HIGH-SPEED ADCs, DACs, & AFEs

Design Guide

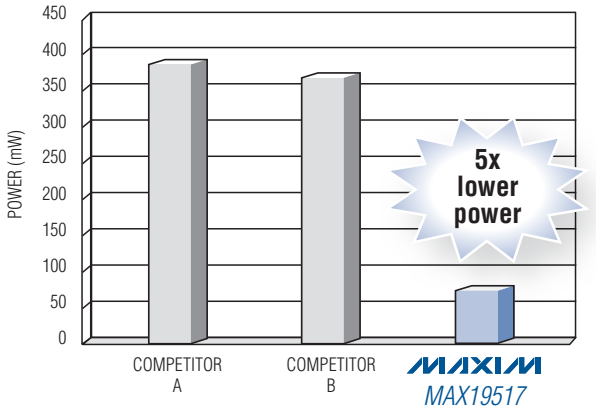
11th Edition September 2008

Industry's lowest power, dual-channel 10-bit, 130Msps ADC has superior dynamic performance

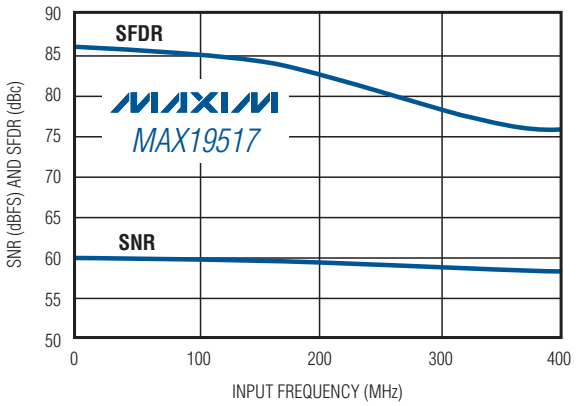
Extensive feature set minimizes external component count

The MAX19517 ADC is a member of Maxim's pin-compatible family of ultra-low-power, dual-channel ADCs. Its extensive set of features (a partial list is shown below) minimizes external component count and supports a wide range of applications that demand high performance.

POWER PER CHANNEL



DYNAMIC PERFORMANCE



- **Lowest power: 75mW per channel**
- **Excellent performance for input frequencies from DC to > 400MHz**
- **Self-sensing supply regulation**
- **1.8V, 2.5V, 3.3V operation**
- **Wide input common-mode range**
- **Programmable CMOS termination**
- **Flexible data formatting**
- **Programmable data timing**
- **Programmable clock divider: 1x, 2x, 4x**
- **Data output test patterns**
- **7mm x 7mm, 48-pin TQFN package**

Pin-compatible, ultra-low-power, dual-channel ADCs

Part	Resolution (Bits)	Sample Rate (Msps)	Power per Channel (mW)	SNR (dBFS)	SFDR (dBc)
MAX19517	10	130	75	60.0	85
MAX19516	10	100	57	60.0	85
MAX19515	10	65	43	60.0	85
MAX19507*	8	130	75	49.7	69
MAX19506*	8	100	57	49.7	69
MAX19505*	8	65	43	49.7	69

*Future product—contact factory for availability.

MAXIM

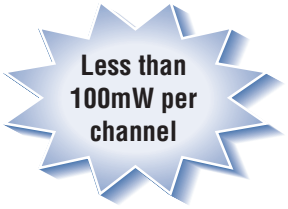
12-/10-bit ADCs

Low-power, octal, 12-bit 40/50/65Msps ADCs

Serial LVDS ADCs offer space-saving solution with outstanding 90dBc SFDR

Maxim expands its high-performance, ultra-low-power, MAX1126/MAX1127 quad 12-bit ADC family by offering the MAX1436/MAX1437/MAX1438 family of pin-compatible octal ADCs. These octal ADCs are ideal for high-channel-count applications with demanding performance, power, and space requirements, such as medical imaging and wireless communications.

To address the high-density requirements, these quad/octal ADCs offer the choice of either a serial low-voltage differential signaling (LVDS) interface or a serial scalable low-voltage signaling (SLVS) interface. The serial LVDS/SLVS interface significantly reduces pin count, resulting in a smaller package and a compact digital interface.



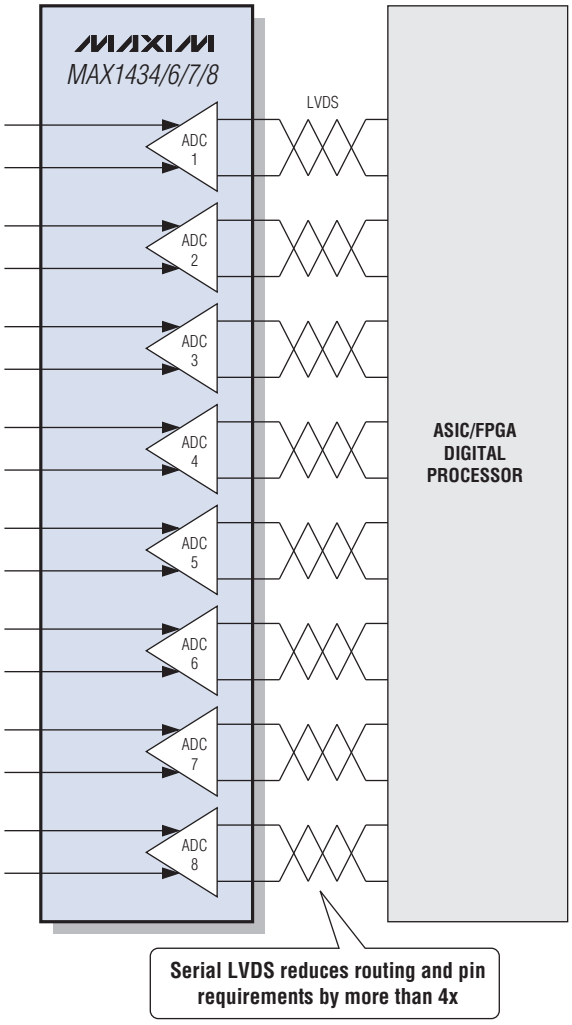
Outstanding dynamic performance

- 69.6dB SNR at f_{IN} = 20MHz
- 90dBc SFDR at f_{IN} = 20MHz
- -95dB crosstalk

Low power

- 93mW per channel (MAX1436)
- 96mW per channel (MAX1437)

