

Smallest, Lowest Power Integrated Solutions for Wireless Handheld Products



See Inside for More About:

UCSP	UCSP™ Packaging
PA CONTROL	PA Control
PRECISION AMPS	Precision Amps
HSCS AMPS	High-Side Current-Sense Amps
AUDIO AMPS	Audio Amps
COMPARATORS	Comparators
PIN-FOR-PIN	Pin-for-Pin Compatible
LOW POWER	Low Power

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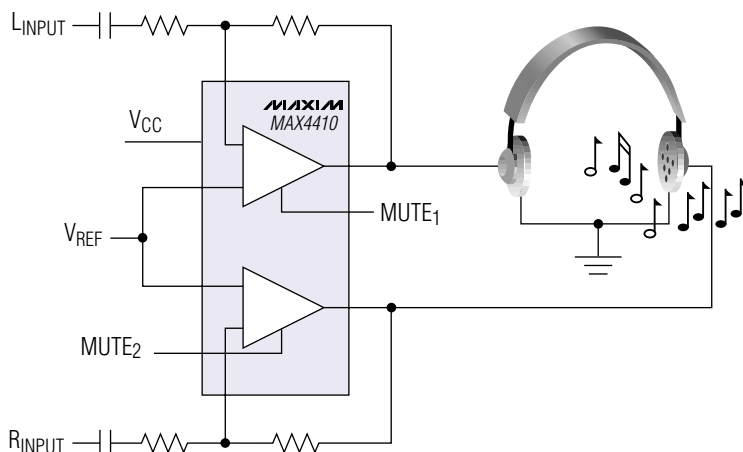
UCSP Packaging for All Your Space-Critical Applications

85% Less Board Space and 27% Lower Profile than MSOP
(continued on next page)

DirectDrive Headphone Amp

MAX4410

- World's First Headphone Amp with DirectDrive
- 90dB PSRR Eliminates External LDO
- 50mW at 0.05% THD+N into 32Ω
- ±8kV ESD Protection on Outputs



Battery/Power Management

MAX9039

- Comparator Plus Internal 1.23V ±1% Reference
- 40μA Supply Current
- 400ns Propagation Delay

MAX972

- Open-Drain Outputs
- Ultra-Low 4μA Supply Current

Microphone Preamplifier/Laser Driver Bias Plus Modulation Monitor

MAX4292

- 1.8V to 5.5V Single Supply
- Rail-to-Rail® I/O
- Low 100μA Supply Current

Op Amps

(Table continued on next page)

Part	Supply Voltage Range (V)	Supply Current (μA)	GBWP (MHz)
MAX4131	2.4 to 6.5	900	10
MAX4163	2.7 to 10	25	0.2
MAX4252	2.4 to 5.5	420	3
MAX4253	2.4 to 5.5	420	3
MAX4292	1.8 to 5.5	100	0.5
MAX4323	2.4 to 6.5	650	5

Comparators

(Table continued on next page)

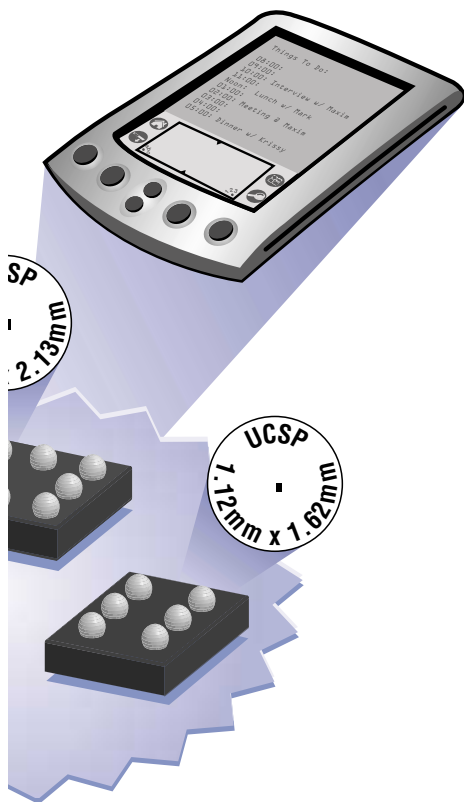
Part	No. of Comparators	Output Type	1.23V ±1% Internal Reference
MAX9039	1	Push-Pull	Yes
MAX972	2	Open-Drain	No

† 2500 pc. factory-direct price, FOB USA.

