12-bit, 1-channel, 3µs, 2.7-5.5V		✔		✔[2]	
TLV5617A	10-bit, 2-channel, 2.5µs, 2.7-5.5V		✔		✔[2]	
TLV5618A	12-bit, 2-channel, 2.5µs, 2.7-5.5V		✔		✔[2]	
TLV5623	8-bit, 1-channel, 3µs, 2.7-5.5V		✔		✔[2]	
TLV5624	8-bit, 1-channel, 1µs, 2.7-5.5V, internal reference		✔		✔[2]	
TLV5625	8-bit, 2-channel, 2.5µs, 2.7-5.5V		✔		✔[2]	
TLV5626	8-bit, 2-channel, 1µs, 2.7-5.5 V, internal reference		✔		✔[2]	
TLV5629	8-bit, 8-channel, 1µs, 2.7-5.5V					
TLV5630	12-bit, 8-channel, 1µs, 2.7-5.5V, internal reference					
TLV5631	10-bit, 8-channel, 1µs, 2.7-5.5V, internal reference					
TLV5632	8-bit, 8-channel, 1µs, 2.7-5.5V					
TLV5636	12-bit, 1-channel, 1µs, 2.7-5.5V, internal reference		✔		✔[2]	
TLV5637	10-bit, 2-channel, 1µs, 2.7-5.5V, internal reference		✔		✔[2]	
TLV5638	12-bit, 2-channel, 1µs, 2.7-5.5V, internal reference		✔		✔[2]	
Codecs						
AIC111	16-bit, 1-channel, 40kSPS, 1.3V, micro-power		✔			
PCM3002	20-bit, stereo, 48kHz		✔		✔	
TLV320AIC10	16-bit, 1-channel, 22kSPS, voiceband codec				✔	
TLV320AIC11	16-bit, 1-channel, 22kSPS, voiceband codec				✔	
TLV320AIC12	16-bit, 1-channel, 26/104kSPS, voiceband codec		✔	✔	✔	✔
TLV320AIC13	16-bit, 1-channel, 26/104kSPS, voiceband codec, 1.1V I/O		✔	✔	✔	✔
TLV320AIC14	16-bit, 1-channel, 26/104kSPS, voiceband codec		✔	✔	✔	✔
TLV320AIC15	16-bit, 1-channel, 26/104kSPS, voiceband codec, 1.1V I/O		✔	✔	✔	✔
TLV320AIC20	16-bit, 2-channel, 26/104kSPS, voiceband codec, 3.3V I/O		✔	✔	✔	✔
TLV320AIC21	16-bit, 1-channel, 26/104kSPS, voiceband codec, 1.1V I/O		✔	✔	✔	✔
TLV320AIC22C	16-bit, 2-channel, 16kHz, dual VOIP codec		✔	✔	✔	
TLV320AIC23B	24-bit, stereo, 96kHz, stereo audio codec		✔[1]	✔[1]	✔[1]	✔[1]
TLV320AIC24	16-bit, 1-channel, 26/104kSPS, voiceband codec, 3.3V I/O		✔	✔	✔	✔
TLV320AIC25	16-bit, 1-channel, 26/104kSPS, voiceband codec, 1.1V I/O		✔	✔	✔	✔
Application Specific						
AFE1230	16-bit, 1-channel, 2.5Mbps, G.SHDSL analog front end			✔		
AFEDRI8201	12-bit, 1-channel, 80MHz, ADC front end for AM/FM and HD radios			✔		
AMC7820	12-bit, 8-channel, 100kSPS, analog monitoring and control circuitry		✔		✔	
AMC7823	12-bit, 8-channel, 200kSPS, analog monitoring and control circuitry	✔				

[1]With (E)DMA support [2]These DACs share the same driver, so an additional alignment might be necessary.

High-Speed DAC Demonstration Kits

TSW evaluation modules (EVMs) are system-solution evaluation tools that help reduce design cycle time by providing designers with an initial proof of concept.

TSW3070EVM Demonstration Kit

Includes the DAC5682Z with each of the two outputs driving into high-speed, current-feedback amplifiers, OPA695 and THS3091/5, CDCM7005, synchronizer and jitter cleaner, power supply circuits as well as user-friendly GUI for easy DAC configuration. The TSW3070 pairs easily with the TSW3100EVM pattern generator, providing easy control for use in rapid prototyping.

Key Features

- Quick evaluation
  - Ready-to-use demonstration kit
  - Simple USB GUI interface
  - Complete solution utilizing DAC, amp, clock and power management
- DAC5682Z dual-channel, 1GSPS DAC with current sink output
- OPA695 current-feedback amplifier with 1.4GHz bandwidth
- THS3091/5 high voltage swing amplifier with 30V supply voltage
- CDCM7005 jitter cleaner with 800MHz VCXO and10MHz reference for complete on-board clock solution
- TPS, UCC family of regulators for complete on-board voltage supplies from a single 6VDC wall supply.
- Flexibility to implement alternative design configurations
- Active output 1: OPA695 and THS3091/5 support wide bandwidth or large voltage swing with gain
- Passive output: transformer with no gain
- Optional capabilities:
  - External VCXO input
  - Baseband filtering to filter out DAC images

For more information, go to
www.ti.com/tsw3070

TSW1200EVM Demonstration Kit

The TSW1200EVM is a circuit board that assists designers in prototyping and evaluating the performance of high speed analog to digital converters (ADCs) that feature parallel or serialized LVDS outputs. When combined with the ADS6000 family of EVM products, the TSW1200EVM is a circuit board that assists designers in prototyping and evaluating the performance of high speed analog to digital converters (ADCs) that feature parallel or serialized LVDS outputs. When combined with the ADS6000 family of EVM products, the TSW1200EVM allows for easy data capture and offers a flexible evaluation environment for ADC analysis. In addition, the TSW1200EVM features a powerful Virtex 4 FPGA from Xilinx which can be used as a flexible and rapid prototyping environment for designing digital circuits that directly interface to TI LVDS output ADCs.

