

1st Edition

ANALOG SIGNAL CHAIN

Product Guide



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Analog Signal Chain

Message from the Senior Vice President, Industrial and Medical Solutions Group

In a world experiencing challenging transitions in multiple arenas—energy, healthcare, industry, finance, and security, to name a few—Maxim Integrated’s Industrial and Medical Solutions Group offers superior signal chain solutions that are innovative, accurate, and cost-effective.

We’re able to deliver these superior solutions because Maxim Integrated has developed a wide range of advanced, flexible, and affordable building blocks—ADCs, DACs, multiplexers, amplifiers, and more—that empower customers to meet their toughest challenges.

At Maxim Integrated, we partner closely with customers to understand their needs, and then develop an appropriate, holistic solution. As a result of this collaboration and customization, we’re able to assemble smaller chips and systems that deliver better performance with fewer components and use less power at a lower cost.

Maxim Integrated recognizes that most customers want to buy from fewer suppliers, suppliers whose products deliver more functionality with ready-made components as well as customizable flexibility for unique applications.

Some key areas that Maxim Integrated’s Industrial and Medical Solutions Group is currently focusing on include:

- Increasing integration
- Enhancing accuracy with precise measurement at the lowest power levels in the industry
- Strengthening security with less vulnerable all-in-one chips
- Developing analog front end (AFE) reference designs for easy prototyping and faster time-to-market with proven circuits and solutions

Maxim Integrated isn’t just focused on integration at the chip level, but also at the company level. This integration is delivered through coordination between our solutions, training, technical support, and customer service—all of which are designed to help you achieve your goals.

From building blocks to building relationships, Maxim Integrated’s Industrial and Medical Solutions Group is ready to assist you. As you review the pages of this guide, remember that we are committed to answering your questions, collaborating with you to develop the solutions you seek, and working together to meet your most complex challenges.

Thank you for considering Maxim Integrated. We’re looking forward to working with you in 2013 and beyond.

Sincerely,

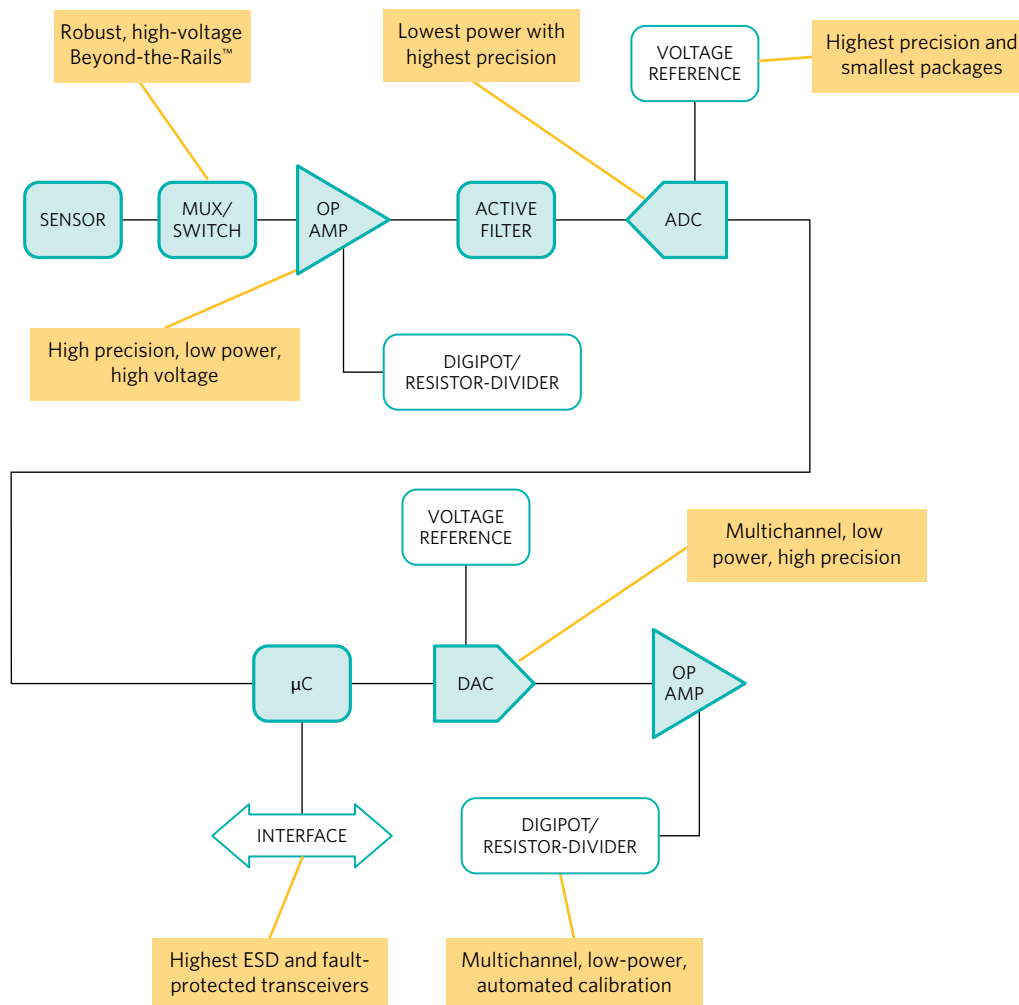
A handwritten signature in black ink that reads "Chris".

Chris Neil

SVP, Industrial and Medical Solutions Group

Better Designs Start with Better Analog Building Blocks

For over 20 years Maxim Integrated has been designing robust, extended-temperature-grade ICs for industrial and medical applications. We have the best product for your design, from a single analog IC to a complete analog signal chain. This product guide offers best-in-class products for key design challenges and provides examples on how to optimize your signal chain designs using our innovative technologies in analog integration.



Best-in-Class Signal Chain Solutions

Lowest Power Signal Solutions

Consume less power and extend operating life with our low-power (operating and standby) and low-voltage solutions.

Multiplexer

Resolution	Part	Benefits
12-bit	MAX4691– MAX4694	Low-voltage multiplexers and switches
16-bit		
18- to 24-bit		

Amplifier

Resolution	Part	Benefits
12-bit	MAX44264	Op amp consumes only 750nA.
16-bit	MAX44265	Op amp consumes only 4μA.
18- to 24-bit		

ADC

Resolution	Part	Benefits
12-bit	MAX11665	Low-power consumption at 8μA/ksps
16-bit	MAX11100	High-precision and low-power consumption
18- to 24-bit	MAX11200	Ultra-low-power (< 300μA active current), high-resolution, serial output ADC

Reference

Resolution	Part	Benefits
12-bit	MAX6029	Low power, high accuracy, and small size
16-bit	MAX6133	Voltage reference has 3ppm/°C drift.
18- to 24-bit	MAX6325	Extremely low, 0.5ppm/°C (typ) temperature coefficients

DAC

Resolution	Part	Benefits
12-bit	MAX5531, MAX5535	Industry's lowest power, single- and dual-channel 12-bit DACs
16-bit	MAX5214, MAX5216	Lowest power 14- and 16-bit DACs
18- to 24-bit	MAX5318	±2 LSB INL (max) accuracy and ±1 LSB DNL (max)

Current-Sense Amplifier

Resolution	Part	Benefits
12-bit	MAX9928	-0.1V to +28V supply, consumes only 20μA.
16-bit		
18- to 24-bit		

Best-in-Class Signal Chain Solutions (cont.)

Highest Performance Signal Solutions

For the highest precision, our signal chain solutions deliver industry-leading specifications covering initial accuracy, long term stability/drift, low noise, and consistency over the full industrial temperature range.