UCSP

UCSP Packaging for All Your Space-Critical Applications

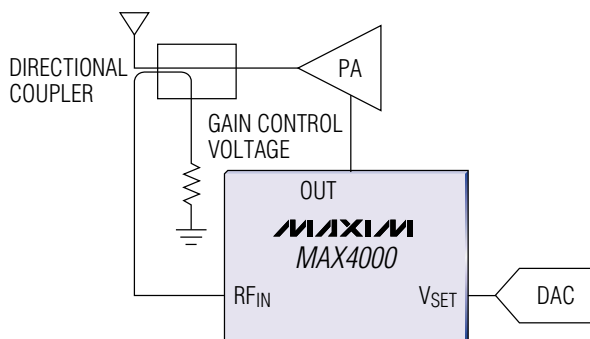
85% Less Board Space and 27% Lower Profile than MSOP
(continued from previous page)



GSM PA Control

MAX4000-MAX4002

- Complete RF-Detecting PA Controller
- 100MHz to 2.5GHz Frequency Range
- 10mA Output Sourcing Capability



MAX4131/MAX4323

- Rail-to-Rail Input/Output

Op Amps

(Table continued from previous page)

V _{OS} (mV, max)	Shutdown Option	Package	Price† (\$)
1.2	Yes	6-Bump UCSP	0.62
4	No	8-Bump UCSP	0.77
0.75	No	8-Bump UCSP	0.80
0.75	Yes	10-Bump UCSP	0.87
1.2	No	8-Bump UCSP	0.80
2.5	Yes	6-Bump UCSP	0.45

Comparators

(Table continued from previous page)

Supply Voltage Range (V)	Supply Current (μA)	Propagation Delay (ns)	Package	Price† (\$)
2.5 to 5.5	40	400	6-Bump UCSP	0.75
2.5 to 11	2.5	12000	8-Bump UCSP	0.48

Photo-Diode Current Monitoring

MAX4252/MAX4253

- 8.9nV/ $\sqrt{\text{Hz}}$ Input Voltage Noise Density
- Low 0.004% THD (1k Ω Load)
- 10V Operating Voltage

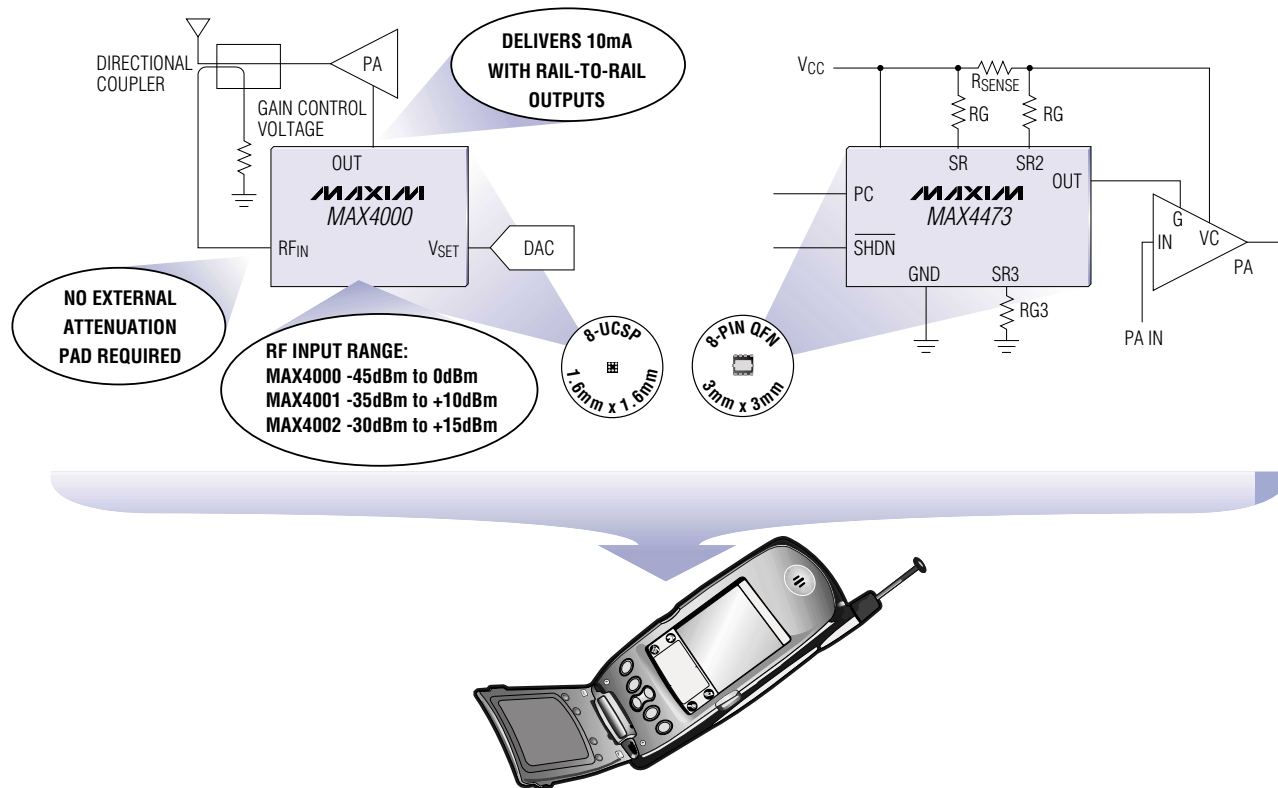
MAX4163

- Rail-to-Rail Input/Output
- Only 25 μA Supply Current (typ)



World's Smallest Single-Chip Solutions for GSM Power-Amp Control

The MAX4000 and MAX4473 enable you to select the best method of power control for your application. For optimal performance, choose the MAX4000 family with its 100MHz to 2.5GHz frequency range and stable linear-in-dB response of $\pm 1.0\text{dB}$ over the temperature range. The MAX4473's robust Rail-to-Rail output drives 500Ω loads and 300pF capacitance, while its external current-sensing and gain-setting resistors maximize flexibility.