The TSW1200EVM comes preloaded with data capture routines for 10 to 16-bit ADCs with both parallel and serialized LVDS outputs and is compatible with all ADCs listed in the Related Devices section of this website. The EVM can be connected to a PC via a USB cable for data analysis. A detailed application report and deserialization source code can be found on Xilinx's website: ***http://direct.xilinx.com/bvdocs/appnotes/xapp866.pdf.***

Key Features

- High speed LVDS ADC interface connection.
- Xilinx 4 LX25 FPGA.
- Factory installed capture solution for parallel and serialized output LVDS
- 64k capture depth with USB transfer
- Eight Deserialized Output Channels with 3.3 V CMOS voltage levels.
- Eight Deserialized Output Channels with 3.3 V CMOS voltage levels.

For more information, go to
www.ti.com/tsw1200

High-Speed DAC Demonstration Kits

TSW evaluation modules (EVMs) are are system-solution evaluation tools that help reduce design cycle time by providing designers with an initial proof of concept.

TSW3100EVM Pattern Generation Circuit Board

The TSW3100EVM assists designers in prototyping and evaluating the performance of high- speed digital-to-analog converters. The TSW3100EVM features a high-speed DDR LVDS data output bus capable of providing 16-bits of data at 1GSPS per bit, as well as a dual, 16-bit CMOS interface capable of 250MSPS per bit. When combined with TI's catalog of high-speed DAC evaluation modules, the TSW3100EVM allows for easy data pattern generation and offers a flexible evaluation environment for TI's family of high-speed DACs including all DAC568x, DAC567x, DAC56x2, DAC290x and DAC90x families.

The TSW3100EVM includes a powerful Altera Stratix II FPGA and 256 Megabits of DDR2 SDRAM which can provide up to 256 Mega vectors of pattern depth in LVDS output mode and 64 Mega vectors of pattern depth in CMOS output mode.

The TSW3100EVM connects directly to a PC via a 100Mbps 10/100 Ethernet connection and can be controlled with a standard TFTP interface browser (Internet Explorer, Firefox), providing easy control for use in rapid prototyping.

For more information, go to
www.ti.com/tsw3100

TSW4100—4-Channel Cellular Wideband Digital Repeater Demonstration Kit

The TSW4100 demonstration kit provides a complete IF transceiver signal chain implementation and a digital filter design tool, which allows equipment manufacturers to bring wireless infrastructure digital repeater systems to market faster and more cost effectively than previously possible. The TSW4100 can amplify three channels (each 5MHz wide) and one channel (10MHz wide) without interfering with or amplifying other channels in the spectrum. The TSW4100 can be used to rapidly implement a proof-of-concept design of a repeater. The TSW4100 demo kit, complete with digital filter design software, can cut the time for developing precision repeater signal filters by a factor of 10 over analog filter design techniques.

At the heart of the TSW4100 demonstration kit is TI's GC5016 digital upconverter (DUC)/digital downconverter (DDC), a digital signal processing device designed for high-speed, high-bandwidth applications like 3G cellular base station and wideband digital repeaters. Additionally, the kit features several of TI's high-performance analog solutions, including the ADS5545, a 14-bit, 170MSPS ADC, the DAC5688, a dual, 16-bit, 800MSPS interpolating DAC, and the CDCM7005, a clock generation and distribution device.

For more information, go to
www.ti.com/tsw4100

Key Features

- Quick evaluations with ready-to-use demonstration kit
- Complete IF transceiver signal chain for a wideband digital repeater design
- Isolates up to four non-contiguous spectrum bands, each as wide as 35MHz
- On-board devices are programmed with a PC-based GUI software tool
- Includes a filter configuration too for rapid digital filter prototyping
- Three easily selectable input/output IF frequency ranges:
  - o 0 to 80MHz
  - o 80MHz to 160MHz
  - o 160MHz to 240MHz
- Flexibility to implement alternative design configurations of one or two channels with this same chipset
- Includes clock generation and distribution circuit
- 3A DC power supply (5V included)

High-Speed DAC Demonstration Kits

TSW7001EVM Demonstration Kit

The TSW7001EVM includes the VCA824 to provide the voltage-controlled gain amplifier function, FET op amp option, OPA656, for high-impedance applications, precision op amp, OPA72, to generate ± control signal, 16-bit precision DAC, DAC8831, for custom VCA control voltage, on-board regulated power supply circuits as well as user-friendly USB GUI interface.

Key Features

- Quick evaluation
- Ready-to-use demonstration kit
- Simple USB GUI interface
- Complete solution utilizing DAC, amp, clock and power management
- VCA824: ultra-wideband, >40dB gain adjust range, linear in V/V, variable gain amplifier
- DAC58831: 16-bit, 1MHz precision DAC
- OPA727: e-trim™ 20MHz, high-precision CMOS op amp
- CDCM7005: jitter cleaner with 800MHz VCXO and10MHz reference for complete on-board clock solution
- TPS, UCC family of regulators for complete, on-board voltage supplies from a single 6VDC wall supply.
- Flexibility to implement alternative design configurations
- Optional capabilities:
  - OPA656: wide-bandwidth, unity-gain stable, FET amplifier for input impedance applications

For more information, go to ***www.ti.com/tsw7001***

TSW3003—RF Transmit Signal Chain Demonstration Kit

The TSW3003 demonstration kit is designed for wireless base station transceivers, fixed wireless transmitters and digital predistortion applications using full IQ compensation, selectable interpolation, flexible input options and multiple outputs. This new tool implements all the necessary circuits from the DAC input to the output of the RF IQ modulation.

This tool demonstrates an in-phase and quadrature (IQ) modulation transmit system with impressive RF performance numbers and the versatility to be adapted to various RF applications. The TSW3003 demonstration kit include the DAC5687, a 16-bit, 500MSPS DAC; the CDCM7005, a clock device to satisfy clocking requirements for the accompanying devices; a passive interface to the TRF3703, a direct-launch IQ modulator; and the TRF3761, an integer N PLL with an integrated VCO to drive the local oscillator of the TRF3703.