Multiplexer

Resolution	Part	Benefits
12-bit	MAX14778	Industry's first $\pm 25V$ above- and below-the-rails multiplexer
16-bit		
18- to 24-bit		

Amplifier

Resolution	Part	Benefits
12-bit	MAX44246	Fast settling time and low distortion
16-bit		
18- to 24-bit	MAX44250- MAX44252	High-voltage (2.7V to 20V) capability; industry's lowest noise, precision amps

ADC

Resolution	Part	Benefits
12-bit	MAX11131, MAX11331	8/10/12 bits, 4/8/16 channels, and 500k/1M/3Msps
16-bit	MAX11166	16-bit, true bipolar input range
18- to 24-bit	MAX11040K	24-bit, 4-channel, simultaneous-sampling delta-sigma ADC

Reference

Resolution	Part	Benefits
12-bit	MAX6225	Ultra-low drift, low noise ($< 1 \text{ ppm}/^{\circ}\text{C}$)
16-bit		
18- to 24-bit	MAX6325	Ultra-low drift, low noise ($< 0.5 \text{ ppm}/^{\circ}\text{C}$); ideal for high-resolution systems up to 18 bits

DAC

Resolution	Part	Benefits
12-bit	MAX5705	Ultra-small, single-channel, 12-bit buffered output voltage DAC
16-bit	MAX5316	Most accurate 16-bit buffered DAC available
18- to 24-bit	MAX5318	Most accurate 18-bit buffered DAC available

Current-Sense Amplifier

Resolution	Part	Benefits
12-bit	MAX9643	Outstanding $50\mu\text{V } V_{\text{OS}}$ precision
16-bit		
18- to 24-bit		

Best-in-Class Signal Chain Solutions *(cont.)*

Bipolar/High-Voltage Signal Solutions

Many industrial systems work at higher operating voltages or require bipolar signal ranges. Our solutions include unique Beyond-the-Rails products to make designing easy, while improving system performance and lowering total implementation cost.

Multiplexer

Resolution	Part	Benefits
12-bit	MAX14752	8-channel/dual 4-channel 72V analog multiplexer
16-bit		
18- to 24-bit		

Amplifier

Resolution	Part	Benefits
12-bit	MAX44246, MAX44248	2.7V to 36V supply voltage; precision, low-noise amplifiers
16-bit		
18- to 24-bit	MAX9632, MAX9633	Fast-settling, high-voltage op amps are ideal for 18-bit SAR ADC front-end.

ADC

Resolution	Part	Benefits
12-bit	MAX1272	Software-programmable analog inputs accept input voltage ranges up to $\pm 10V$.
16-bit	MAX1300	4 and 8 channels, single-ended or differential input ranges with an internal reference
	MAX11166	Industry's smallest, true bipolar $\pm 5V$, 16-bit ADC

Reference

Resolution	Part	Benefits
12-bit	MAX6035	Extremely low-power consumption and small size
16-bit	MAX6173- MAX6177	Wide operating range: 2.7V to 40V input voltages
18- to 24-bit	MAX6325	Best performance (e.g., 1ppm/ $^{\circ}C$ tempco)

DAC

Resolution	Part	Benefits
12-bit	MAX531	Complete 12-bit DAC; single-supply or bipolar operation
16-bit	MAX5732	Smallest and most accurate 32-channel, 16-bit DAC

Current-Sense Amplifier

Resolution	Part	Benefits
12-bit	MAX9611, MAX9612	High-side CSAs with integrated 12-bit ADC and op amp/comparator
16-bit	MAX4080, MAX4081	0.1% accuracy with operation up to 76V
18- to 24-bit		

Best-in-Class Signal Chain Solutions (cont.)

Smallest Size Signal Solutions

For space-constrained systems in industrial, consumer, computing, and medical applications, we offer the smallest and thinnest packages in the industry.

Multiplexer

Resolution	Part	Benefits
12-bit	MAX14589E	High-density, $\pm 5V$ -capable DPDT analog switch
16-bit		
18- to 24-bit		

Amplifier

Resolution	Part	Benefits
12-bit	MAX44281	Industry's first op amp in a 0.9mm x 0.9mm, 4-bump WLP
16-bit	MAX9617- MAX9620	Low-power, zero-drift op amps in space-saving 2mm x 2mm SC70
18- to 24-bit		

ADC

Resolution	Part	Benefits
12-bit	MAX11108	Fast 3Msps, 12-bit, ADC in tiny 1.6mm x 2.1mm, 10-pin VQFN
16-bit	MAX11100	High precision in 12-bump WLP
18- to 24-bit	MAX11202	24-bit resolution at $< 1mW$ in space-saving 10-pin μMAX°

Reference

Resolution	Part	Benefits
12-bit	MAX6023	Industry's smallest V_{REF} (1.5mm ²) with 30ppm/ $^{\circ}C$ tempco
16-bit	MAX6070	Most accurate reference (7ppm/ $^{\circ}C$ tempco) in a SOT23 package
18- to 24-bit	MAX6325	Best performance (1ppm/ $^{\circ}C$ tempco)

DAC

Resolution	Part	Benefits
12-bit	MAX5715, MAX5725	Industry's smallest complete DACs
16-bit	MAX5134	Industry's smallest 16-bit DAC

Current-Sense Amplifier

Resolution	Part	Benefits
12-bit	MAX9643	Industry's smallest current-sense amp, 1mm x 1mm 4-bump UCSP [™] /SOT23
16-bit		
18- to 24-bit		

High-Performance Switches and Multiplexers

Maxim Integrated has the industry's broadest portfolio of analog switches and multiplexers, which allows our customers to select products based on their key specifications, such as voltage range, R_{ON} , leakage, bandwidth, and switch/mux configuration. With a focus on robust high-voltage and flexible Beyond-the-Rails products, our parts help reduce external circuitry and simplify your system designs.

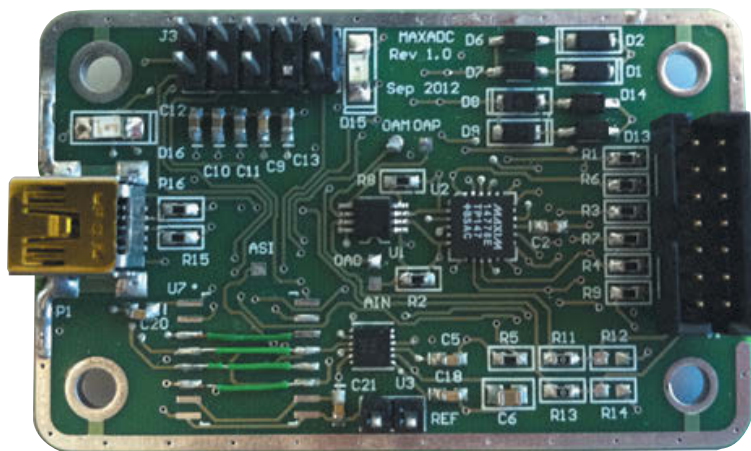
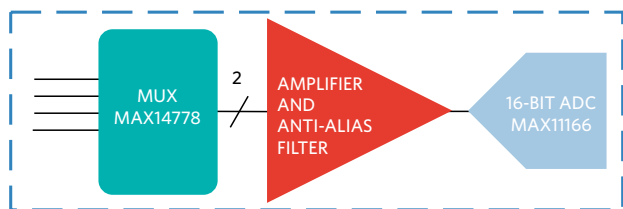
Part	Benefits	Features
MAX14778	Beyond-the-Rails, single 3V to 5V supply	$\pm 25V$, 2 4:1, $1.5\Omega R_{ON}$
MAX14759-MAX14764	Beyond-the-Rails, single 3V to 5V supply	$\pm 25V$, SPST, 2 SPST, SPDT, $2\Omega R_{ON}$
MAX14589E/MAX14594E	Beyond-the-Rails, 1.6V to 5.5V supply	$\pm 5V$, 2 DPDT, $0.38\Omega R_{ON}$
MAX14752	Robust 72V signal	$72V/\pm 36V$ supply, 2 4:1, $60\Omega R_{ON}$, $30m\Omega R_{ON}$ flatness
MAX14757	Robust 70V signal	$70V/\pm 36V$ supply, 4 SPST, $10\Omega R_{ON}$

Our Beyond-the-Rails switches and multiplexers simplify power supplies. Integrated bias circuitry enables switching bipolar signals up to $\pm 25V$, while operating from a low-voltage (3.0V to 5.5V) single supply. This technology is ideal for applications such as audio and data multiplexing, interface termination, switching, PhotoMOS[®] switch replacement, industrial measurement, and instrumentation systems.