MAX4000-MAX4002

- Integrated Attenuation Pad at RF_{IN} Minimizes Component Count
- 100MHz to 2.5GHz Frequency Range
- Stable Linear-in-dB Response: $\pm 1.0\text{dB}$ Over Entire Temp Range
- Fast Response: 70ns, 10dB Step
- Low 5.6mA Supply Current, 15 μA in Shutdown
- Low Cost: 0.85¢[†]

MAX4473

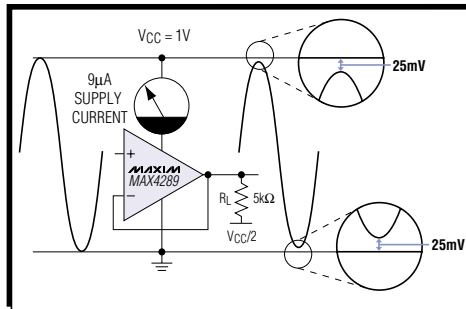
- External Current-Sensing and Gain-Setting Resistors Maximize Flexibility
- Robust Rail-to-Rail Output Drives 500Ω Loads with 300pF Capacitance
- Guaranteed 1.5 μs Enable and Disable Times
- 2MHz Gain-Bandwidth Product
- Low 1.2mA Supply Current, 1 μA in Shutdown
- Low Cost: 0.75¢[†]

[†]50k piece recommended resale. FOB USA. International prices will differ due to local duties, taxes, and exchange rates. Prices are subject to change.

First 1V Micropower Op Amps and Comparators

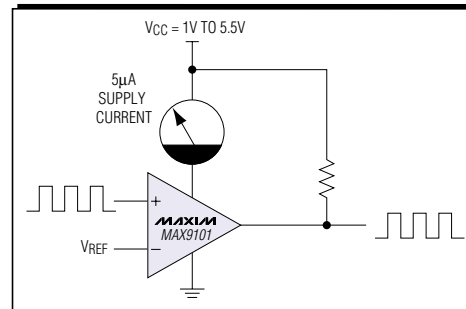
COMPARATORS

Consume Less than 9 μ A; Available in Space-Saving SOT23 Packages



MAX4289 1V Op Amp

- Input Voltage Range Extends from 0 to V_{CC}
- Single NiCd, NiMH, and Alkaline Cell Operation
- Rail-to-Rail Output Voltage Range with 5k Ω Loads



MAX9101 1V Comparator

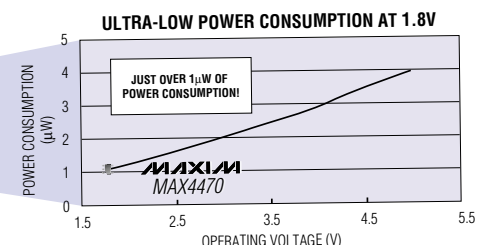
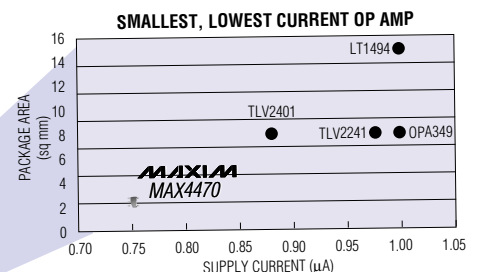
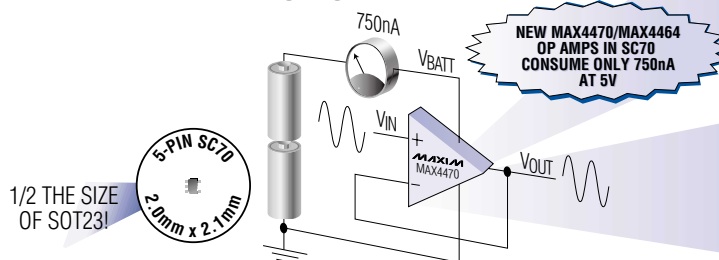
- No Phase Reversal for Overdriven Inputs
- Open-Drain Version for Level Translation
- Only 5 μ A Supply Current



Guaranteed 1V Operation for Single-Cell Applications

Industry's Smallest Submicroamp Op Amps Operate Down to 1.8V

- Guaranteed to Operate to End of Battery Life (1.8V)
- Rail-to-Rail Outputs
- Ground-Sensing Inputs
- Ultra-Small Packaging