For more information, go to: ***www.ti.com/tsw3003***

Key Features

- Over 76dB of ACPR for one WCDMA carrier at 2.14GHz
- Full IQ compensation including DC offset, gain and phase control for excellent LO and sideband suppression
- 500MSPS, 16-bit resolution DAC
- Complex mixer with 32-bit NCO, and coarse mixer at Fs/4 and Fs/2
- RF carriers tunable from 374MHz to 2385MHz with an integer N PLL and integrated VCO
- RF output power at 1dB compression point of +9dBm, OIP3 of 23dBm
- Three independent clock outputs selectable by /2n, LVPECL/LVCMOS interface
- Requires single 6VDC wall supply included, power management onboard
- Easy-to-use graphical user interface simplifies system setup
- USB interface

Amplifier and Signal Processing Application Reports

Title	Lit No.
4-20mA Transmitters	
IC Building Blocks Form Complete Isolated 4-20mA Current-Loop	SBOA017
Single Supply 4-20mA Current Loop Receiver	SBOA023
Use Low-Impedance Bridges on 4-20mA Current Loop	SBOA025
Implementing a 4 mA to 20 mA Current Loop on TI DSPs	SZZA045
ADC Interfaces	
High-Speed Data Conversion	SBAA045
RLC Filter Design for ADC Interface (Rev. A)	SBAA108
ADS8342 ADC SAR Inputs	SBAA127
Interfacing the VCA8617 with High-Speed ADCs	SBAA130
Interfacing the VCA8613 with High-Speed ADCs	SBAA131
Measuring Single-Ended 0V-5V Signals with Differential Delta-Sigma ADCs	SBAA133
Wideband Complementary Current Output DAC Single-Ended Interface	SBAA135
High-Voltage Signal Conditioning for Differential ADCs	SBOA096
Design Methodology for MFB Filters in ADC Interface Applications	SBOA114
Connecting ADS8410/13 With Long Cable	SLAA284
Multiplexing ADS8411	SLAA285
Amplifiers and Bits: An Introduction to Selecting Amplifiers for Data Conv.	SLOA035
Buffer Op Amp to ADC Circuit Collection	SLOA098
Interfacing op amps and analog-to-digital converters	SLYT104
Evaluating operational amplifiers as input amplifiers for A-to-D converters	SLYT193
Low-power, high-intercept interface to the ADS5424, 105MSPS converter	SLYT223
Matching the Noise Performance of the Operational Amplifier to the ADC	SLYT237
DAC Interfaces	
Design for a Wideband, Differential Transimpedance DAC Output	SBAA150
Amp/Switched Integrator	
Implementation and Applications of Current Sources and Current Receivers	SBOA046
Compensate Transimpedance Amplifiers Intuitively	SBOA055
Amplifier and Noise	
Noise Analysis for High-Speed Op Amps	SBOA066
Noise Analysis In Operational Amplifier Circuits (Rev. A)	SLVA043
Amplifier Basics	
Handbook of Operational Amplifier Applications	SBOA092
Understanding Operational Amplifier Specifications	SLOA011
Effect of Parasitic Capacitance in Op Amp Circuits (Rev. A)	SLOA013
Feedback Amplifier Analysis Tools (Rev. A)	SLOA017
Stability Analysis of Voltage-Feedback Op Amps, Including Compensation Technique (Rev. A)	SLOA020
Understanding Basic Analog - Active Devices (Rev. A)	SLOA026
Understanding Basic Analog Passive Devices	SLOA027
Selecting High-Speed Operational Amplifiers Made Easy (Rev. A)	SLOA051
DC Parameters: Input Offset Voltage	SLOA059
How (Not) To Decouple High-Speed Operational Amplifiers	SLOA069
Using Texas Instruments SPICE models in PSPICE	SLOA070
Expanding the Usability of Current-Feedback Amplifiers	SLYT099
RF and IF Amplifiers with Op Amps	SLYT102
Using a Decompensated Op Amp for Improved Performance	SLYT174
Audio Amplifiers	
Audio Power Amplifier Solutions for New Wireless Phones	SLOA053
Guidelines for Measuring Audio Power Amplifier Performance	SLOA068
Calculating Gain for Audio Amplifiers	SLOA105
Measuring Class-D Amplifiers for Audio Speaker Overstress Testing	SLOA116
Current-Feedback Amplifiers	
The Current-Feedback Op Amp: A High-Speed Building Block	SBOA076
Current Feedback Amps: Review, Stability Analysis,and Applications	SBOA081
Stabilizing Current-Feedback Op Amp while optimizing circuit performance using Pspice	SBOA095
A Current Feedback Op-Amp Circuit Collection	SLOA066
Voltage Feedback vs. Current Feedback Op Amps	SLVA051