Benefits

- Simplifies power supplies
- Robust bipolar signal range (up to $\pm 25V$)
- Single 3V supply
- Low and flat R_{ON}
- Full family of configurations
- Robust ESD

Beyond-the-Rails Building Blocks



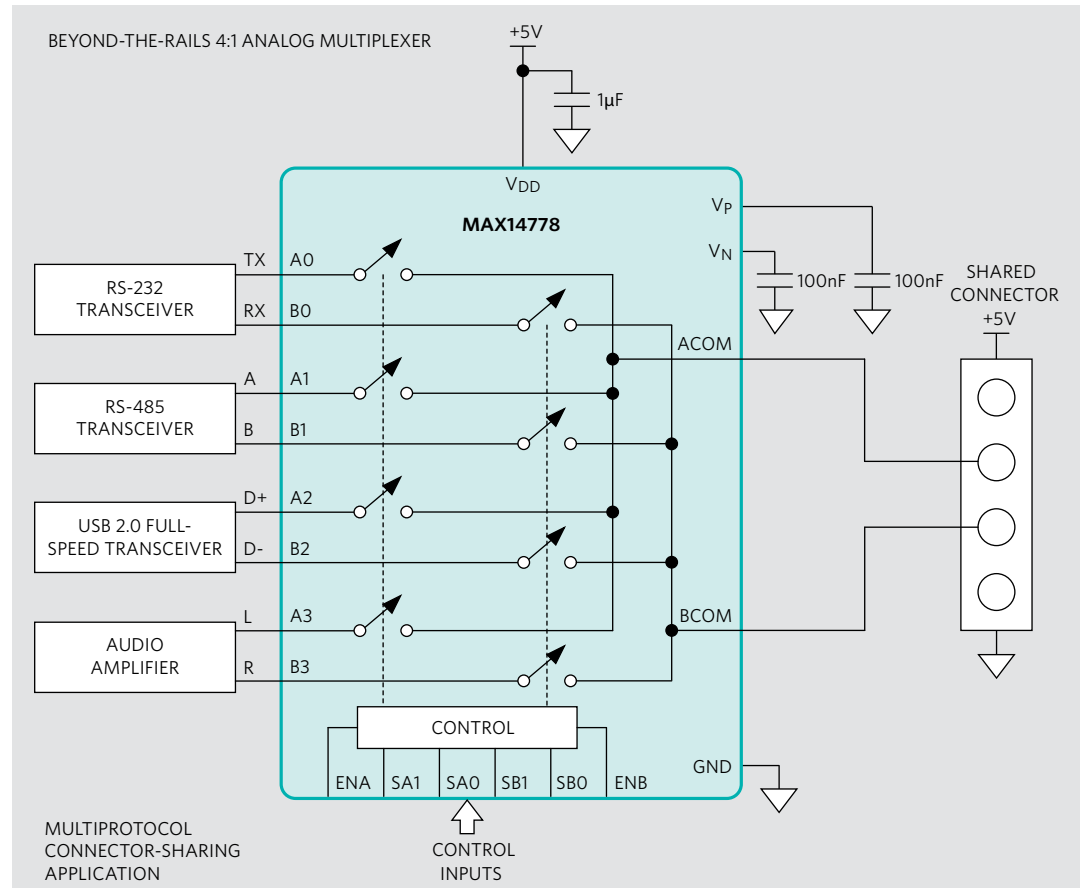
For our complete portfolio of Beyond-the-Rails switches and multiplexers, go to www.maximintegrated.com/beyond-the-rails-portfolio.

High-Performance Switches and Multiplexers (cont.)

Industry's First Beyond-the-Rails Multiplexer

Benefits: MAX14778

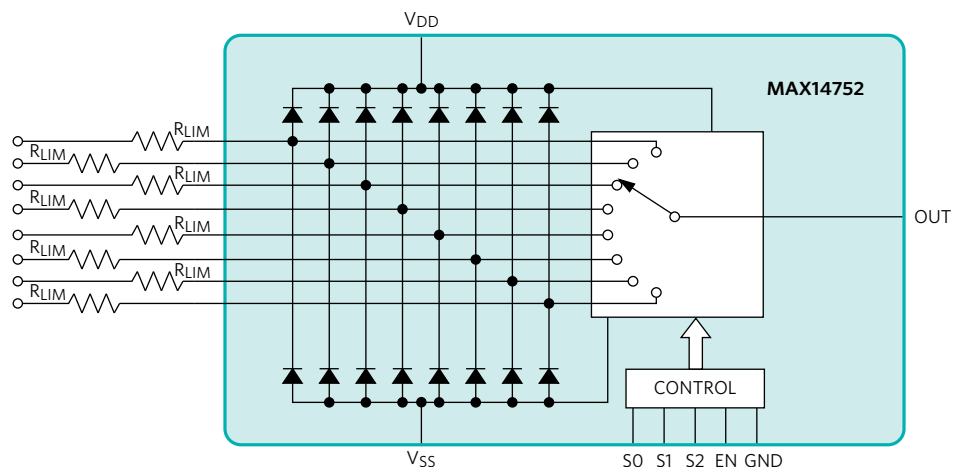
- Robust $\pm 25\text{V}$ bipolar signal range protects against input spikes
- Single 3V to 5V supply simplifies power supplies
- Highly accurate flat 1.5Ω R_{ON}
- Full-speed USB bandwidth
- Robust $\pm 6\text{kV}$ ESD



Robust 70V Multiplexer Eliminates External Overvoltage Protection

Benefits: MAX14752

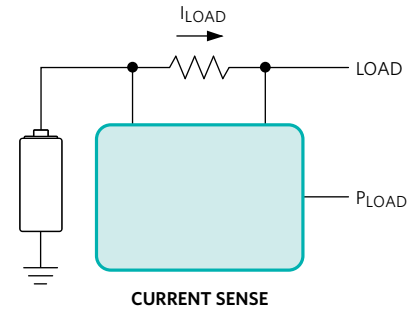
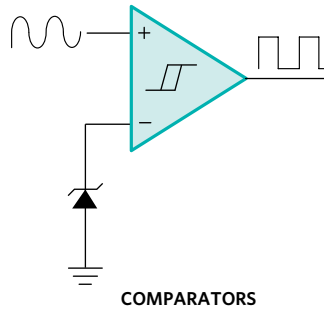
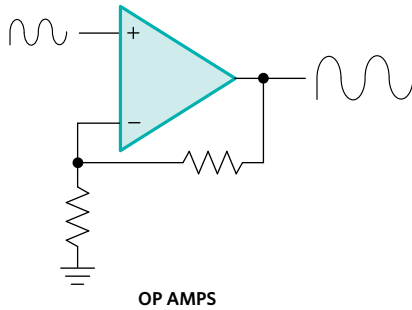
- High 72V voltage supply eliminates OVP diodes and opto relays
- $30\text{m}\Omega$ (typ) R_{ON} flatness reduces calibration needs
- Device enable (EN) defines voltage logic level of channel-select inputs



For our complete portfolio of multiplexers and switches, go to www.maximintegrated.com/switch-mux-portfolio.

Amplifiers and Comparators

Maxim Integrated has the widest selection of amplifiers and comparators for signal conditioning. Offering high bandwidth and minimal current consumption, our products achieve the industry's best speed-to-power ratios. Miniature packaging technology enables a variety of amplifiers and comparators in ultra-small footprints.



HIGH PERFORMANCE	HIGH VOLTAGE	LOW POWER	CMOS INPUTS
<ul style="list-style-type: none"> $V_{OS} < 10\mu V$ Low-drift TC $V_{OS} < 50nV/^{\circ}C$ Low noise $< 10nV/\sqrt{Hz}$ 	<ul style="list-style-type: none"> Supply voltage up to 38V $\pm 4kV$ to $\pm 8kV$ ESD 	<ul style="list-style-type: none"> $< 10\mu A$ quiescent current Shutdown capability Small WLP, μDFN, and SC70 packages 	<ul style="list-style-type: none"> Low-bias current $< 1pA$ Current noise $< 1pA/\sqrt{Hz}$

Op Amps

Part	No. of Op Amp/Pkg	Rail-to-Rail	Supply Voltage (V)	Supply Current/Op Amp (μA , max)	V_{OS} (μV , max)	Input I_{BIAS} (nA, max)	Unity GBW (MHz, typ)	Slew Rate (V/ μs , typ)	e_N (nV/ \sqrt{Hz})	Operating Temp ($^{\circ}C$)	Smallest Package
High Performance											
MAX44250/1/2	1, 2, 4	O	2.7 to 20	1550	6	1.3	10	8	5.9	-40 to +85	8-SOT23
MAX9632	1	O	4.5 to 36	6500	125	180	55	30	0.94	-40 to +85	8-TDFN
High Voltage											
MAX44246	2	O	2.7 to 36	1100	5	0.6	5	3.8	9	-40 to +85	8- μ MAX
MAX44248	2	O	2.7 to 36	120	7.5	0.3	1	0.7	50	-40 to +85	8- μ MAX
CMOS Inputs											
MAX9636/7/8	1, 2	I/O	2.1 to 5.5	55	2200	0.0008	1.5	0.9	38	-40 to +85	6-SC70
MAX44260/1/3	1, 2	I/O	1.7 to 5.5	1200	50	0.005	15	7	12.7	-40 to +85	6-UTLGA
Low Power											
MAX44264	1	O	1.8 to 5.5	1.2	7000	1.5	0.009	0.002	120	-55 to +125	6-WLP
MAX44265	1	I/O	1.8 to 5.5	5	1000	0.01	0.2	0.1	400	-55 to +125	6-WLP

For our complete portfolio of amplifiers, go to www.maximintegrated.com/amplifier-portfolio.