Part	No. of Op Amps	Supply Voltage Range (V)	Supply Current per Op Amp (nA) [†]	GBWP (kHz)	Min Gain (V/V)	Pin-Package
MAX4464/74	1/2	1.8 to 5.5	750	40	5	5-SC70, 8-SOT23
MAX4470/71/72	1/2/4	1.8 to 5.5	750	9	1	5-SC70, 8-SOT23, 14-TSSOP

[†] $V_{CC} = 5V$

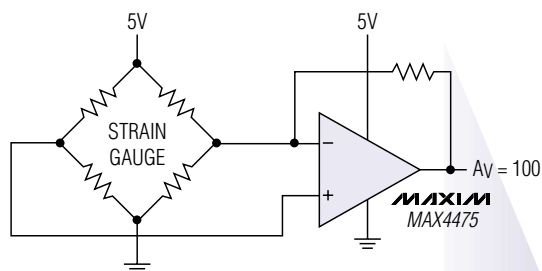


PRECISION
AMPS

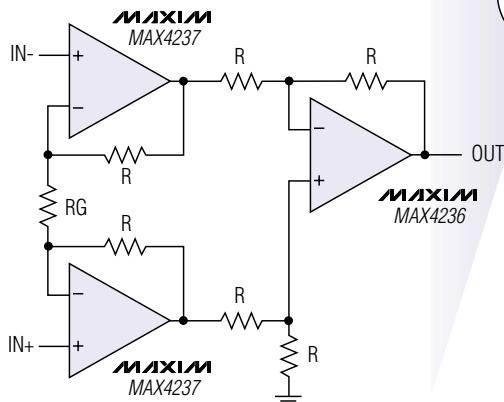
4.5nV/ $\sqrt{\text{Hz}}$ —Lowest Noise, High-Precision Op Amps in SOT23

The MAX4475–MAX4479, with noise density of 4.5nV/ $\sqrt{\text{Hz}}$ at 1kHz, have the lowest noise of any op amp in a tiny SOT23 package. The MAX4236/MAX4237, also in a SOT23 package, use post-package trim to achieve 10 μV offset voltage precision. These op amps offer the best combination of ultra-low offset and drift, low noise, CMOS input bias current, and wide gain-bandwidth product (GBWP).

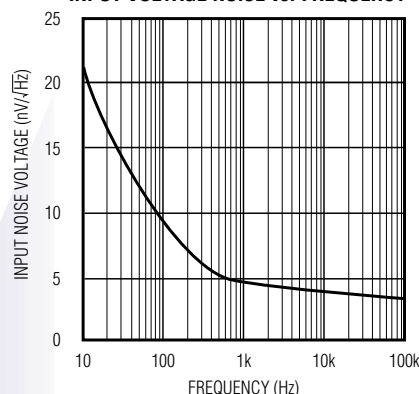
DIFFERENTIAL BRIDGE AMPLIFIER



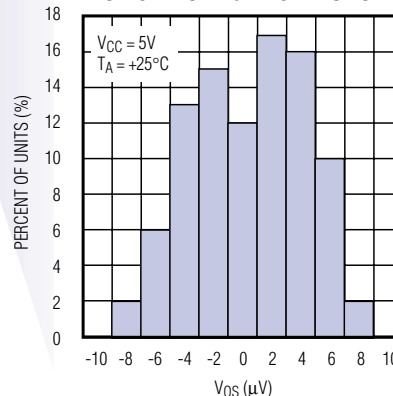
INSTRUMENTATION AMPLIFIER



INPUT VOLTAGE NOISE vs. FREQUENCY



OFFSET VOLTAGE DISTRIBUTION



MAX4475

- 4.5nV/ $\sqrt{\text{Hz}}$ Noise
- 50 μV Offset Voltage
- 0.3 $\mu\text{V}/^{\circ}\text{C}$ Offset Drift
- 1pA Input Bias Current
- 120dB A_{VOL} and CMRR

MAX4236

- 10 μV Offset Voltage
- 0.6 $\mu\text{V}/^{\circ}\text{C}$ Offset Drift
- 1pA Input Bias Current
- 15nV/ $\sqrt{\text{Hz}}$ Noise
- 128dB A_{VOL} , 102dB CMRR

Part	No. of Amps	Min Stable Gain (V/V)	GBWP (MHz)	Supply Voltage Range (V)	Shutdown Mode	Pin-Package
MAX4236	1	1	1.7	2.4 to 5.5	Yes	SOT23, μMAX
MAX4237	1	5	7.2	2.4 to 5.5	Yes	SOT23, μMAX
MAX4475	1	1	10	2.4 to 5.5	No	SOT23, μMAX
MAX4476/77/78	1/2/4	1	10	2.7 to 5.5	No	SOT23, μMAX , TSSOP
MAX4488/89	1/2/4	5	40	2.7 to 5.5	Yes/No	SOT23, μMAX