Title	Lit No.
Difference Amplifiers	
Fully-Differential Amplifiers (Rev. D)	SLOA054
A Differential Operational Amplifier Circuit Collection	SLOA064
Differential Op Amp Single-Supply Design Techniques	SLOA072
Fully-Differential OP Amps Made Easy	SLOA099
Active Output Impedance for ADSL Line Drivers	SLOA100
Low-Power, High-Intercept Interface to the ADS5424, 105MSPS Converter	SLYT223
Analysis of Fully Differential Amplifiers	SLYT157
General Tutorials	
Dynamic Tests for ADC Performance	SBAA002
Selecting an ADC	SBAA004
A Glossary of Analog-to-Digital Specifications and Performance Characteristics	SBAA146
Understanding Data Converters	SLAA013
The Op Amp's Place in the World (Chap.1-Op Amps for Everyone)	SLOA073
Review of Circuit Theory (Chap. 2-Op Amps for Everyone)	SLOA074
Development of Ideal Op Amp Equations (Chap. 3-Op Amps for Everyone)	SLOA075
Single-Supply Op Amp Design Techniques (Chap. 4-Op Amps for Everyone)	SLOA076
Feedback and Stability Theory (Chap. 5-Op Amps for Everyone)	SLOA077
Development of the Non-Ideal Op Amp Equations (Chap. 6-Op Amps for Everyone)	SLOA078
Voltage Feedback Op Amp Compensation (Chap. 7-Op Amps for Everyone)	SLOA079
Current Feedback Op Amp Analysis (Chap. 8-Op Amps for Everyone)	SLOA080
Voltage and Current-Feedback Op Amp Comparison (Chap. 9-Op Amps for Everyone)	SLOA081
Op Amp Noise Theory and Applications (Chap. 10-Op Amps for Everyone)	SLOA082
Understanding Op Amp Parameters (Chap. 11-Op Amps for Everyone)	SLOA083
Instrumentation: Sensors to A/D Converters (Chap. 12-Op Amps for Everyone)	SLOA084
Wireless Communication Signal Conditioning for IF Sampling (Chap. 13-OAE)	SLOA085
Interfacing D/A Converters to Loads (Chap. 14-Op Amps for Everyone)	SLOA086
Sine Wave Oscillator (Chap. 15-Op Amps for Everyone)	SLOA087
Active Filter Design Techniques (Chap. 16-Op Amps for Everyone)	SLOA088
Circuit Board Layout Techniques (Chap. 17-Op Amps for Everyone)	SLOA089
Designing Low-Voltage Op Amp Circuits (Chap. 18-Op Amps for Everyone)	SLOA090
Single-Supply Circuit Collection (Appendix A)	SLOA091
Op Amps for Everyone Design Guide and Excerpts	SLOD006
Fully Differential Amplifiers Applications: Line Termination, Driving High-Speed ADCs, and Differential Transmission Lines	SLYT143
Introduction to phase-locked loop system modeling	SLYT169
Instrumentation Amplifiers	
AC Coupling Instrumentation and Difference Amplifiers	SBOA003
Programmable-Gain Instrumentation Amplifiers	SBOA024
Precision Absolute Value Circuits	SBOA068
PGA309 Quick Start System Reference Guide	SBOA103
Signal Conditioning Wheatstone Resistive Bridge Sensors	SLOA034
Getting the Most Out of Your Instrumentation Amplifier Design	SLYT226
Isolation Amplifiers	
Composite Op Amp Gives You The Best of Both Worlds	SBOA002
Isolation Amps Hike Accuracy and Reliability Composite Amplifier	SBOA064
Layout	
Measuring Board Parasitics in High-Speed Analog Design	SBOA094
NanoStar™ & NanoFree™ 300_m Solder Bump WCSP Application	SBVA017
PowerPAD™ Thermally Enhanced Package Application Report	SLMA002
High-Speed Operational Amplifier Layout Made Easy	SLOA046
Power Amplifiers and Buffers	
Combining an Amplifier with the BUF634	SBOA0651

Amplifier and Signal Processing Application Reports

Title	Lit No.
Rail-to-Rail Amplifiers	
Use of Rail-to-Rail Operational Amplifiers (Rev. A)	SLOA039
A Single Supply Op Amp Circuit Collection	SLOA058
References	
The Design and Performance of a Precision Voltage Reference Circuit for 14-bit and 16-bit	SLYT168
A-to-D and D-to-A Converters	
Precision Voltage References	SLYT183
Switch Mode	
Conditioning a Switch-Mode Power Supply Current Signal	SLOA044
PWM Power Driver Modulation Schemes	SLOA092
Transimpedance	
Comparison of Noise Performance of FET Transimpedance	SBOA034
Using TI Op Amps for Filtering	
Getting the Full Potential from your ADC	SBAA069
FilterPro MFB and Sallen-Key Low-Pass Filter Design Program (Rev. A)	SBFA001
Analysis of the Sallen-Key Architecture (Rev. B)	SLOA024
Active Low-Pass Filter Design (Rev. A)	SLOA049
Using the Texas Instruments Filter Design Database	SLOA062
Filter Design on a Budget	SLOA065
Filter Design in Thirty Seconds	SLOA093
More Filter Design on a Budget	SLOA096
Active filters using current-feedback amplifiers	SLYT081
Video	
Measuring Differential Gain and Phase	SLOA040
Video Designs Using High-Speed Amplifiers	SLOA057
Video Operational Amplifier	SBOA069
Analog Monitor and Control Circuitry	
AMC7820REF: A Reference Design for DWDM Pump Lasers	SBAA072
Using a SAR ADC for Current Measurement in Motor Control Applications	SBAA081
Choosing an Optocoupler for the ADS1202 Operating in Mode 1	SBAA088
Combining ADS1202 with FPGA Digital Filter for Current Measurement in Motor Control Applications	
Interfacing the ADS1202 Modulator w/a Pulse Transformer in Galvanically Isolated	SBAA096
Clock Divider Circuit for the ADS1202 in Mode 3 Operation	SBAA105
Designing with the THS1206 High-Speed Data Converter	SLAA094
Resetting Non-FIFO Variations of the 10-bit THS10064	SLAA144
Resetting Non-FIFO Variations of the 12-bit THS1206	SLAA145
Software Control of the ADS8364	SLAA155
Interfacing the ADS8361 to the TMS320VC5416 DSP	SLAA162
Interfacing the ADS8364 to the TMS320F2812 DSP	SLAA163
Interfacing the ADS8361 to the TMS320C6711 DSP	SLAA164
Interfacing the ADS8361 to the TMS320F2812 DSP	SLAA167
Using the ADS1202 Reference Design	SLAA186
Using the ADS7869 Reference Design Evaluation Module	SLAA231
Analog-to-Digital Converters	
Tips for Using the ADS78xx Family of ADCs	SBAA003
Programming Tricks for Higher Conversion Speeds Utilizing DS Converters	SBAA005
Giving Delta-Sigma Converters a Gain Boost with a Front-End Analog Gain Stage	SBAA006
ADS7809 Tag Features	SBAA007
Voltage Reference Scaling Techniques Increase Converter and Resolution Accuracy	SBAA008
DEM-ADS1210/11 Demo Board Tricks Evaluate ADS1211 Multiplexer Switch Response	SBAA009
Interfacing the ADS1210 with an 8x C51 Microcontroller	SBAA010
Accessing the ADS1210 Demo Board with Your PC	SBAA011
Overdriving the Inputs To The ADS1210, ADS1211, ADS1212, and ADS1213	SBAA012
Synchronization of External Analog Multiplexers with Delta-Sigma ADCs	SBAA013
Short Cycling the 8-Pin ADS78xx Family	SBAA014