Amplifiers and Comparators (cont.)

Current-Sense Amplifiers

Part	Features	Input Voltage (V)	Supply Current (μA)	V _{OS} at +25°C (μV, max)	Gain (V/V)	Gain Accuracy +25°C (% , max)	Bandwidth (kHz)	Operating Temp (°C)	Smallest Package
High Voltage and Precision									
MAX9922/3	Ultra-precision CSAs	1.9 to 28	700	10	Adj, 25, 100, 250	0.4	10, 50, 1000	-55 to +125	10-μMAX
MAX9643	Wide input, precision CSA	-0.1 to +60	1000	50	2.5, 10	0.5	10,000	-40 to +85	8-TDFN
MAX4080	High-voltage CSA	4.5 to 76	75	600	5, 20, 60	0.6	250	-40 to +85	8-μMAX
Low Power									
MAX9634	Precision CSA	1.6 to 28	1	250	25, 50, 100, 200	0.5	15, 30, 60, 125	-55 to +125	4-UCSP
MAX9928/9	SIGN output, current output	-0.1 to +28	20	400	Adj, 20, 50	1	150	-40 to +85	6-UCSP
Multifunction									
MAX9611/2	CSA + 12-bit ADC + op amp/comparator	0 to 60	1600	300	Adj	0.5	4000	-40 to +85	10-μMAX

For our complete portfolio of amplifiers, go to www.maximintegrated.com/amplifier-portfolio.

Comparators

Part	No. of Comparators	Propagation Delay (ns, typ)	Supply Voltage (V)	I _{CC} per Comp (μA, typ)	V _{OS} (mV, typ)	V _{OS} (mV, max)	Logic Output	Operating Temp (°C)	Smallest Package
High Speed									
MAX9600/1/2	2, 4	0.5	8.3 to 10.5	12,000	1	5	ECL/PECL	-55 to +125	20-TSSOP
MAX999	1, 2, 4	4.5	2.7 to 5.5	6500	0.5	1.5	Push-pull	-55 to +125	5-SOT23
Low Power, Ultra Small									
MAX9060/1	1	25,000	0.9 to 5.5	0.35	1.3	9	Open drain	-55 to +125	4-UCSP
MAX44269	2	13,000	1.8 to 5.5	0.85	0.15	5	Open drain	-55 to +125	9-WLP
Integrated Reference									
MAX9062-MAX9064	1	15,000 (0.2V threshold)	1 to 5.5	1.1	—	—	Open drain/push-pull	-55 to +125	4-UCSP
MAX44268	2	14,000 (1.236V threshold)	1.8 to 5.5	1.15	0.15	5	Open drain	-55 to +125	9-WLP
MAX9025, MAX9026	1	20,000 (1.236V threshold)	1.8 to 5.5	1.7	0.3	5	Open drain/push-pull	-55 to +125	6-UCSP

For our complete portfolio of comparators, go to www.maximintegrated.com/comparator-portfolio.

Analog-to-Digital Converters

Maxim Integrated has the largest ADC product offering with over 500 ADCs that provide industry-leading performance and features. From ultra-high precise delta-sigma converters at 24-bit resolution, to SAR converters providing the unmatched combination of high precision at fast sample rate and low power, to exceedingly fast pipeline and flash architectures offering multigigabit sample rate ADCs. Whatever your need to bridge the gap between real-world signals and digital data, Maxim Integrated has the ADC to provide the solution.

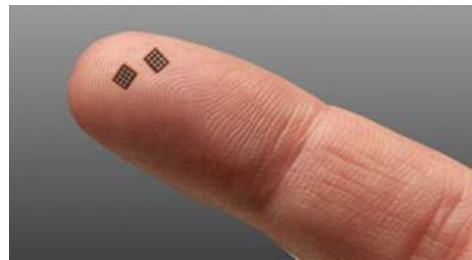
16-Bit SAR ADCs

For your most challenging designs, we now offer innovative 14- and 16-bit SAR ADCs. We also offer hundreds of 12-bit parts to meet nearly every application need.

Smallest 16-Bit SAR ADC

Benefits: MAX11100

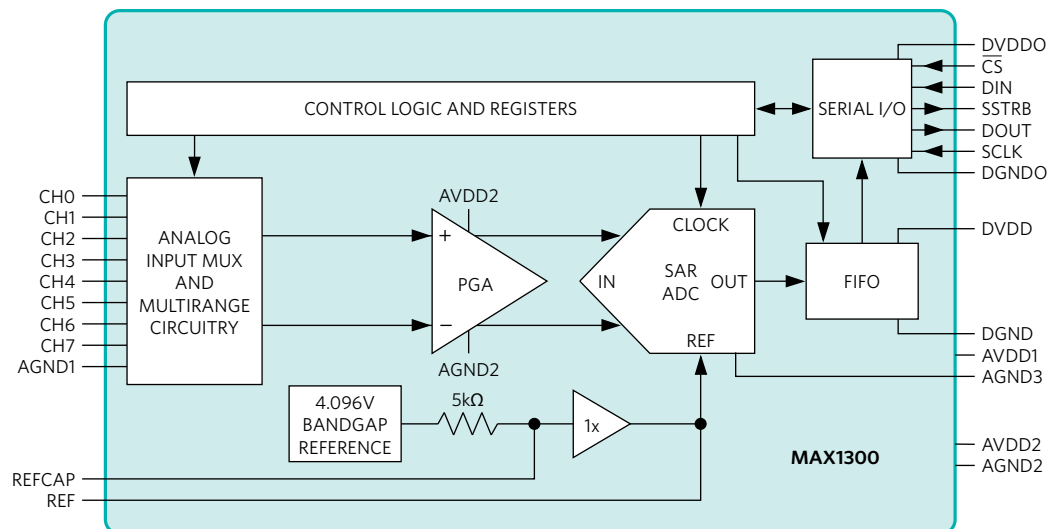
- Space-saving: 1.6mm x 2.2mm
- Ultra-low power, 130 μ A at 10ksps—ideal for portable or loop-powered systems; maximum sample rate 200ksps consumes only 2.5mA
- 3V, 5V, and 14-bit options



Most Flexible 16-Bit SAR ADC

Benefits: MAX1300

- Programmable per input pin up to $3 \times V_{REF}$, simplifies design
- Programmable per pin, single-ended or differential inputs provides flexibility
- Integrated PGA and voltage reference for high integration and reduced bill of materials



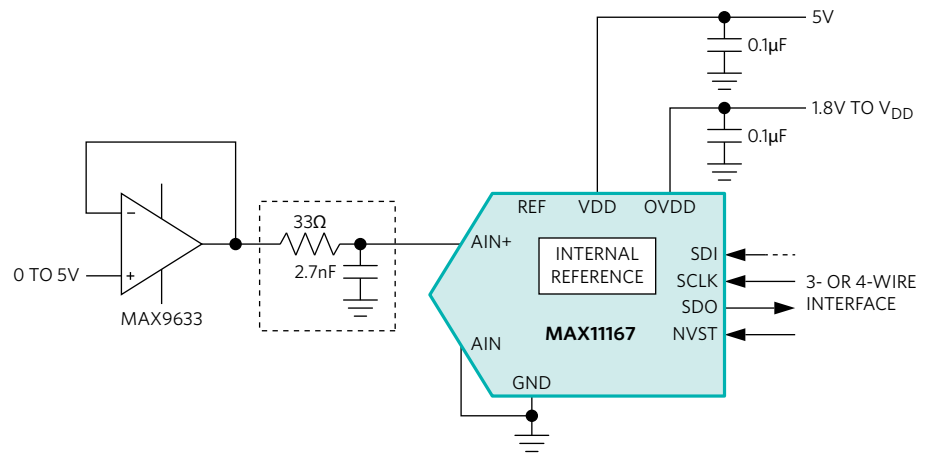
Analog-to-Digital Converters (cont.)