Part	Channels	Resolution (Bits)	Speed (Msps)
MAX1438	8	12	65
MAX1437	8	12	50
MAX1436	8	12	40
MAX1434	8	10	50
MAX1127	4	12	65
MAX1126	4	12	65



To speed designs, obtain an EV kit at:
www.maxim-ic.com/hscMAX1438EVKIT

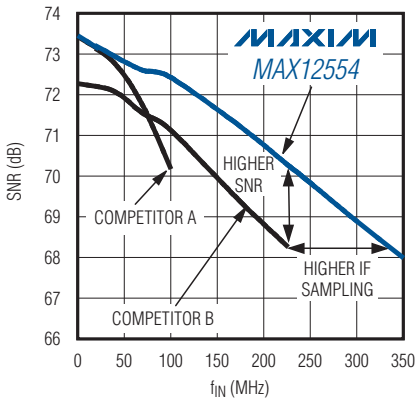
14-/12-bit, 95Msps ADCs deliver 72.1dB SNR at 175MHz and 497mW

High-speed, single/dual, direct IF-sampling ADCs simplify system design and reduce cost

The MAX12555/MAX12554/MAX12553 single 14-bit ADCs are optimized for lower power and high dynamic performance in IF-sampling applications such as communications receivers, medical imaging, instrumentation, and data acquisition. For example, the MAX12555 delivers 72.1dB SNR at an input frequency of 175MHz while consuming only 497mW. These ADCs are capable of direct IF sampling up to 400MHz, which simplifies system design and reduces cost by eliminating downconversion stages. Pin-compatible, 12-bit versions are offered for additional design flexibility.

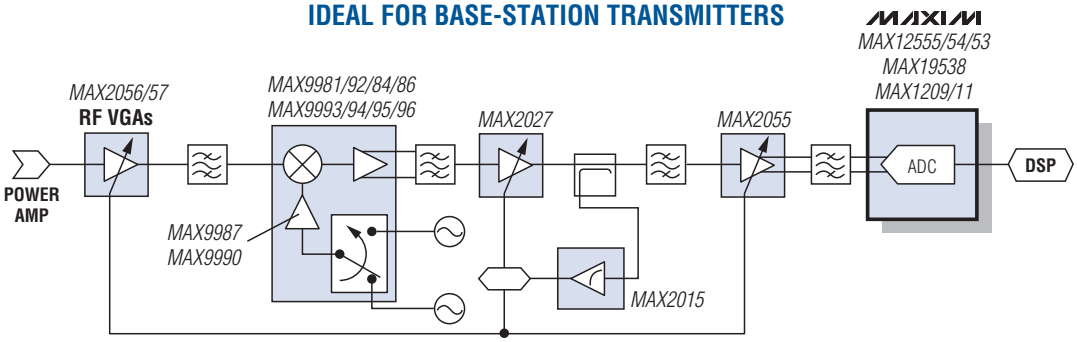
The MAX12559/MAX12558/MAX12557/MAX12529/MAX12528/MAX12527 integrate two ADC channels into one package. These dual 14-/12-bit ADCs offer similar performance to the single ADCs, and are ideal for I/Q sampling or for main and diversity IF sampling.

SUPERIOR SNR AT ANY FREQUENCY



For more information on Maxim's wireless infrastructure products, go to: www.maxim-ic.com/btsdesign

IDEAL FOR BASE-STATION TRANSMITTERS



Part	Resolution (Bits)	Channels	Speed (Msps)	SNR (dB) f_{IN} = 175MHz, -0.5dBFS	Power (mW)
MAX12555	14	1	95	72.1	497
MAX12554	14	1	80	70.9	429
MAX12553	14	1	65	71.0	363
MAX19538	12	1	95	68.4	492
MAX1209	12	1	80	66.5	393
MAX1211	12	1	65	66.8	340
MAX12559	14	2	96	72.7	980
MAX12558	14	2	80	72.2	789
MAX12557	14	2	65	72.5	637
MAX12529	12	2	96	70.2	980
MAX12528	12	2	80	69.8	760
MAX12527	12	2	65	69.8	647

16-bit ADCs

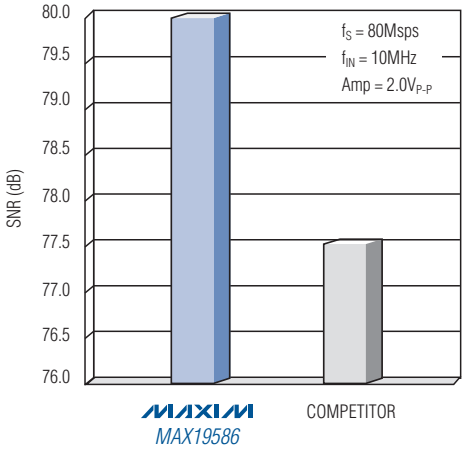
16-bit, 80Msps/100Msps ADCs have the best noise floor at -82dBFS

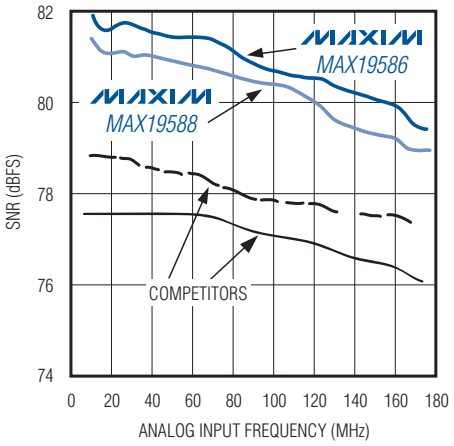
Outstanding dynamic performance at low power

The MAX19586 (16-bit, 80Msps ADC) and the MAX19588 (16-bit, 100Msps ADC) are designed for applications that demand very high dynamic range and excellent spurious performance. Ideal applications are cellular base-station receiver systems, multicarrier and multistandard communication receivers, E911 location receivers, antenna-array processing, and high-end test and measurement instrumentation.