Title	Lit No.
Analog-to-Digital Converters (Continued)	
Remove the DC Portion of Signals with the ADS7817	SBAA015
Guide for Delta-Sigma Converters: ADS1210, ADS1211, ADS1212, ADS1213	SBAA016
How to Get 23 bits of Effective Resolution from Your 24-bit Converter	SBAA017
Interfacing the ADS7822 to Syn. Serial Port of the 80x51 Microcontroller	SBAA018
Using the Continuous Parallel Mode with the ADS7824 and ADS7825	SBAA019
Customizing the DDC112 Evaluation Fixture	SBAA021
ADS121x ADC Applications Primer	SBAA022
Understanding The DDC112's Continuous and Non-Continuous Modes	SBAA024
The DDC112's Test Mode	SBAA025
Retrieving Data from the DDC112	SBAA026
Using External Integration Capacitors on the DDC112	SBAA027
Multi-DDC112 DUT Board for the DDC112 Evaluation Fixture	SBAA029
New Software For The DDC112 Evaluation Fixture	SBAA030
Using the ADS1201 Evaluation Board	SBAA031
Creating a Bipolar Input Range for the DDC112	SBAA034
DDC112UK DEMO BOARD	SBAA038
Comparing the ADS1201 to the CS5321	SBAA039
Improved 60Hz Performance for ADS1211	SBAA040
Interfacing the ADS7870 and the MC68HC11E9 Analog to µcomputer Made Easy	SBAA041
Coding Schemes used with Data Converters	SBAA042
CDAC Architecture gives ADC574 Pinout/Sampling, Low Power, New Input Ranges	SBAA043
Using the ADS7800 12-bit ADC with Unipolar Input Signals	SBAA044
Complete Temp Data Acquisition System from a Single +5V Supply	SBAA050
A Clarification of Use of High-Speed S/H to Improve Sampling ADC Performance	SBAA053
Measuring Temperature with the ADS1216, ADS1217, or ADS1218	SBAA073
The Offset DAC	SBAA077
Understanding the ADS1252 Input Circuitry	SBAA082
ADS1240, 1241 App-Note: Accessing the Onboard Temp Diode in the ADS1240 / ADS1241	SBAA083
Overclocking the ADS1240 and ADS1241	SBAA084
Understanding the ADS1251, ADS1253, and ADS1254 Input Circuitry	SBAA086
Calibration Routines and Register Value Generation for the ADS121x Series	SBAA099
A Spreadsheet for Calculating the Frequency Response of the ADS1250-54	SBAA103
Using Ceramic Resonators with the ADS1255/6	SBAA104
ADC Gain Calibration - Extending the ADC Input Range	SBAA107
ADS5500, OPA695: PC Board Layout for Low Drivers Distortion High-Speed ADC	SBAA113
Data Capture with Multiple ADS1244 or ADS1245 Devices in Parallel	SBAA116
Data Converters for Industrial Power Measurements	SBAA117
LVDS Outputs on the ADS527x	SBAA118
Using the ADSDeSer-50EVM to Deserialize ADS527x 10-Bit Outputs	SBAA119
Interfacing the ADS1241 to the MSP430F449	SBAA121
Reading Data from the ADS7862	SBAA138
Synchronizing the ADS1271	SBAS355
Solder Pad Recommendations for Surface-Mount Devices (Rev. A)	SBFA015
Interfacing High-Speed LVDS Outputs of the ADS527x/ADS524x	SBOA104
Using TI FIFOs to Interface High-Speed Data Converters with TI TMS320 DSPs	SDMA003
Interfacing the TLV1549 10-bit Serial-Out ADC to Popular 3.3-V Microcontrollers	SLAA005
Microcontroller Based Data Acquisition Using the TLC2543 12-Bit Serial Out ADC	SLAA012
Interfacing the TLC2543 ADC to the TMS320C25 DSP	SLAA017
Signal Acquisition and Conditioning with Low Supply Voltages	SLAA018
Interfacing the TLV1544/1548 ADC to Digital Processors	SLAA022
Interfacing the TLV1544 ADC to the TMS320C50 DSP	SLAA025
Interfacing the TLV1572 ADC to the TMS320C203 DSP	SLAA026