16-Bit SAR ADCs (cont.)

Most Integrated 1-Channel, 16-Bit SAR ADC

Benefits: MAX11167

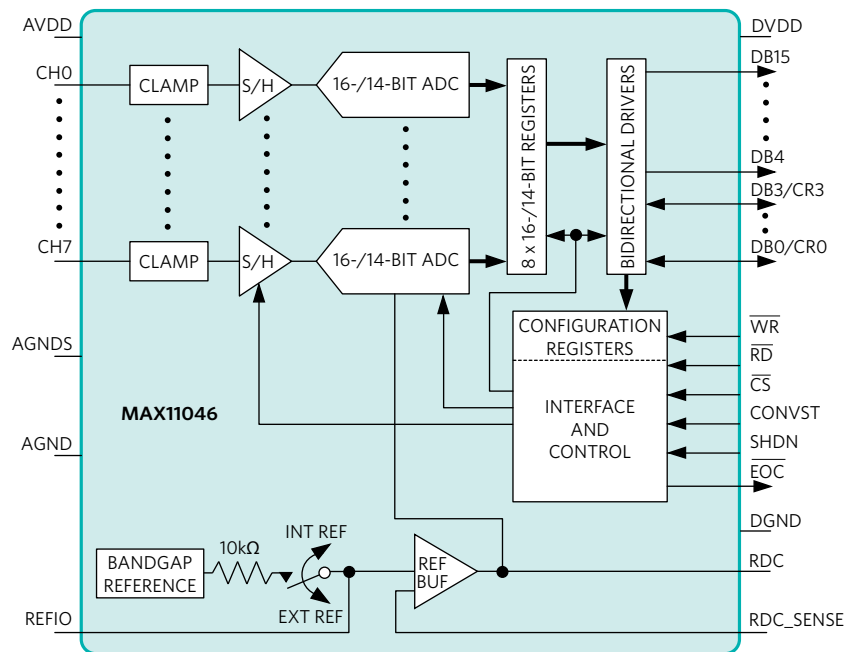
- Industry's only 12-pin, 16-bit bipolar part saves space
- Beyond-the-Rails 16-bit bipolar part simplifies system design; $\pm 5V$ input support with a single 5V supply
- Integrated reference reduces bill of material costs
- 0 to 5V unipolar 16-bit version is also available



8-Channel, Simultaneous-Sampling, 16-Bit SAR ADC

Benefits: MAX11046

- Up to 8-channel simultaneous sampling in 8mm x 8mm provides high integration and saves space
- Beyond-the-Rails inputs simplify design by supporting $\pm 5V$ from a single 5V supply
- World-class SNR (92.3dB) at 250ksps per channel



Analog-to-Digital Converters (cont.)

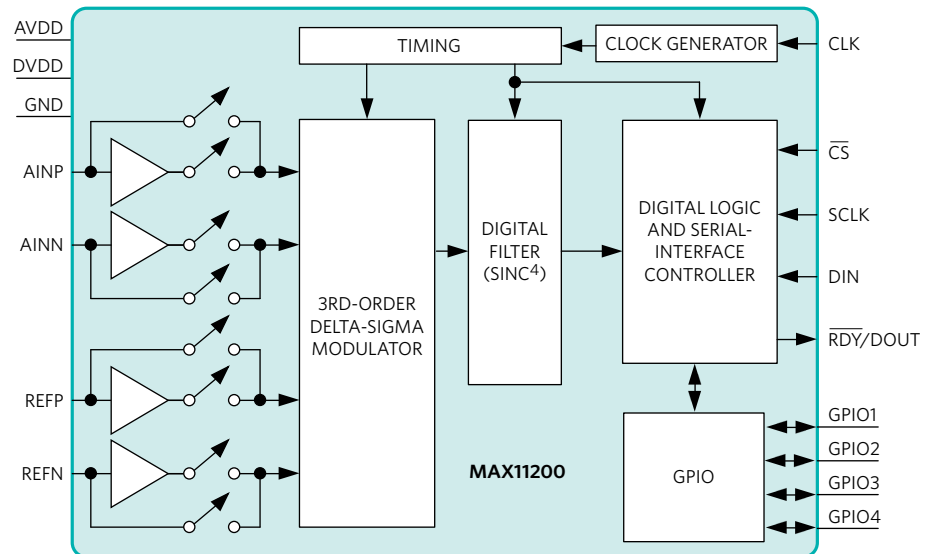
24-Bit, Delta-Sigma ADCs

Our lineup of high-performance delta-sigma ADCs offers high integration, industry-leading noise-free resolution, and world-class power specifications.

Ultra-Low-Power, High-Performance, 24-Bit Delta-Sigma ADC

Benefits: MAX11200

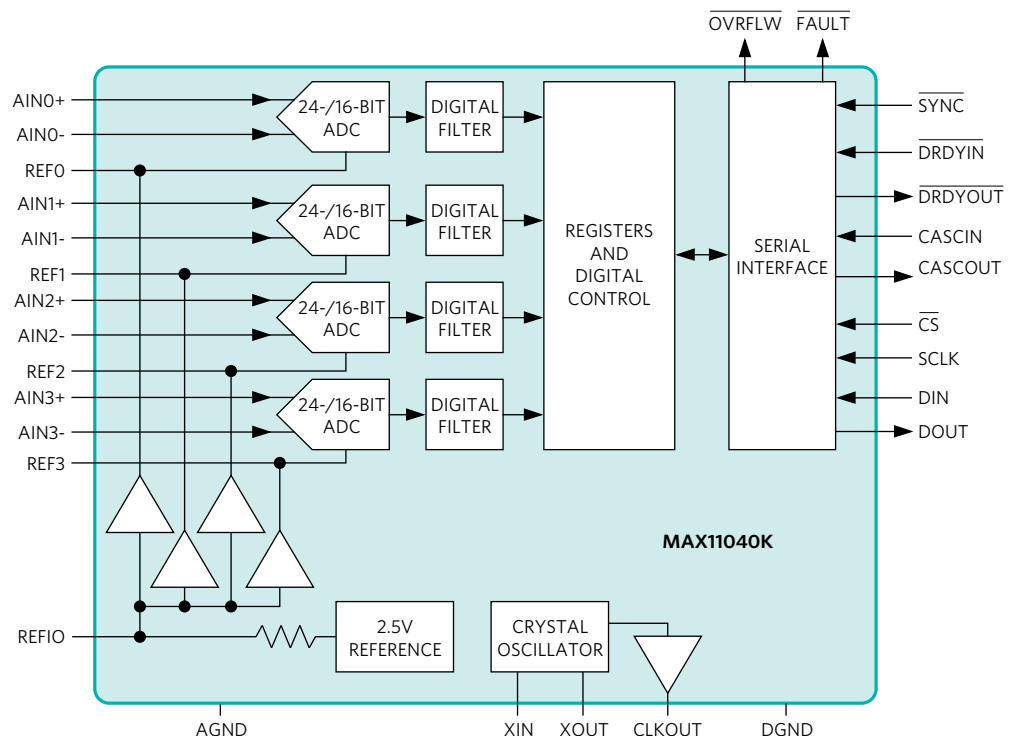
- Ultra-low-power ($< 300\mu\text{A}$), high-precision, 24-bit delta-sigma enables loop-powered sensor applications
- Integrated GPIO allows for simplified isolation schemes and easy external mux control
- Buffer input and differential reference for high-impedance sensors and radiometric resistive bridge applications



4-Channel, Simultaneous-Sampling, 24-Bit Delta-Sigma ADC

Benefits: MAX11040K

- Per-channel programmable-phase delay simplifies system
- $\pm 6\text{V}$ overvoltage protection and $2.5\text{V } V_{\text{REF}}$ offer high integration, reducing system bill of material
- Sync pin and daisy-chain SPI interface allow up to 32 channels of simultaneous sampling
- $\pm 2.5\text{V}$ Beyond-the-Rails inputs off of a positive 3V supply