These two ADCs are in the elite class of ADCs that achieve 80dB or more of SNR. They provide this 80dB SNR at an input frequency of 10MHz, as well as a -82dBFS noise floor and 96dBc SFDR.

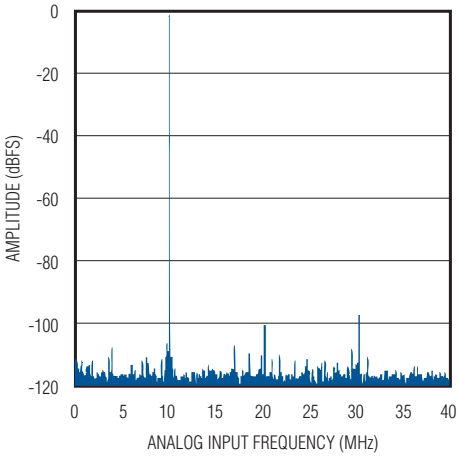
OUTSTANDING WIDEBAND SNR PERFORMANCE





- **Outstanding dynamic performance**
  - **-82dBFS noise floor**
  - **80dB SNR at f_{IN} = 10MHz***
  - **78.5dB SNR at f_{IN} = 100MHz***
  - **96dBc SFDR at f_{IN} = 10MHz***
  - **84dBc SFDR at f_{IN} = 100MHz***
- **Low power: 1.1W***
- **Ideal for multicarrier receivers, multistandard receivers, and high-performance instrumentation**

FFT PLOT (32,768-POINT RECORD)



www.maxim-ic.com/hscMAX19586

or

www.maxim-ic.com/hscMAX19588

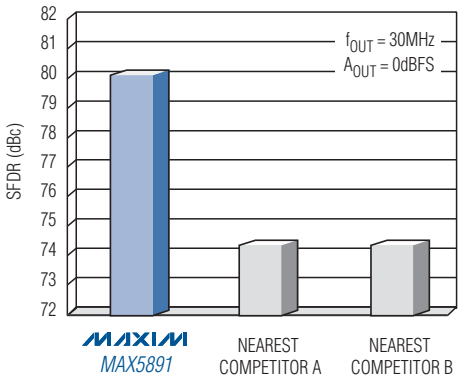
*MAX19586, f_S = 80Msps.

High-speed, 16-/14-/12-bit DACs are ideal for broadband communications

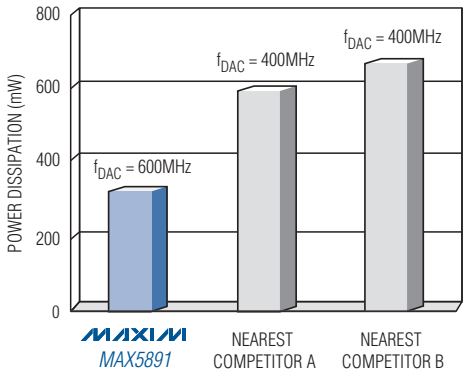
16-bit, 600Msps DAC delivers best SFDR, IMD at the lowest power

The MAX5891 and MAX5885 high-speed DAC families deliver outstanding spurious-free and noise-density performance, while offering 600Msps/200Msps update rates at very low power consumption. These devices are designed for single-/multicarrier communication systems (cellular base stations, microwave point-to-point links), instrumentation, and automated test equipment.

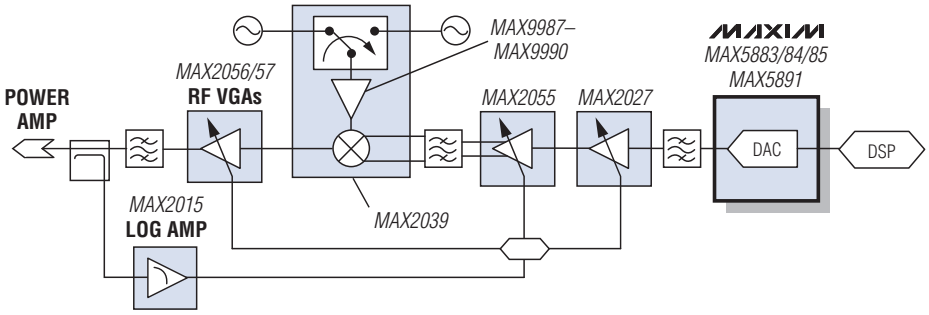
SUPERIOR SFDR



INDUSTRY'S LOWEST POWER AT FAST UPDATE RATES



IDEAL FOR BASE-STATION TRANSMITTERS



- **Outstanding dynamic performance**
  - **SFDR: 80dBc at f_{OUT} = 30MHz**
  - **Noise density: -163dBFS/Hz at f_{OUT} = 36MHz**
  - **Two-tone IMD: -95dBc at f_{OUT} = 30MHz**
  - **ACLR: 73dB at f_{OUT} = 122.88MHz**
- **Low-power: 298mW at 600Msps**
- **Pin-compatible, 16-/14-/12-bit LVDS and CMOS families**
- **Evaluation kits available**