Amplifier and Signal Processing Application Reports

Title	Lit No.
Analog-to-Digital Converters (Continued)	
Interfacing the TLV1544 Analog-to-Digital Converter to the TMS320C203 DSP	SLAA028
Low-Power Signal Conditioning For A Pressure Sensor	SLAA034
Switched-Capacitor ADC Analog Input Calculations	SLAA036
Interfacing the TLV1562 Parallel ADC to the TMS320C54x DSP	SLAA040
Choosing an ADC and Op Amp for Minimum Offset	SLAA064
Interfacing the TLV1571/78 ADC to the TMS320C542 DSP	SLAA077
Interfacing the MSP430x11x(1) and TLV0831	SLAA092
Interfacing the TLV2544/TLV2548 ADC to the TMS320C5402 DSP	SLAA093
Using the TMS320C5402 DMA Channels to Read From the TLV2548	SLAA095
Using the TMS320C5402 DMA Channels to Read from the TLV1570 ADC	SLAA097
Interfacing the TMS320C5402 DSP to the TLV2541 ADC and the TLV5636 DAC	SLAA098
Interfacing the TLV2544/TLV2548 ADC to the TMS320C31 DSP	SLAA101
Interfacing the ADS7822 to the TMS3420C5402 DSP	SLAA107
SPI-Based Data Acquisition/Monitor Using the TLC2551 Serial ADC	SLAA108
Interfacing the TLV2541 ADC and the TLV5618A DAC to the TMS320C31 DSP	SLAA111
Interfacing the MSP430 and TLC549/1549 ADCs	SLAA112
Interfacing the ADS8320 ADC to the TMS320C5402 DSP	SLAA118
Implementing a Direct Thermocouple Interface with MSP430x4xx and ADS1240	SLAA125
Interfacing the TLC3544/48 ADC to the MSP430F149	SLAA126
Interfacing the ADS7842 ADC to the TMS320C5400 and TMS320C6000 DSPs Platforms	SLAA130
Reading the Configuration Registers of the 10-bit THS10064, THS1007, THS10082	SLAA143
Interfacing the ADS8364 ADC to the MSP430F149	SLAA150
Interfacing the TLC4541 to TMS320C6711 DSP	SLAA156
Interfacing the ADS8345 to TMS320C5416 DSP	SLAA160
Interfacing the TLC2552 and TLV2542 to the MSP430F149	SLAA168
Interfacing the TLV2541 to the MSP430F149	SLAA171
Interfacing the ADS8383 to TMS320C6711 DSP	SLAA174
Interfacing the ADS8320/ADS8325 to TMS320C6711 DSP	SLAA175
Interfacing the ADS8320/ADS8325 to TMS320C6711 DSP	SLAA175
Controlling the ADS8342 with TMS320 Series DSP's	SLAA176
Operating the 16-bit, 5MSPS ADS1605 at Double the Output Data Rate	SLAA180
Interfacing the MSOP8EVM to TMS320C6x Processors	SLAA190
Using ADS8411/2 (16-Bit 2MSPS SAR) as a Serial ADC	SLAA199
Interfacing the MSOP8EVM to TMS320C5x Processors	SLAA201
Interfacing the ADS1100 to the MSP430F413	SLAA206
Interfacing the MSOP8EVM to TMS470 Processors	SLAA209
Interfacing the MSOP8EVM to MSP430 Processors	SLAA209
Interfacing the ADS8402/ADS8412 to TMS320C6713 DSP	SLAA211
Interfacing the ADS8401/ADS8411 to TMS320C6713 DSP	SLAA212
Controlling the ADS7805 With TMS320 Series DSPs	SLAA229
Interfacing the ADS8371 to TMS320C6713 DSP	SLAA232
Interfacing Low Power Serial (SPI) ADCs to the MSP430F449	SLAA234
Using the ADS8380 with the TMS320C6713 DSP	SLAA240
Interfacing the ADS1251/52 to the MSP430	SLAA242
Using the ADS7841 and ADS7844 with 15-Clock Cycles	SLAA256
Interfacing the TLC4541 & the DAC7654 to the MSP430F449	SLAA258
Connecting ADS8410/13 With Long Cable	SLAA284
Multiplexing ADS8411	SLAA285
A New Generation of Hall Sensors Including Delta-Sigma Modulators	SLAA286
Interfacing the ADS786x to the MSP430F2013	SLAA308
Interfacing the ADS786x to TMS470 Processors	SLAA312
Interfacing the ADS8361 to TMS470 Processors	SLAA314
Interfacing the DAC8803EVM to TMS470 Processors	SLAA316
Interfacing the DAC8814EVM to TMS470 Processors	SLAA317
Interfacing the DAC8803EVM to MSP430 Processors	SLAA318
Interfacing the DAC8814EVM to MSP430 Processors	SLAA319

Title	Lit No.
Analog-to-Digital Converters (Continued)	
ADS8422 Example Programs	SLAA326
Using the ADS8327 with the TMS320C6713 DSP	SLAA342
Using the ADS8328 in Auto Trigger and Auto Channel Mode w/the C6713 DSP	SLAA343
Evaluating the TLV2462 and TLV2772 as Drive Amps for the TLV2544/TLV2548 ADC	SLOA048
Thermistor Temperature Transducer to ADC Application	SLOA052
Pressure Transducer to ADC Application	SLOA056
Implementing a CDC7005 Low Jitter Clock Solution for HIgh Speed High IF ADC Dev	SLWA034
Standard Procedure Direct Measurement Sub-picosecond RMS Jitter High-Speed ADC	SLWA036
ADCs Support Multicarrier Systems	SLWY001
Analogue-to-Digital Converters Support Multicarrier Systems	SLWY001
14-Bit, 125-MSPS ADS5500 Evaluation	SLYT074
Clocking High-Speed Data Converters	SLYT075
Two-Channel, 500-kSPS Operation of the ADS8361	SLYT082
ADS809 Analog-to-Digital Converter with Large Input Pulse Signal	SLYT083
ADS82x ADC with Non-Uniform Sampling Clock	SLYT089
Evaluation Criteria for ADSL Analog Front End	SLYT091
Adjusting the A/D Voltage Reference to Provide Gain	SLYT109
Using Direct Data Transfer to Maximize Data Acquisition Throughput	SLYT111
Synchronizing Non-FIFO Variations of the THS1206	SLYT115
Intelligent Sensor System Maximizes Battery Life: Interfacing MSP430F123, AD7822,	SLYT123
A/D&D/A Conversion of PC Graphics & Component Video Signals Part 2: Software&Cntrl	SLYT129
Building a Simple Data Acquisition System Using the TMS320C31 DSP	SLYT136
A/D and D/A Conversion of PC Graphics & Component Video Signals Part 1: Hardware	SLYT138
Smallest DSP-Compatible ADC Provides Simplest DSP Interface	SLYT148
Using Quad and Octal ADCs in SPI Mode	SLYT150
New DSP Development Environment Includes Data Converter Plug-Ins	SLYT158
Higher Data Throughput for DSP Analog-to-Digital Converters	SLYT159
Efficiently Interfacing Serial Data Converters to High-Speed DSPs	SLYT160
A Methodology of Interfacing Serial A-to-D Converters to DSPs	SLYT175
The Operation of the SAR-ADC Based on Charge Redistribution	SLYT176
Techniques for Sampling High-Speed Graphics with Lower-Speed A/D Converters	SLYT184
Keep an Eye on the LVDS Input Levels	SLYT188
Aspects of Data Acquisition System Design	SLYT191
Low-Power Data Acquisition Sub-System Using the TI TLV1572	SLYT192
Operating Multiple Oversampling Data Converters	SLYT222
Using the ADS8361 with the MSP430 USI Port	SLYT244
Upgrading from the ADS7804/05 to the ADS8504/05	SLAA354
Upgrading From ADS7806/07 To ADS8506/07 Devices (Rev. B)	SLAA355
Interfacing the DAC8806 and DAC8820 to TMS320 DSPs	SLAA346
Efficient MSP430 Code Synthesis for an FIR Filter	SLAA357
Digital-to-Analog Converters	
Interfacing The DAC714 To Microcontrollers Via SPI	SBAA023
Wideband Complementary Current Output DAC Single-Ended Interface	SBAA135
Interfacing the TLC5618A DAC to the TMS320C203 DSP	SLAA033
Bipolar Voltage Outputs for the TLV56xx Family of DACs	SLAA113
Interfacing with the DAC8541 DAC	SLAA146
Interfacing the DAC7731 to the MSP430F149	SLAA165
Building a Stable DAC External Reference Circuit	SLAA172
Interfacing the DAC8534 to the TMS320VC33 DSP	SLAA179
Interfacing the DAC8574 to the MSP430F449	SLAA189
Interfacing the DAC8534EVM to TMS320C5x Processors	SLAA191
Interfacing the DAC7654 to the MSP430F449	SLAA213
Interfacing the DAC8811 to the MSP430F449	SLAA238
Interfacing the DAC7554 to the MSP430F449	SLAA252