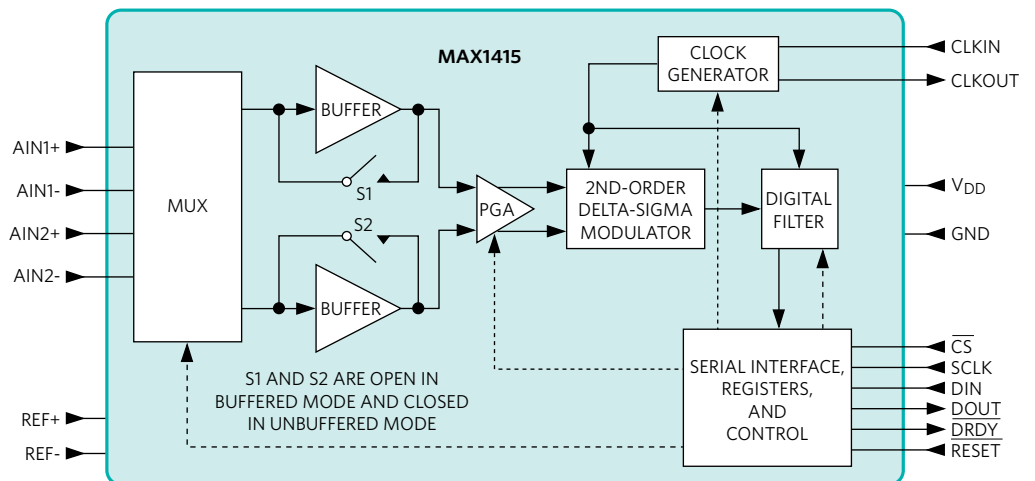
Analog-to-Digital Converters (cont.)

24-Bit, Delta-Sigma ADCs (cont.)

High-Integration, 16-Bit, Delta-Sigma ADC

Benefits: MAX1415

- Integrated PGA (1 to 128 gain) simplifies system design
- Pin-to-pin upgrade of AD7705; better linearity and integrated clock generator to reduce bill of materials
- Supports bipolar inputs from single positive supply rail



For our complete portfolio of ADCs, go to www.maximintegrated.com/adc-portfolio.

Digital-to-Analog Converters

Maxim Integrated offers over 600 comprehensive DAC products with resolutions from 6 to 18 bits and sampling rates up to 5Gbps. For precision DACs, we have the industry's first true 18-bit DAC with ± 1 LSB DNL and also the industry's first 1.8V supply DAC.

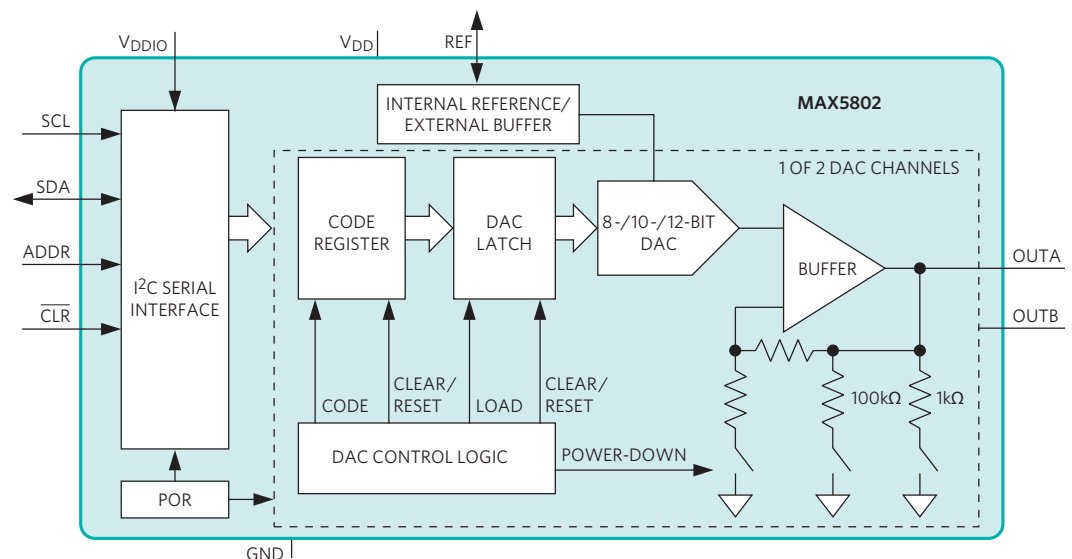
Complete DAC Family with Internal Reference and Output Buffer

Part	No. of Channels	Interface	Package
MAX5725/24*/23*	8	SPI	TSSOP, WLP
MAX5825/24*/23*	8	I ² C	TSSOP, WLP
MAX5715/14*/13*	4	SPI	TSSOP, WLP
MAX5815/14*/13*	4	I ² C	TSSOP, WLP
MAX5702/01*/00*	2	SPI	μ MAX, TDFN
MAX5802/01*/00*	2	I ² C	μ MAX, TDFN
MAX5705/04*/03*	1	SPI	μ MAX, TDFN
MAX5805/04*/03*	1	I ² C	μ MAX, TDFN

Ultra-Small, 2-Channel, 12-Bit DACs with SPI or I²C Interface

Benefits: MAX5702, MAX5802

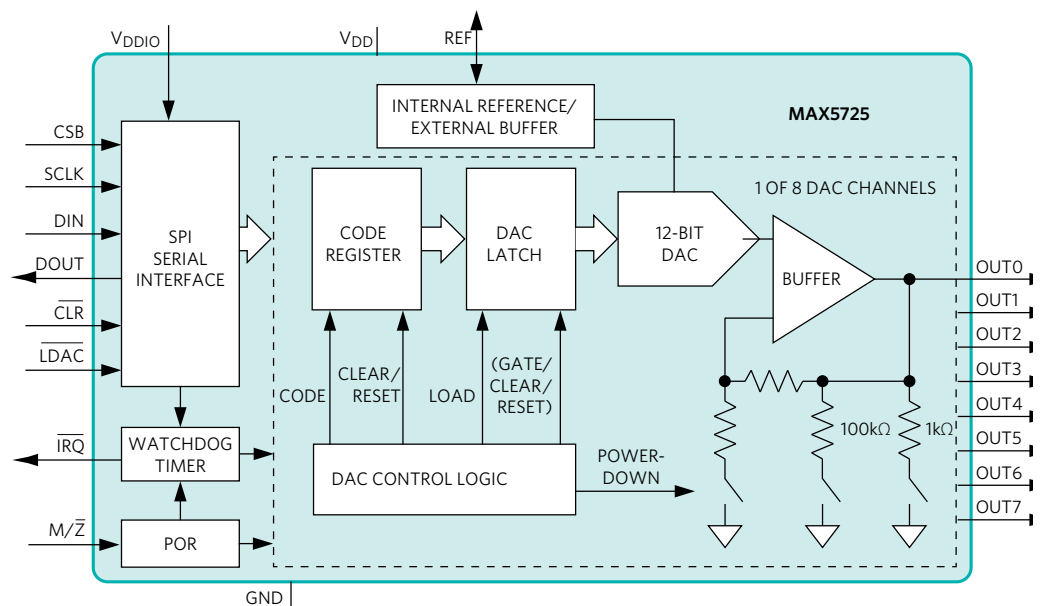
- Independent digital I/O supply: 1.8V to 5V
- Internal 10ppm (max) reference with selectable voltages: 2.048V, 2.5V, or 4.096V
- Packages: leaded 10-pin μ MAX or leadless 10-pin TDFN



Ultra-Small, Octal-Channel, 12-Bit Buffered Output DACs with Internal Reference

Benefits: MAX5725, MAX5825

- Small footprint in a WLP package (2.5mm x 2.5mm) saves board space and cost
- Three internal voltage references: 2.048V, 2.500V, or 4.096V
- Integrated watchdog programmable timer
- Independent 1.8V to 5.5V digital I/O power supply

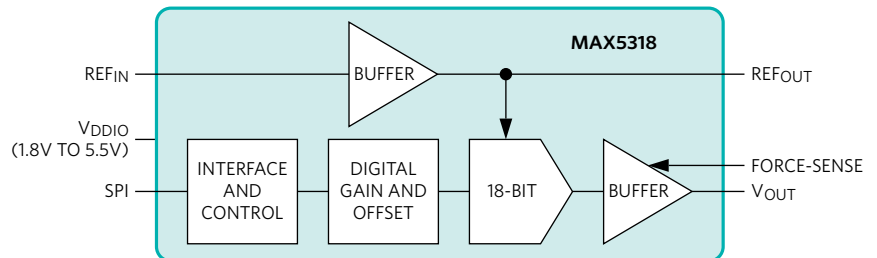


Digital-to-Analog Converters (cont.)