Part	Resolution (Bits)	DAC Update Rate (Msps)	SFDR (dBc) f_{OUT} = 30MHz	Noise Density (dBFS/Hz)	Input Interface
MAX5891	16	600	80	-163 at 36MHz	LVDS
MAX5890	14		80	-162 at 36MHz	
MAX5889	12		79	-157 at 36MHz	
MAX5885	16	200	71	-155 at 16MHz	CMOS
MAX5884	14		66	-153 at 16MHz	
MAX5883	12		66	-150 at 16MHz	

www.maxim-ic.com/hscMAX5891

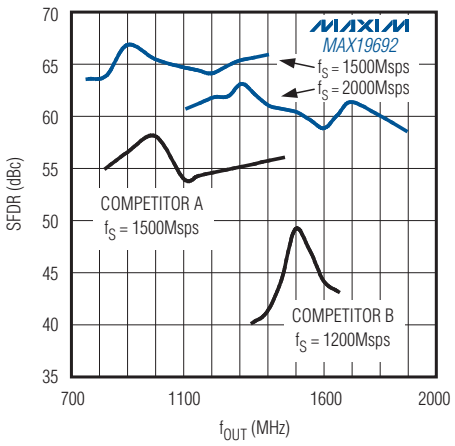
12-bit DAC

12-bit, 2.3Gsps multi-Nyquist DAC delivers industry's best SFDR at high IF

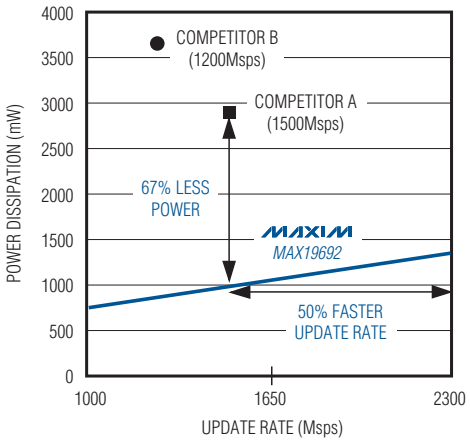
Enables wideband and direct RF communications at one-third the power

The MAX19692 12-bit, 2.3Gsps DAC synthesizes wideband signals (up to 1GHz bandwidth) in baseband and in higher Nyquist zones (from DC to more than 2GHz) with excellent spurious and noise performance. This DAC has a high SNR and excellent gain flatness in the first three Nyquist zones directly, thus eliminating the need for upconversion stages in a radio transmitter. With its unique ability to generate broadband signals over a wide frequency range, the MAX19692 enables ultra-high-data-rate wireless modems, multistandard software radio transmitters, wideband radar, arbitrary waveform generators, and automatic test equipment (ATE) applications.

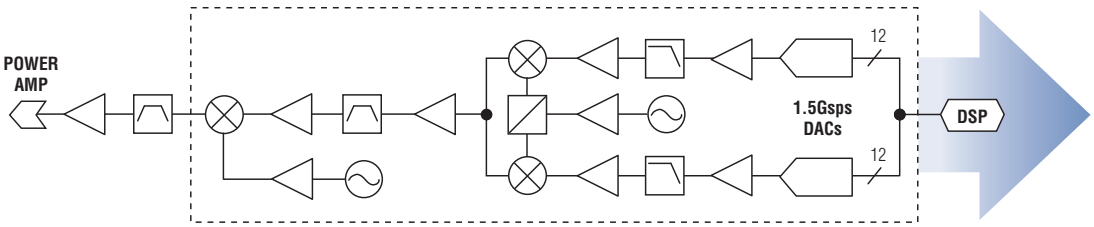
SUPERIOR SFDR AND SIGNAL BANDWIDTH AT HIGH IF



SUPERIOR UPDATE RATE AT A FRACTION OF THE POWER



REPLACE THIS



WITH THIS

- **Industry's highest dynamic performance**
  - **Noise spectral density = -162dBm/Hz at f_{OUT} = 200MHz**
  - **SFDR = 75dBc at f_{OUT} = 200MHz**
  - **SFDR = 73dBc at f_{OUT} = 600MHz**
  - **SFDR = 65dBc at f_{OUT} = 1300MHz**
  - **SFDR = 60dBc at f_{OUT} = 1800MHz**
- **2.3Gsps output-update rate**
  - **Synthesizes 1GHz signal bandwidth**
- **4:1 multiplexed LVDS inputs**
- **Low power: 760mW at 1Gsps**
- **11mm x 11mm, 169-pin CSBGA package**
- **Data source (FPGA) board available**
- **Evaluation kit available**

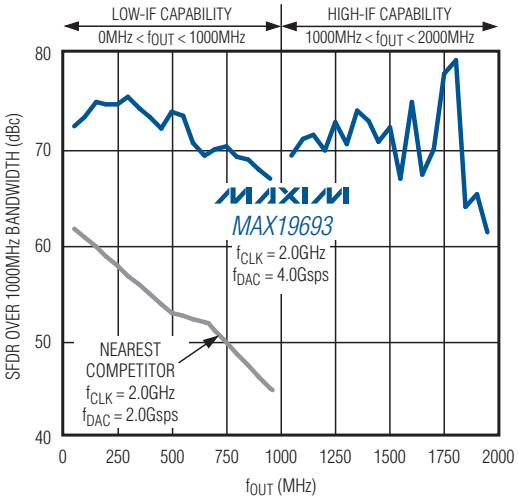
NEW

12-bit, 4.0Gsps wideband DAC delivers best dynamic performance with lowest power

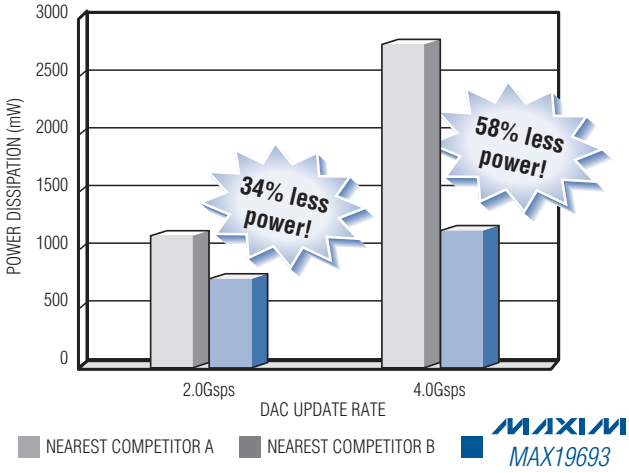
Simplifies design of wideband communications, instrumentation, and military applications

The MAX19693 12-bit, 4.0Gsps DAC synthesizes wideband signals (up to 2GHz bandwidth) with excellent spurious and noise performance, while consuming the lowest power and space. As such, this DAC simplifies the design of wideband communications transmitters, radars, jammers, arbitrary waveform generators, ATE, and other commercial and military equipment.