Amplifier and Signal Processing Application Reports

Title	Lit No.
Digital-to-Analog Converters (Continued)	
Interfacing the DAC7558 to the MSP430F449	SLAA261
Interfacing the DAC8551 on the MSP430F449	SLAA297
Interfacing the DAC8554 to the TMS320C6x Processors	SLAA300
Interfacing the DAC8832 to the MSP430F449	SLAA337
Interfacing the DAC8555 to the MSP430F449	SLAA344
Interfacing the DAC8806 and DAC8820 to MSP430 Microcontrollers	SLAA345
Interfacing the DAC8806 and DAC8820 to TMS320 DSPs	SLAA346
Interfacing the TLV5639 DAC to the TMS320C31 DSP	SLAU071
DAC5686/DAC5687 Clock Generation Using PLL & External Clock Modes	SLWA040
Using SPI Synchronous Communication w/DACs: Interfacing the MSP430F149 & TLV5616	SLYT137
Codecs	
Using the PGA Function in TSC210x/AIC26/AIC28/DAC26 Devices	SLAA253
Programming Audio Power Up/Down on TSC210x & TLV320AIC26/28	SLAA230A
MicroSystem Mixed-Signal Data Converters	
What Designers Should Know About Data Converter Drift	SBAA046
Principles of Data Acquisition and Conversion	SBAA051
Analog-to-Digital Converter Grounding Practices Affect System Performance	SBAA052
Programming the MSC1210 (Rev. B)	SBAA076
Using Keil MON51 for Debugging the MSC121x Family	SBAA078
MSC1210 Debugging Strategies	SBAA078
Debugging Using the MSC1210 Boot ROM Routines	SBAA079
MSC1210 ROM Routines (Rev. B)	SBAA085
MSC1210: In-Application Flash Programming	SBAA087
Programming the MSC1210 by Using a Terminal Program (Rev. A)	SBAA089
Maximizing Endurance of MSC1210 Flash Memory	SBAA091
MSC1210: Incorporating the MSC1210 into Electronic Weight Scale Systems (Rev. B)	SBAA092
MSC1210 Versatile Flash Programmer	SBAA093
ADC Offset in MSC12xx Devices (Rev. B)	SBAA097
Using the MSC121x as a High-Precision Intelligent Temperature Sensor	SBAA100
Getting Started with the MSC1210	SBAA102
MSC12xx Programming with SDCC	SBAA109
Ratiometric Conversions: MSC1210, 1211, 1212	SBAA110
Understanding the ADC Input on the MSC12xx	SBAA111
MSC1211 / 12 DAC INL Improvement	SBAA112
A Complete Webserver on the MSC121x	SBAA114
MSC12xx Serial Programming Board	SBAA122
Using Crystal Oscillators with MSC12xx MicroSystem Products	SBAA123
Average Measurements with the MSC12xx	SBAA124
Improving MSC120x Temperature Measurements	SBAA126
Incremental Flash Memory Page Erase	SBAA137
Minimizing Power Consumption on the MSC12xx	SBAA139
High-Speed Data Acquisition with MSC12xx Devices	SBAA140
Implementing IIR Filters on the MSC12xx	SBAA142
Supply Voltage Measurement and ADS PSRR Improvement in MSC12xx Devices	SLYT073
MSC1210 Debugging Strategies for High-Precision Smart Sensors	SLYT110

Title	Lit No.
Touch Screen Controllers	
ADS7843 Pen Interrupt	SBAA028
Touch Screen Controller Tips	SBAA036
Evaluating the ADS7846E: Using the DEM-ADS7843E/45E Evaluation Fixture	SBAA037
Using the ADS7846 Touch Screen Ctrl. with the Intel SA-1110 StrongArm Processor	SBAA070
Windows CE Touch and Keypad Device Drivers for the TSC2200	SBAA075
Applying the Current DAC on the TSC2000, TSC2200, TSC2300, and TSC2301 Touch Screen	SBAA098
Windows CE .NET Touch Screen, Keypad and Audio Device Drivers for the TSC2301	SLAA169
TCS2301 WinCE Generic Drivers	SLAA187
Programming Sequences and Tips for TSC2000/2200/230x Applications	SLAA197
TSC2100 WinCE Generic Drivers	SLAA198
TSC2101 Touch Screen, Battery and Audio WinCE Drivers	SLAA200
Interface TSC Through McBSP	SLAA214
TSC2101 WinCE 5.0 Drivers	SLAA251
TSC2003 WinCE 5.0 Driver	SLAA277
TSC2046 WinCE 5.0 Driver	SLAA278
TSC2100 WinCE5.0 Drivers	SLAA292
How to Use TI's 4-Wire TSC to Control an 8-Wire Resistive Touch Screen	SLAA298
Apply TI TSC for Various and Multiple Functions	SLAA339
Q4 2007 Issue Analog Applications Journal	SLYT282
Using a touch-screen controller?s auxiliary inputs	SLYT283
Calibration in touch-screen systems	SLYT277
Voiceband Codecs	
Low Voltage Modem Platform Based on TMS320LC56	BPRA049
Designing with the TLC320AC01 Analog Interface for DSPs	SLAA006
Common Sample Rate Selection For TLV320AIC12/13/14/15/20/21/24/25 Codecs	SLAA009
Multiple TLC320AC01/02 Analog I/F Circuits on One TMS320C5x DSP Serial Port	SLAA016
Evaluation Board for the TLC320AD545 DSP Analog Interface Circuit (Rev. A)	SLAA085a
Design Guidelines for the TLC320AD50	SLAA087
Comparison of TI Voiceband Codecs for Telephony Applications	SLAA088
Design Guidelines for the TLC320AD535/545	SLAA090
Interfacing the TMS320C54x DSP to the TLC320AD535/545 Codecs	SLAA091
Interfacing the TLV320AIC10/11 Codec to the TMS320C5402 DSP	SLAA109
TLV320AIC12/13/14/15 CODEC Operating Under Stand-Alone Slave Mode	SLAA142
Sample Code for Interfacing the TLV320AIC1106 CODEC with the TMS320C5402 DSP	SLAA147
Demo/Test CODEC System with TLV320AIC20/21/24/25 EVM	SLAA153
Interfacing the TLV320AIC12/13/14/15 Codec to the TMS320C5402y DSP	SLAA154
Interface the TLV320AIC1110 CODEC With The TMS320C5402 DSP	SLAA158
TMS320C54x DSP Reference Framework & Device Driver for the TLV320AIC20 HPA DC	SLAA166
Interface with Voice-Band Codecs Using I^2C	SLAA173
Efficient Resampling Filters for the AIC111	SLAA193
Hardware auto-identification&software auto-configuration for the	SLYT149a
TLV320AIC10 DSP Codec - a "plug-and-play" algorithm	
Interfacing Two Analog Interface Circuits to One TMS320C5x Serial Port	SPRA268
TMS320C54xx McBSP to TLV320AIC24 Interface	SPRA957