Industry's Most Integrated 18-Bit Low-Power DAC

Benefits: MAX5318

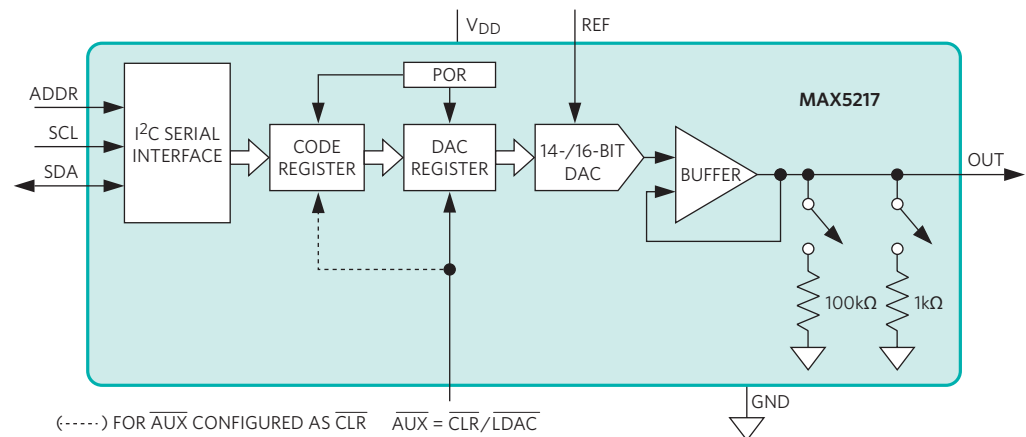
- Internal output and reference buffer
- Digital gain and offset adjustments
- ± 2 LSB INL over all codes and temperatures
- Separate digital I/O voltage: 1.8V to 5.5V
- Force-sense on output for precision control
- Low drift: $< 0.1\text{ppm}/^\circ\text{C}$



Best INL in Ultra-Low Power Space

Benefits: MAX5216, MAX5217

- Low power consumption
80 μA (max)
- Accuracy: ± 1.2 LSB INL (typ),
4 LSB (max)
- Choice of serial interface:
SPI (MAX5216),
I²C (MAX5217)
- Lowest 10Hz noise: 3.5 $\mu\text{V}_{\text{p-p}}$



For our complete portfolio of DACs,
go to www.maximintegrated.com/dac-portfolio.

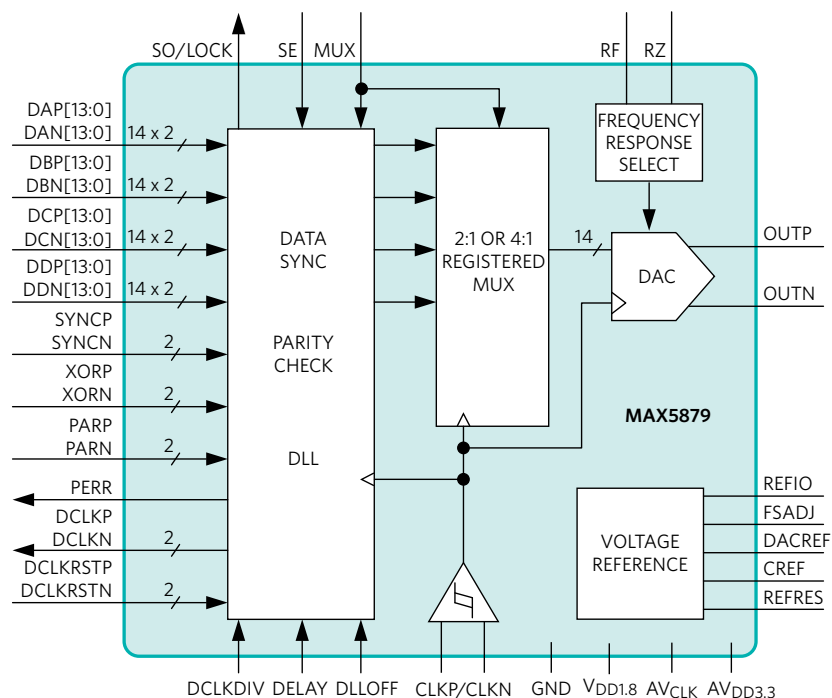
High-Speed Data Converters

Maxim has an extensive lineup of high-speed DACs and ADCs to meet your design's demanding requirements for dynamic performance and power dissipation. Data converters are offered in single-/dual-/quad-/octal-channel and analog front end (AFE) formats, giving you options for higher levels of integration and a lower solution cost. Maxim also offers direct RF-synthesis DACs and direct RF-sampling ADCs that can eliminate intermediate RF upconversion and downconversion stages, reducing system cost and complexity.

High-Speed DACs and ADCs

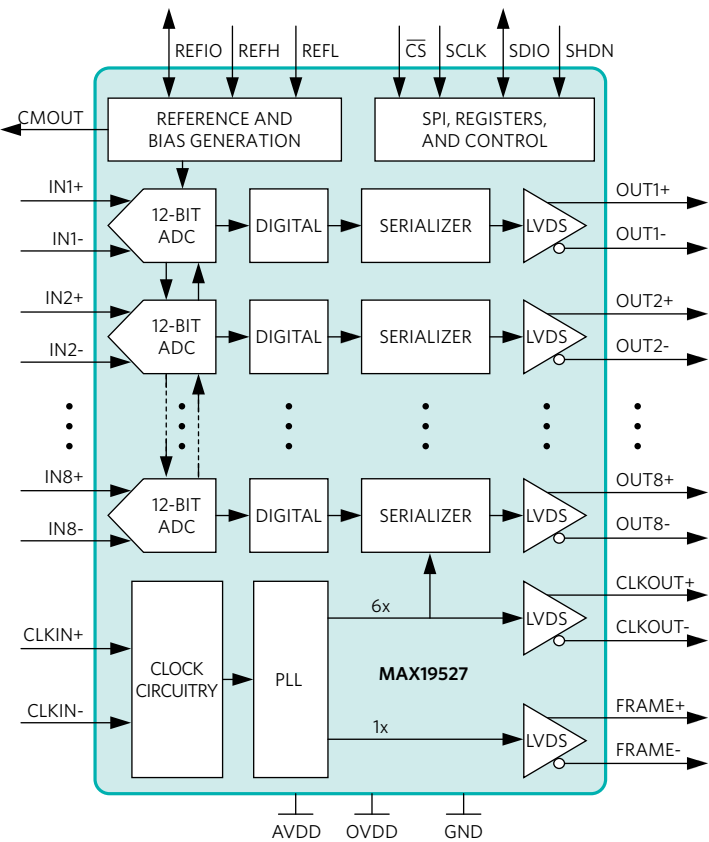
Part	Description	Features	Benefits
MAX5879	14-bit, 2.3Gsp/s RF DAC	2:1 or 4:1 multiplexed LVDS inputs	Optimizes pin count or timing margin.
		Delayed-lock loop (DLL)	Ensures data synchronization between the FPGA and the DAC.
		Parity check and error flag	More easily ensures data integrity.
		Data scrambling	Whitens spectral content to eliminate data-dependent spurs.
		SDR, DDR data interface	Increased flexibility to interface with broader set of FPGAs
MAX109	8-bit, 2.2Gsp/s RF ADC	1:4 demultiplexed LVDS outputs	Increased timing margin
		SDR, DDR, QDR data interface	Increased flexibility to interface with broader set of FPGAs
MAX19527	Octal, 12-bit, 50Msps ADC with serial LVDS outputs	Serial LVDS outputs with programmable test patterns	Compact ADC/FPGA interface; ensures data timing alignment.
		Output drivers with programmable current drive and internal termination	Eliminates reflections to ensure data integrity (open eye diagram).
MAX19517, MAX19507	10-/8-bit, dual 130Msps ADCs	Programmable data output timing; programmable internal termination	Simplify high-speed FPGA/ADC interface; eliminate reflections to ensure data integrity (open eye diagram).
		Selectable data bus (dual CMOS or single multiplexed CMOS)	Trade-off I/O and interface speed to optimize FPGA resources.

14-Bit, 2.3Gsp/s RF DAC



High-Speed Data Converters (cont.)