SUPERIOR SFDR vs. OUTPUT FREQUENCY



LOWEST POWER DISSIPATION vs. UPDATE RATE



- 4.0Gsps output-update rate
  - Low-IF and high-IF direct synthesis
- Industry's highest dynamic performance
  - Noise spectral density = -164dBm/Hz at f_{OUT} = 200MHz
  - SFDR* > 69dBc at f_{OUT} < 800MHz
  - SFDR = 70dBc at f_{OUT} = 1700MHz
- Low power: 1.2W at 4.0Gsps
- 4:1 multiplexed LVDS inputs
- 11mm x 11mm, 169-pin CSBGA package—20x smaller than the competition
- -40°C to +85°C extended temperature range
- Data source (FPGA) board available
- Evaluation kit available

www.maxim-ic.com/hscMAX19693

*SFDR in 1000MHz bandwidth of f_{out} .

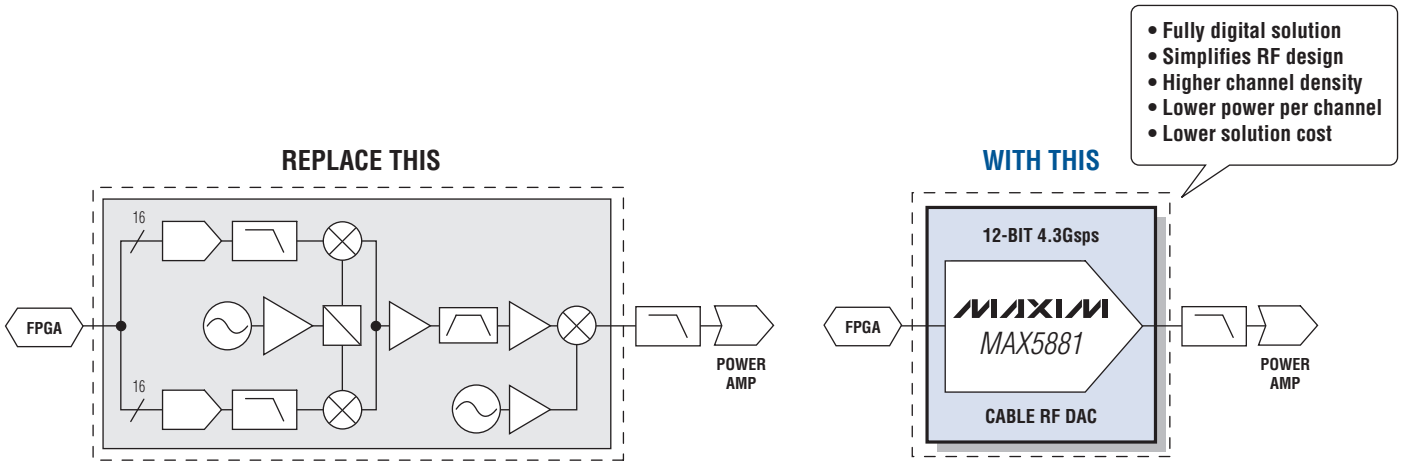
12-bit DAC

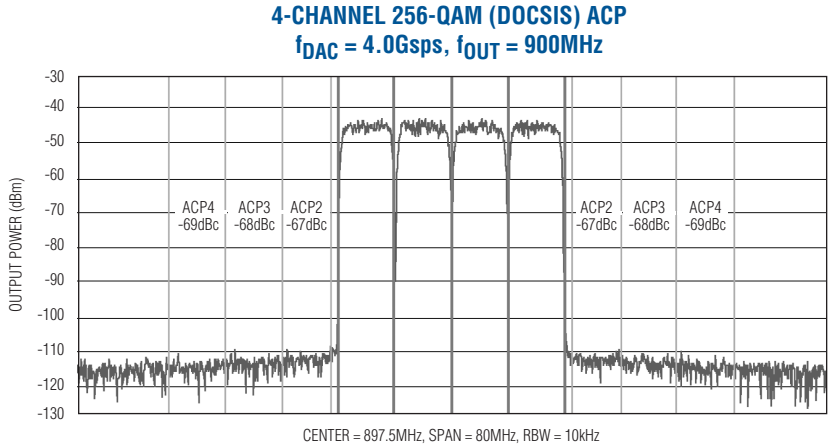
12-bit, 4.3Gsps RF DAC directly synthesizes four QAM channels in 50MHz to 1000MHz cable downstream band

NEW

Enables fully digital upconverter for DOCSIS® 3.0-compliant edge QAM devices and cable modem termination systems (CMTS)

The MAX5881 12-bit, 4.3Gsps RF DAC directly synthesizes multichannel QAM signals in the 50MHz to 1000MHz cable downstream band, and meets the requirements of DOCSIS 3.0 for up to four contiguous channels per RF port. This DAC not only simplifies the RF portion of an upconverter design, but also provides higher density, lower power, and lower cost per channel than the traditional analog approach.