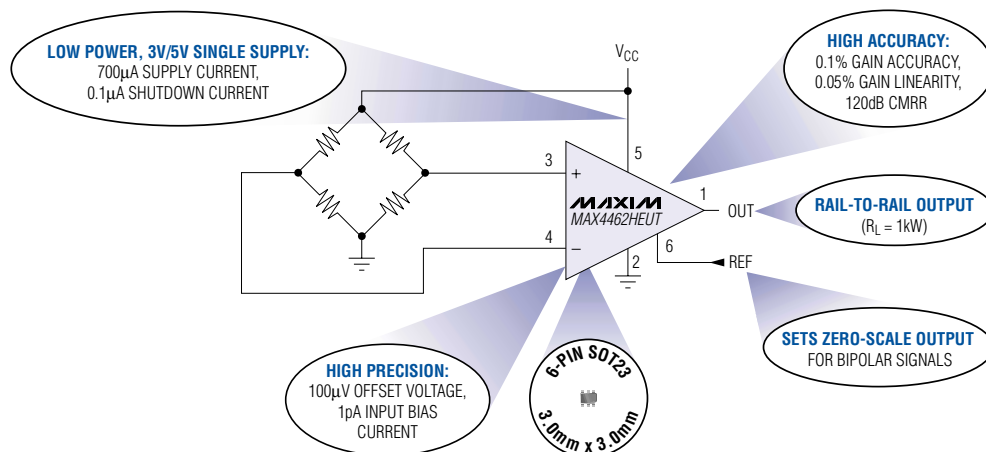


World's Smallest Instrumentation Amps Fit in SOT23

PRECISION
AMPS

SOT23, $V_{OS} = 100\mu V$, $I_{BIAS} = 1pA$, Accuracy = 0.1%, Price = 0.98¢†

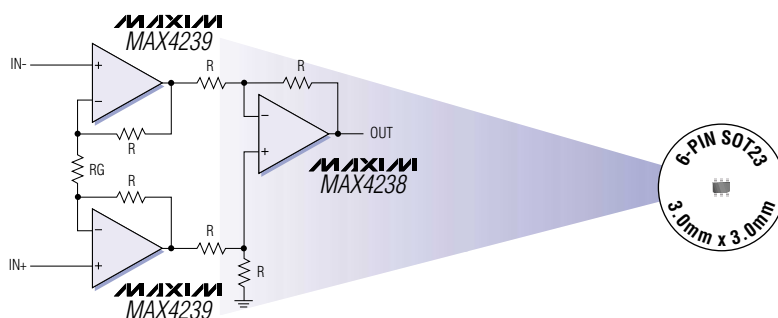
Maxim sets a new industry benchmark by squeezing a precision instrumentation amplifier into a tiny 6-pin SOT23 package. The MAX4460 has adjustable gain, while the MAX4461 and MAX4462 are available with gain internally trimmed to 0.1% accuracy at 1V/V, 10V/V, and 100V/V.



Part	Gain (V/V)	CMRR (dB)	Output Referred to	SHDN	Price† (\$)
MAX4460	Adjustable	120	GND	No	0.98
MAX4461U/T/H	1/10/100	120	GND	Yes	0.98
MAX4462U/T/H	1/10/100	120	REF	No	0.98
MAX4194/5/6/7	Adj./1/10/100	115	REF/GND	No	1.45

†1000 pc. factory-direct price, FOB USA.

Ultra-Low Offset/Drift, Low-Noise, Precision SOT23 Op Amps



- Ultra-Low 5µV Max Offset Voltage at +25°C
- Low 30nV/°C Drift (-40°C to +125°C)
- 135dB A_{VOL}
- High Gain Bandwidth Product:
 - 1MHz (MAX4238, $A_V \geq 1V/V$)
 - 6.5MHz (MAX4239, $A_V \geq 10V/V$)
- 0.1µA Shutdown Mode

Applications:

- Thermocouples
- Strain Gauges
- Electronic Scales
- Medical Instrumentation
- Instrumentation Amplifiers