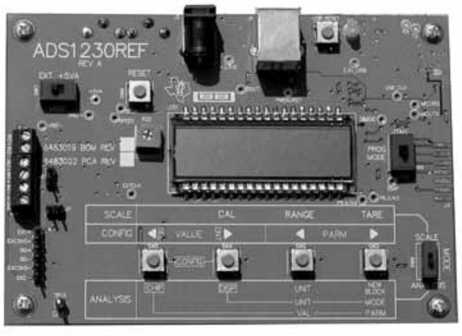
Reference Designs

ADS1230/ADS1232REF: Weigh Scale Reference Design

Built around an ultra-low-power MSP430F449 MCU, this fully functional weigh scale board (just add your own load cell) can be used by itself, powered from a 9V battery. The LCD display and simple push buttons provide an easy-to-use interface that allows you to calibrate the scale, adjust for tare, and make measurements in several different units of weight (grams, ounces, pounds, etc). A USB interface allows the board to connect to a PC and the data collected can be viewed and analyzed with the included software. All source code for the firmware and software, as well as the PCB design files, are included.

ADS1230/ADS1232REF:

- Fully functional weigh scale
- MSP430-based
- Operates alone or connected to a PC
- Firmware and software source dode and Gerber files available

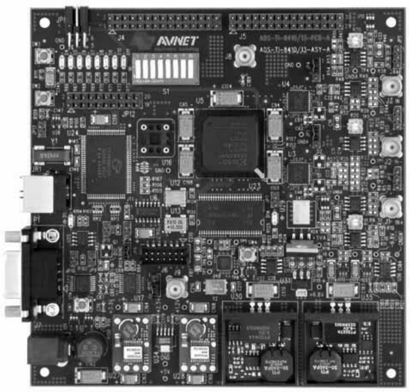


ADS8410/13REF: High-Speed SAR with LVDS Interface Reference Design

The ADS8410/ADS8413REF, designed by Avnet Design Services, allows the high-speed analog systems designer a fully functional reference platform to evaluate the TI ADS841x family of 16-bit SAR, 2MSPS analog-to-digital converters. The analog front-end design allows raw signals to be fed into either a differential or single ended topology while the Xilinx® Spartan™-3 FPGA allows the system the flexibility of independent or cascaded LVDS modes. The signal is displayed on a LabVIEW™ console via a USB link to the PC.

ADS8410/13REF:

- Two channel data acquisition system based on the ADS841x, 16-bit, 2MSPS ADC
- Single-ended or differential analog input stage configuration
- Front-end signal conditioning included
- Outputs can be cascaded to support daisy chaining
- Xilinx Spartan-3 FPGA
- LVDS data path from ADCs
- USB 2.0 interface to PC
- 16MB SDRAM
- Controlled via host PC



Notes

TI Worldwide Technical Support

Internet

TI Semiconductor Product Information Center Home Page
support.ti.com

TI Semiconductor KnowledgeBase Home Page
support.ti.com/sc/knowledgebase

Product Information Centers

Americas

Phone	+1(972) 644-5580
Fax	+1(972) 927-6377
Internet/Email	support.ti.com/sc/pic/americas.htm

Europe, Middle East, and Africa

Phone

European Free Call	00800-ASK-TEXAS (00800 275 83927)
International	+49 (0) 8161 80 2121
Russian Support	+7 (4) 95 98 10 701

Note: The European Free Call (Toll Free) number is not active in all countries. If you have technical difficulty calling the free call number, please use the international number above.

Fax	+(49) (0) 8161 80 2045
Internet	support.ti.com/sc/pic/euro.htm

Japan

Fax	International	+81-3-3344-5317
	Domestic	0120-81-0036
Internet/Email	International	support.ti.com/sc/pic/japan.htm
	Domestic	www.tij.co.jp/pic

Asia

Phone

International	+91-80-41381665
Domestic	Toll-Free Number
Australia	1-800-999-084
China	800-820-8682
Hong Kong	800-96-5941
India	1-800-425-7888
Indonesia	001-803-8861-1006
Korea	080-551-2804
Malaysia	1-800-80-3973
New Zealand	0800-446-934
Philippines	1-800-765-7404
Singapore	800-886-1028
Taiwan	0800-006800
Thailand	001-800-886-0010

Fax	+886-2-2378-6808
Email	tiasia@ti.com
	ti-china@ti.com
Internet	support.ti.com/sc/pic/asia.htm

Printed in U.S.A. by (Printer, City, State)

Texas Instruments

14950 F.A.A. Blvd.
Fort Worth, Texas 76155

Address service requested

PRSRT STD
U.S. POSTAGE
PAID
DALLAS, TEXAS
PERMIT NO.
2758