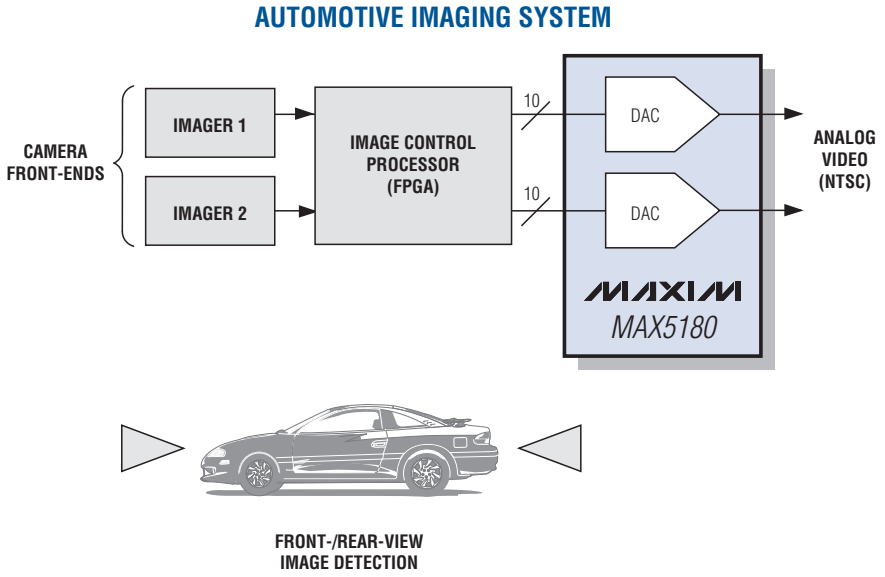
- **Industry-leading dynamic performance**
  - **Supports up to four 6MHz* QAM channels**
  - **ACP2 = -67dBc at f_{OUT} = 1000MHz (6MHz offset)**
  - **ACP3 = -68dBc at f_{OUT} = 1000MHz (12MHz offset)**
  - **ACP4 = -69dBc at f_{OUT} = 1000MHz (18MHz offset)**
- **Data source (FPGA) board available**
- **4.3Gsps output-update rate**
  - **Direct RF synthesis: 50MHz to 1000MHz**
- **Low power: 1.2W at 4.0Gsps**
- **4:1 multiplexed LVDS inputs**
- **11mm x 11mm, 169-pin CSBGA package**
- **Evaluation kit available**

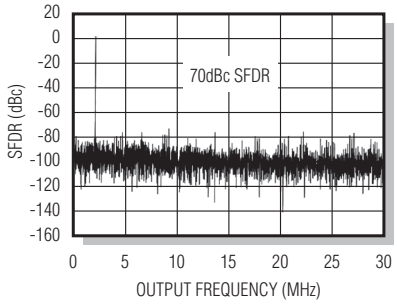
DOCSIS is a registered trademark of Cable Television Laboratories, Inc. (CableLabs®).
*Supports EuroDOCSIS, 8MHz QAM channels.

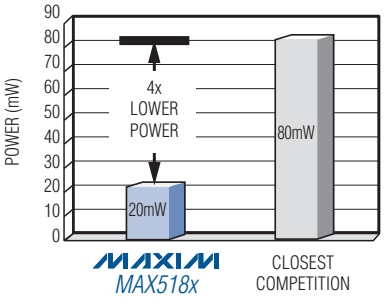
Low-power, 3V, dual 10-/8-bit DACs deliver 70dBc SFDR at 20mW

Single/dual 40MHz DACs ideal for automotive imaging and communication applications

The MAX518x family of high-speed DACs features internal 50ppm/°C, low-noise, 1.2V references. These DACs meet the dynamic performance and low-power requirements of high-speed communication, signal synthesis, and imaging applications. The dual DACs accept interleaved data on a single digital-input bus and provide differential outputs in current or voltage format, updated simultaneously on each clock cycle. Alternate-phase-update output and single-channel DAC versions are available. These DACs are designed for the extended-industrial temperature range (-40°C < T_A < +85°C).*







- **Low 10pV-s impulse energy for ultra-low distortion**
- **Close channel matching (dual)**
  - **±1% FSR gain error**
  - **±0.2° phase error**
- **Small package options**
  - **24-pin QSOP/TQFN (single)**
  - **28-pin QSOP (dual)**
- **70dBc SFDR at f_{OUT} = 2.2MHz**
- **Single 2.7V to 3.3V supply**
- **Low power at 3V**
  - **18mW (single)**
  - **20mW (dual)**
- **< 1µA shutdown and standby mode to conserve power**
- **Evaluation kits available**

Part	Resolution (Bits)	DACs per Package	Output Update**	SFDR (dBc)	Gain Mismatch (%)	Phase Mismatch (Degrees)	Output Type
MAX5180/MAX5183	10	2	Simultaneous	70	±1	±0.2	I_{OUT}/V_{OUT}
MAX5181/MAX5184		1	—		—	—	
MAX5182/MAX5185		2	Alternate		—	—	
MAX5186/MAX5189	8	2	Simultaneous		±1	±0.2	
MAX5187/MAX5190		1	—		—	—	
MAX5188/MAX5191		2	Alternate		—	—	

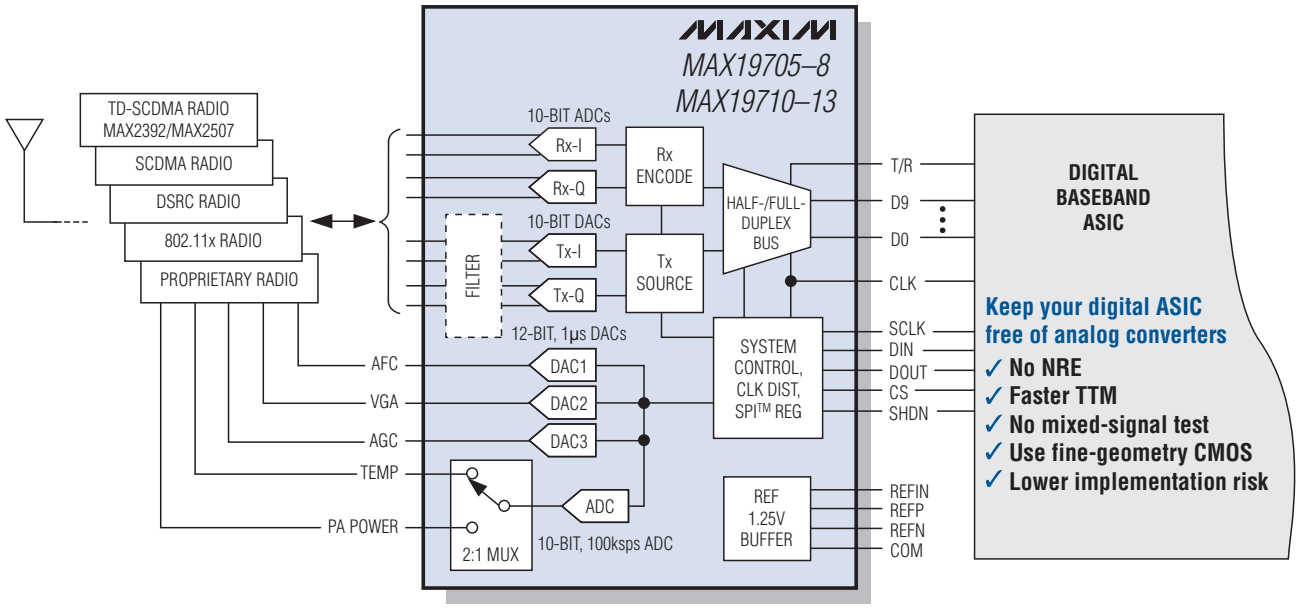
*Contact factory if alternative temperature range is required.
**Alternate-phase-update, dual-DAC versions available for applications requiring lowest latency.