High-Side Current Sensing that Meets Your Needs

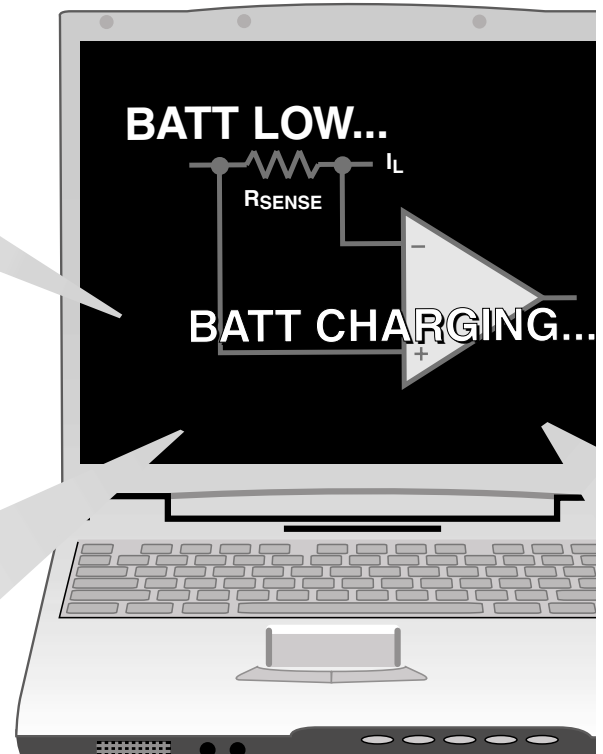
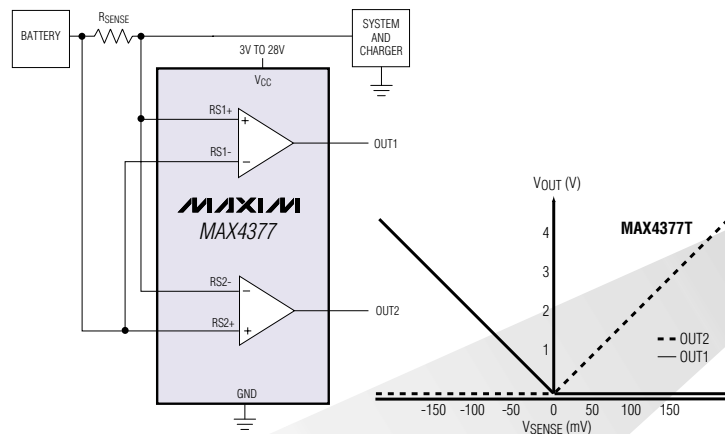
**Ideal for Notebook PCs, Cell Phones, and Other Battery-Powered Systems
(continued on next page)**

Applications that require accurate measurement or control of current levels, such as power management and battery charging, benefit from dedicated current-sense amplifiers. Maxim's high-side current-sense amplifiers use a resistor placed between the positive terminal of the power supply and the supply input of the monitored circuit. High-side current sensing keeps the ground plane free of extraneous resistances. This technique improves overall circuit performance and greatly simplifies layout.

Bidirectional/ Unidirectional

MAX4376-MAX4378

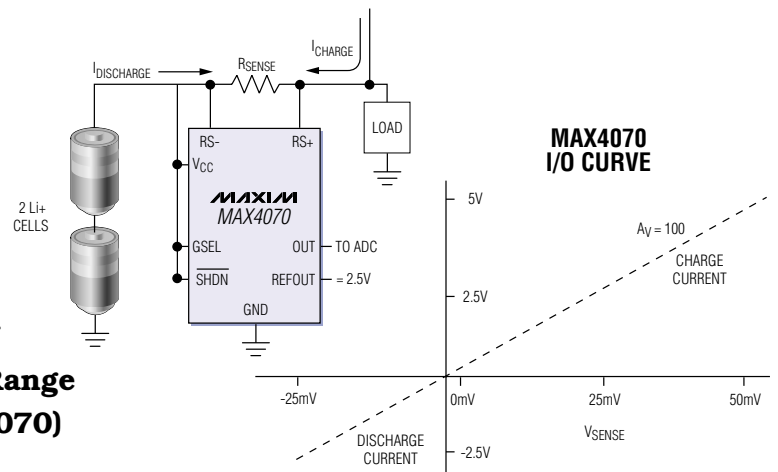
- **Low-Cost Single/Dual/Quad High-Side Current-Sense Amplifiers**
- **Buffered Output Voltage with 2mA Drive**
- **Automotive Temperature Range (-40°C to +125°C)**



Bidirectional

**MAX471/MAX472
MAX4069-MAX4072**

- **Total Output Error Less than 5%**
- **Selectable Gain of 50V/V or 100V/V**
- **Wide 1.35V to 24V Common-Mode Range**
- **Internal Precision Reference (MAX4070)**
- **Available in 8-Pin QFN and μ MAX (MAX4070/MAX4071/MAX4072)**



High-Side Current Sensing that Meets Your Needs

Ideal for Notebook PCs, Cell Phones, and Other Battery-Powered Systems
(continued from previous page)

Maxim has a wide variety of bidirectional and unidirectional current-sense ICs from which to choose. We offer bidirectional current-sense amplifiers with or without internal-sense resistors that measure current in or out of the load. Unidirectional offerings include current-sense ICs with adjustable gain, internal gain (of 20V/V, 50V/V, or 100V/V), or internal gain plus a single or dual comparator. Meeting the strict demands of compact applications, Maxim brings you the only current-sense amplifiers available in tiny SOT23 packages.