Octal, 12-Bit, 50Msps ADC with
Serial LVDS Outputs



FPGA Support Collateral

Part	Description	Features
DCEP	Data converter evaluation platform	Data source based on Xilinx® Virtex® -4 FPGA; compatible with Maxim Integrated's high-speed ADC evaluation kits
HSDCEP	High-speed data converter evaluation platform	Data source based on Xilinx Virtex-5 FPGA; compatible with Maxim Integrated's high-speed DACs (≥ 1.5Gsps)

For our complete portfolio of high-speed data converters, go to www.maximintegrated.com/high-speed-converters.

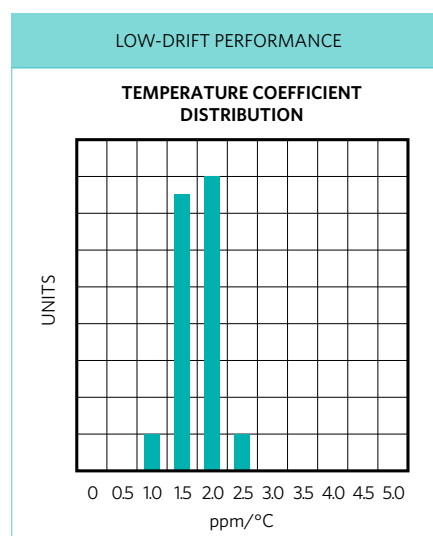
Precision Voltage References

Maxim Integrated offers the industry's most extensive line of series and shunt voltage references, allowing customers to choose among numerous key specifications, such as accuracy, temperature coefficient, noise, and package size.

Industry-Leading Combination of Low-Noise, Low-Drift Series Voltage Reference in SOT23

Features: MAX6070, MAX6071

- MSOP-SO performance in SOT23, 3mm x 3mm package
 - Low temperature drift: 7ppm/°C (max)
 - Excellent long-term drift: 25ppm/1000 hours
- Low noise: 4.8μV_{P-P} at 2.5V_{OUT}
- 10mA source and sink
- Noise reduction filter: MAX6070
- Force-sense GND and output: MAX6071
- 30μs turn-on time to 0.01% with 0.1μF
- Drop-in upgrade to TI's REF32xx and ADI's ADR34xx with the MAX6071



Best-in-Class Voltage References

Part	Benefits	Features
MAX6325	Lowest drift	1ppm/°C (max) with trim and noise reduction
MAX6126	Lowest noise	3ppm/°C, 1.45mV _{P-P} , 0.1Hz to 10Hz noise trim and force-sense output
MAX6173	Lowest drift high voltage, in and out	3ppm/°C, 10V or 5V output, temperature output: 1.9mV/°C
MAX6070	Lowest drift in SOT23	7ppm/°C (max) with enable and noise reduction
MAX6023	Smallest package footprint	30ppm/°C (max), 35μA quiescent current in 1.5mm ² package
MAX6138	Lowest drift shunt	25ppm/°C in SC70, with LM4040 pinout

For our complete portfolio of voltage references, go to www.maximintegrated.com/voltage-ref-portfolio.

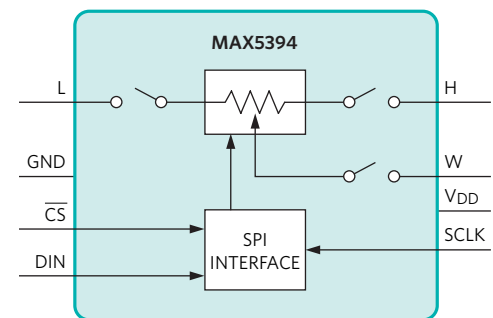
Digital Potentiometers

Digital potentiometers perform the same function as a mechanical potentiometer or a variable resistor. These devices consist of a fixed resistor and a wiper contact with multiple tap points that are digitally controlled through a 2-wire serial interface (typically SPI). The small package size, low supply voltage, low supply current, and industrial temperature range make the devices uniquely suitable for the portable consumer market, medical and industrial applications, and the automotive market.

256-Tap, Volatile Digital Potentiometers

Benefits: MAX5394, MAX5395

- Industry-leading low supply voltage: 1.7V to 5.5V extended supply range
- Ultra-low supply current ($< 1\mu\text{A}$)
- Minimized board space is available in a space-saving, 8-pin TDFN (4mm^2) package
- Guaranteed performance over extended temperatures (-40°C to $+125^\circ\text{C}$) enables operation in harsh environmental conditions
- Flexible design choices include an I²C (MAX5395) or SPI (MAX5394) communications interface with 10k Ω , 50k Ω , or 100k Ω end-to-end resistance options



Best-in-Class Digital Potentiometers

Digipot Application	Best-in-Class Products	Benefits
Nonvolatile memory	MAX5481-MAX5484, MAX5494-MAX5499	Return wiper setting to preset condition after power-off.
Volatile memory	MAX5386-MAX5389, MAX5391/MAX5393	Operation down to 1.7V; ideal for portable battery-operated devices
Bipolar	MAX5436-MAX5439	Dual- or single-supply operation
Small footprint	MAX5460-MAX5468	Save cost and board space, tiny 5mm^2 SC70 package.
Resistor- and voltage-dividers	MAX5430/MAX5431, MAX5420/MAX5421	Programmable gains, single- or dual-supply operation
Log taper	DS1882	High design flexibility: bipolar or single supply, 1dB steps or variable, configurable nonvolatile or volatile memory

For our complete portfolio of digital potentiometers, go to www.maximintegrated.com/digipot-portfolio.

Reference Designs

Maxim Integrated enables customers to help themselves, with an eye towards efficiency. You can search for products you need, view training videos, design with our tools, and receive samples quickly. For our technical documents and design tools, go to www.maximintegrated.com/design.

To meet the needs of industrial control and industrial automation applications, where isolation, higher resolutions, and higher voltage system solutions are often needed, Maxim Integrated provides complete subsystem signal chain reference designs. Hardware and firmware design files as well as FFTs and histograms from lab measurements are provided.

The Cupertino (MAXREFDES5#) subsystem reference design is a 16-bit high-accuracy industrial analog front end (AFE) that accepts -10V to +10V, 0 to 10V, and 4-20mA current loop signals with isolated power and data, all integrated into a small form factor. The Cupertino design integrates low-noise high-impedance analog buffers (MAX9632); a highly accurate ADC with innovative on-chip attenuation (MAX1301); an ultra-high precision 4.096V voltage reference (MAX6126); 600V_{RMS} data isolation (MAX14850); and isolated/regulated +12V, -12V, and 5V power rails (MAX256/MAX1659). This AFE solution can be used in any application that needs high-accuracy analog-to-digital conversion, but it is mainly targeted for industrial sensors, industrial automation, process control, programmable logic controllers (PLCs), and medical applications.

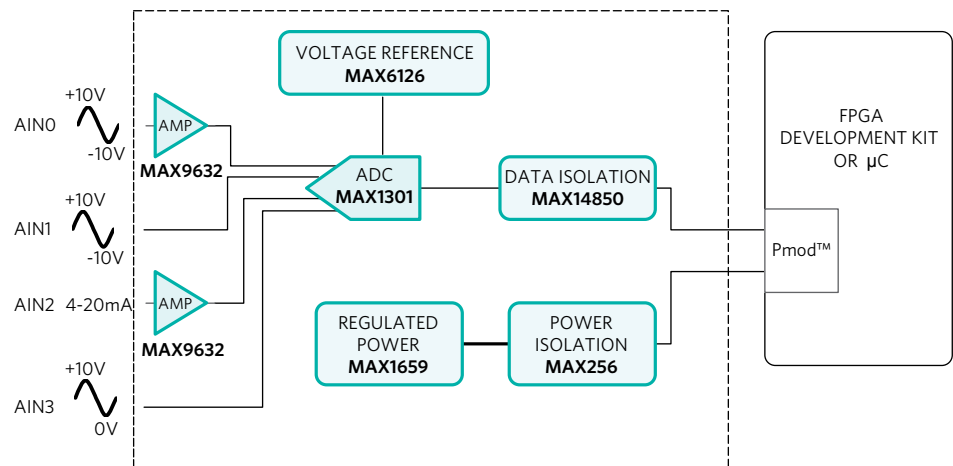
Features

- High accuracy
- $\pm 10\text{V}$, 0 to 10V, and 4-20mA inputs
- Isolated power and data
- Small printed-circuit board (PCB) area
- Pmod™-compatible form factor

Applications

- Industrial sensors
- Process control
- Industrial automation
- PLCs
- Medical

The Cupertino Subsystem Design Block Diagram



For our complete portfolio of reference designs, go to www.maximintegrated.com/reference-designs.

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