10-bit AFEs

Integrated AFEs offer lowest power, smallest size, and lowest cost

Ideal for ZIF transceivers in handsets, PDAs, data cards, CPEs, and WLANs

Maxim expands its portfolio of half-duplex analog front-ends (AFEs), the MAX19705–MAX19708, with the MAX19710–MAX19713 full-duplex AFEs. These products have been designed for applications that demand good dynamic performance, ultra-low power, and a high level of integration. These AFEs offer integrated high-speed, 10-bit ADCs and DACs for the receive/transmit path. They also incorporate auxiliary low-speed, 12-bit DACs and a 10-bit ADC for various housekeeping control (e.g., gain) and measurement (e.g., temperature) functions. Typical applications for this family of AFEs include battery-powered wireless devices, PDAs, and cellular handsets.



High level of integration

- Tx: dual 10-bit DACs
- Rx: dual 10-bit ADCs
- Aux ADC/DACs, optional Tx filter
- Half-/full-duplex digital bus options
- Compact 7mm x 7mm x 0.8mm, 48-/56-pin TQFN package

Excellent dynamic performance

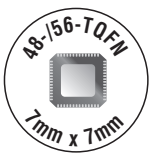
- > 54dB SINAD (Rx ADCs)
- > 70dBc SFDR (Tx DACs)

Ultra-low power and versatile control

- 28mW to 92mW (7.5Msps to 45Msps)
- Shutdown, idle, standby, Tx/Rx disable

Lowest cost solution

- Save 56% over discrete solutions
- Pricing starts at less than $5.00†



Part		Speed (Msps)	Features
Half-Duplex Bus	Full-Duplex Bus		
MAX19705ETM	MAX19710ETN	7.5	Aux DAC, aux ADC
MAX19708ETM	MAX19711ETN	11	Aux DAC, aux ADC, LP Tx filters
MAX19706ETM	MAX19712ETN	22	Aux DAC, aux ADC
MAX19707ETM	MAX19713ETN	45	Aux DAC, aux ADC

SPI is a trademark of Motorola, Inc.

†50k-up recommended resale. Prices provided are for design guidance and are FOB USA. International prices will differ due to local duties, taxes, and exchange rates. Not all packages are offered in 1k increments, and some may require minimum order quantities.

High-Speed ADCs

Part	Resolution (Bits)	Sample Rate (Msps)	Input Channels	Data-Bus Interface	Supply Voltage (V)
MAX105	6	800	2	LVDS	5 and 3.3
MAX107	6	400	2	LVDS	5 and 3.3
MAX1003	6	90	2	CMOS	5 and 3.3
MAX1002	6	60	2	CMOS	5
MAX108	8	1500	1	PECL	±5
MAX104	8	1000	1	PECL	±5
MAX106	8	600	1	PECL	±5
MAX1121	8	250	1	LVDS	1.8
MAX19507*/6*/5*	8	130/100/65	2	CMOS	1.8 or 2.5 to 3.3
MAX1198/7/5	8	100/60/40	2	CMOS	3
MAX1196	8	40	2	CMOS, mux	3
MAX1193/2/1	8	45/22/7.5	2	CMOS, mux	3
MAX1124/3/2	10	250/210/170	1	LVDS	1.8
MAX1449/8/6/4	10	105/80/60/40	1	CMOS	3.3/3/3/3
MAX1425/6	10	20/10	1	CMOS	5 and 3.3
MAX1190	10	120	2	CMOS	3.3
MAX19517/6/5	10	130/100/65	2	CMOS	1.8 or 2.5 to 3.3
MAX1180/1/2/3/4	10	105/80/65/40/20	2	CMOS	3.3/3/3/3/3
MAX1186/5	10	40/20	2	CMOS, mux	3
MAX1434	10	50	8	LVDS	1.8
MAX1215/4/3	12	250/210/170	1	LVDS	1.8
MAX1215N/14N/13N	12	250/210/170	1	LVDS	1.8
MAX1219/8/7	12	210/170/125	2	LVDS	1.8
MAX19542/1	12	170/125	1	CMOS	1.8
MAX19538	12	95	1	CMOS	3.3
MAX1209/11	12	80/65	1	CMOS	3.3
MAX1208/7/6	12	80/65/40	1	CMOS	3.3
MAX12529/8/7	12	96/80/65	2	CMOS	3.3
MAX1127/6	12	65/40	4	LVDS	1.8
MAX1438/7/6	12	65/50/40	8	LVDS	1.8
MAX1420/1/2	12	60/40/20	1	CMOS	3
MAX12555/4/3	14	95/80/65	1	CMOS	3.3
MAX12559/8/7	14	96/80/65	2	CMOS	3.3
MAX1205	14	1	1	CMOS	5/3.3
MAX19588/6	16	100/80	1	CMOS	3.3