Unidirectional Internal or Adjustable Gain

MAX4073T/F/H, MAX4172
MAX4173T/F/H, MAX4372T/F/H

MAX4172

- **Input Common-Mode Range Independent of Supply Voltage**
- **Adjustable Gain**

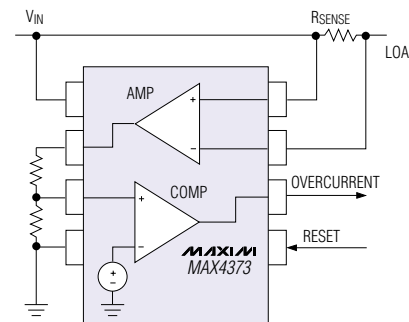
MAX4173/MAX4372

- **Compact SOT23 with Internal Gain**
- **Input Common-Mode Range Independent of Supply Voltage**

Part	Gain (V/V)	Full-Scale Gain Accuracy (%)	Supply Current (μ A)	Bandwidth (kHz)	Supply Voltage Range (V)	Input Common-Mode Range (V)	Pin-Package
MAX4073	20/50/100	0.5	500	1800	3 to 28	2 to 28	5-SC70
MAX4172	Adj	0.5	800	800	3 to 32	0 to 32	8- μ MAX
MAX4173T	20	0.5	420	1700	3 to 28	0 to 28	6-SOT23
MAX4173F	50	0.5	420	1400	3 to 28	0 to 28	6-SOT23
MAX4173H	100	0.5	420	1200	3 to 28	0 to 28	6-SOT23
MAX4372T	20	0.18	30	275	2.7 to 28	0 to 28	5-SOT23
MAX4372F	50	0.18	30	200	2.7 to 28	0 to 28	5-SOT23
MAX4372H	100	0.18	30	110	2.7 to 28	0 to 28	5-SOT23

Unidirectional Low Power Plus Comparator

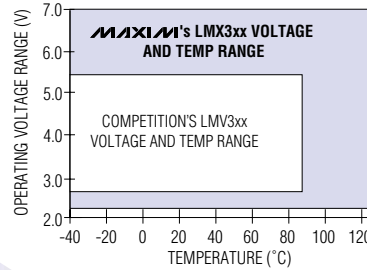
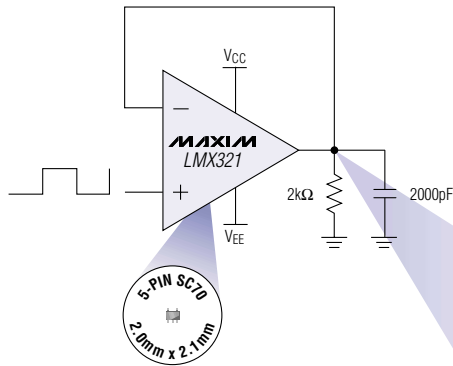
MAX4373-MAX4375T/F/H



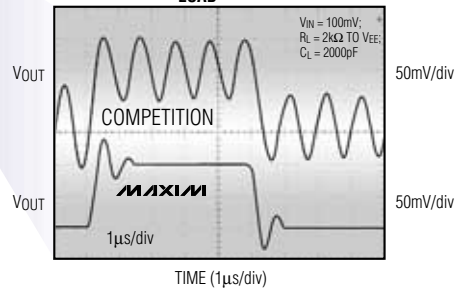
Part	No. of Comparators per Configuration	Internal Gain (V/V)	Full-Scale Gain Accuracy (%)	Supply Current (μ A)	Bandwidth (kHz)	Comparator Response Time (μ s)	Supply Voltage Range (V)	Input Common-Mode Range (V)	Pin-Package
MAX4373T/F/H	Single Over Detector	20/50/100	0.5	60	200/175/110	5	2.7 to 28	0 to 28	8- μ MAX
MAX4374T/F/H	Dual Over Detector	20/50/100	0.5	60	200/175/110	5	2.7 to 28	0 to 28	10- μ MAX
MAX4375T/F/H	Dual/Window Detector	20/50/100	0.5	60	200/175/110	5	2.7 to 28	0 to 28	14-SO

PIN-FOR-PIN

Improved Pin-for-Pin Compatible LMV3xx Op Amps at No Extra Cost



SUPERIOR C_{LOAD} PERFORMANCE

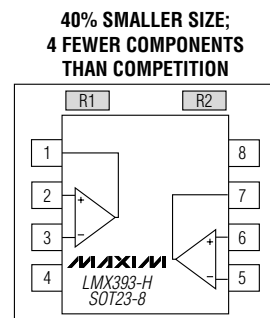
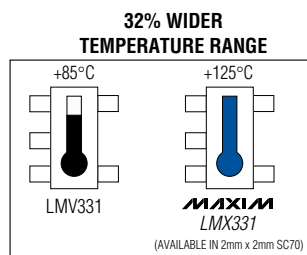
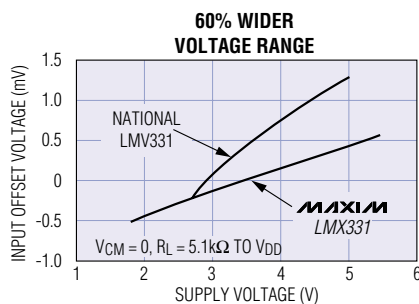


- 100% Wider Voltage Range
- 32% Wider Temperature Range
- Dual LMX358 in 8-Pin SOT23 is 40% Smaller than Competition's MSOP
- Drives 2000pF Loads

	Part	Supply Voltage Range (V)	Temp Range (°C)	Supply Current (μA, max)	GBWP (MHz)	CMVR (V)	Pin-Package	Pricing† (\$)
MAXIM	LMX321/358/324	2.3 to 7	-40 to +125	150	1.3	-0.2 to $V_{CC} - 0.9$	SC70/SOT23/TSSOP	0.26
Competition	LMV321/358/324	2.7 to 5	-40 to +85	170	1	-0.2 to $V_{CC} - 1.0$	SC70/MSOP/TSSOP	0.26

†2500 pc. factory-direct price, FOB USA.