High-Speed DACs

Part	Resolution (Bits)	Update Rate (Msps)	DACs	Data-Bus Interface	Supply Voltage (V)
MAX5190/87	8	40	1	CMOS	2.7 to 5.5
MAX5186/88/89/91	8	40	2	CMOS	2.7 to 5.5
MAX5184/1	10	40	1	CMOS	2.7 to 5.5
MAX5180/2/3/5	10	40	2	CMOS	2.7 to 5.5
MAX5852/1	8	165/80	2	CMOS	3
MAX5854/3	10	165/80	2	CMOS	3
MAX5856A/58A	8/10	300	2	CMOS	3.3
MAX5883/4/5	12/14/16	200	1	CMOS	3.3
MAX5873/4/5	12/14/16	200	2	CMOS	1.8, 3.3
MAX5876/7/8	12/14/16	250	2	LVDS	1.8, 3.3
MAX5886/7/8	12/14/16	500	1	LVDS	3.3
MAX5893/4/5	12/14/16	500	2	CMOS	1.8, 3.3
MAX5898	16	500	2	LVDS	1.8, 3.3
MAX5889/90/91	12/14/16	600	1	LVDS	1.8, 3.3
MAX19692	12	2300	1	LVDS	1.8, 3.3
MAX19693	12	4000	1	LVDS	1.8, 3.3
MAX5881	12	4300	1	LVDS	1.8, 3.3

AFEs

Part	ADCs (Bits)	ADC Sample Rate (Msps)	DACs (Bits)	DAC Update Rate (Msps)	Supply Voltage (V)
MAX5866/5/4/3	2 x 8	60/40/22/7.5	2 x 10	60/40/22/7.5	3.3
MAX19700	2 x 10	7.5	2 x 10	7.5	3.3
MAX19707/6/8/5	2 x 10	45/22/11/7.5	2 x 10	45/22/11/7.5	3.3
MAX19713/12/11/10	2 x 10	45/22/11/7.5	2 x 10	45/22/11/7.5	3.3

*Future product—contact factory for availability.

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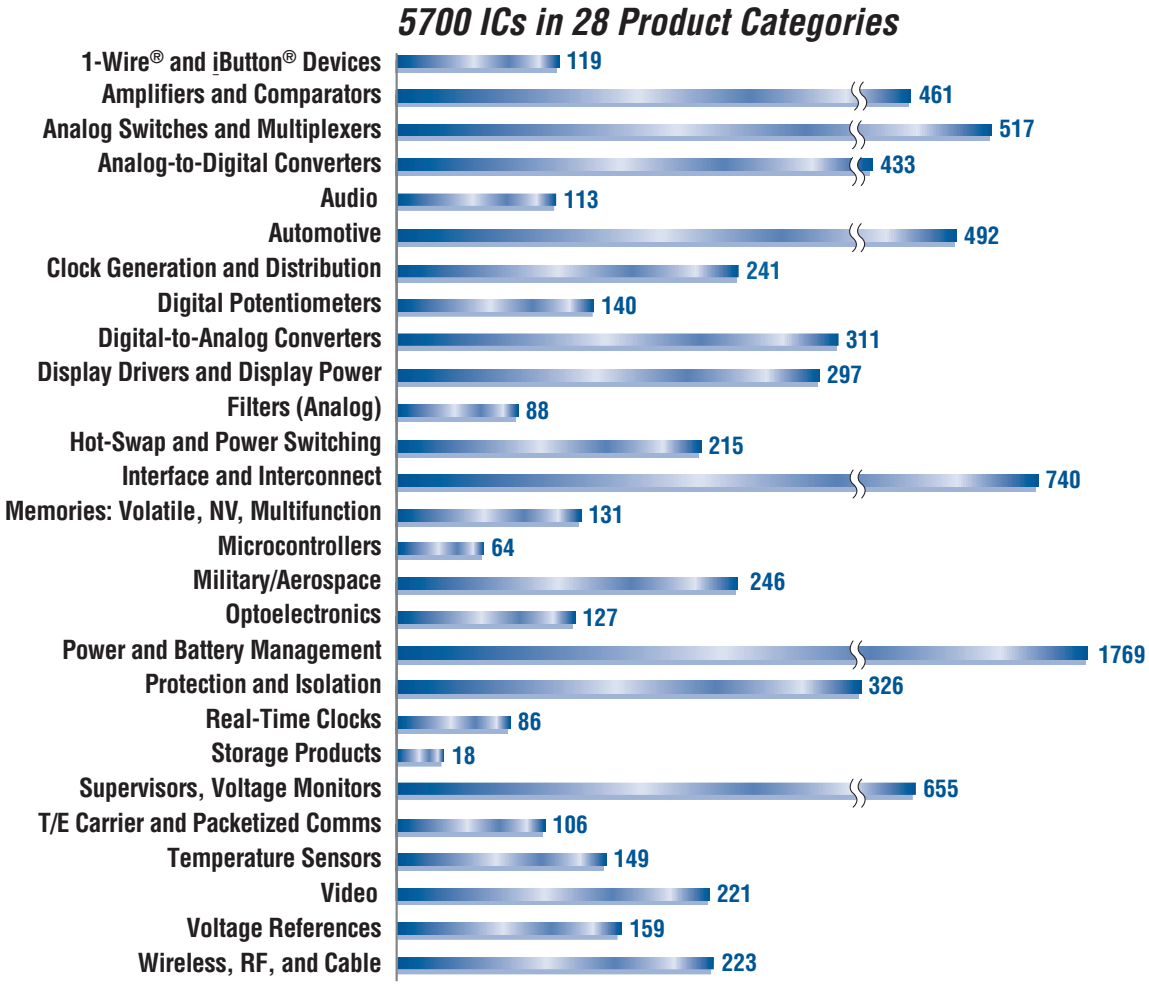

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