Improved Pin-for-Pin Compatible LMV3xx Comparator at No Extra Cost



Part	Supply Voltage Range (V)	Temp Range (°C)	Propagation Delay (ns)*	Input Leakage (pA)	Hysteresis	Price (\$)†
LMV331/393/339	2.7 to 5	-40 to +85	Low to High 400, High to Low 350	5000	No	0.26
LMX331/393/339	1.8 to 5.5	-40 to +125	100	50	No	0.26
LMX331H/393H/339H	1.8 to 5.5	-40 to +125	100	50	Yes (2mV)	0.29

* (Overdrive voltage (V_{OD}) = 100mV and $V_{SUPPLY} = 2.7V$)
 † 1k FOB USA pricing for singles.

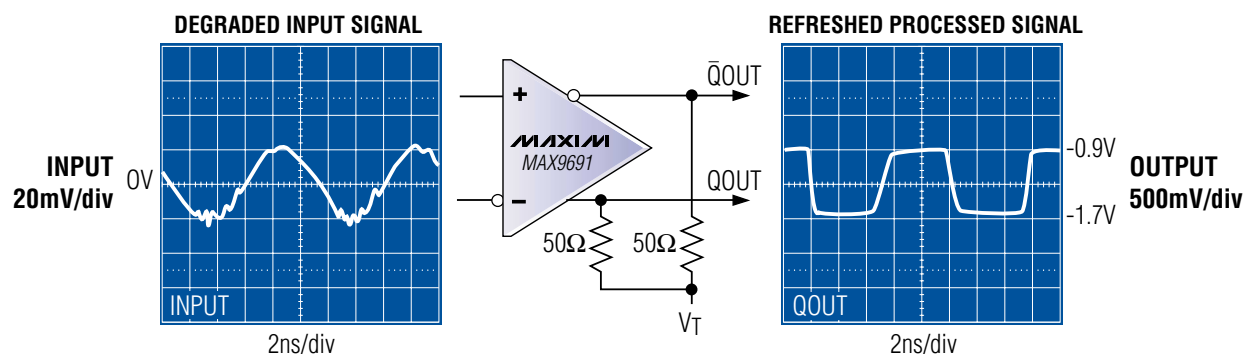


World's Fastest Comparators Achieve 500ps Prop Delay

COMPARATORS

ECL/PECL Outputs Drive 50Ω Terminated Transmission Lines

The MAX9600/MAX9601/MAX9602 are ultra-high-speed comparators with extremely low propagation delay (500ps). These dual and quad comparators are specially designed to minimize channel-to-channel skew (10ps) and for low propagation delay dispersion (30ps). These devices are ideal for high-speed instrumentation and VLSI ATE applications where high-fidelity tracking capability of narrow pulses is critical.



- **500ps Propagation Delay (MAX9600–MAX9602)**
- **30ps Propagation Delay Dispersion (MAX9600–MAX9602)**
- **4Gbps Tracking Frequency (MAX9600–MAX9602)**
- **Hysteresis Is Adjustable (MAX9600/MAX9601)**
- **1.2ns Propagation Delay (MAX9691–MAX9693)**
- **Ultra-Small (3mm x 5mm) μ MAX Package (MAX9691)**

Ideal For High-Speed Signal Restoration

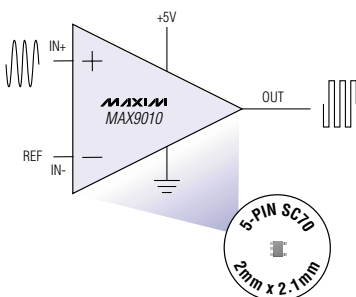
Part	Latch Enable	Adjustable Layers	t_{PD} (ns)	No. of Comparators	Maximum Signal Frequency (MHz)	Logic Output	Pin-Package
MAX9600	Yes	Yes	0.5	2	4000	ECL	20-TSSOP
MAX9601	Yes	Yes	0.5	2	4000	PECL	20-TSSOP
MAX9602	No	No	0.5	4	4000	PECL	24-TSSOP
MAX9691	No	No	1.2	1	600	ECL	8- μ MAX/SO/PDIP
MAX9692	Yes	No	1.2	1	600	ECL	10- μ MAX/16-SO/PDIP
MAX9693	Yes	No	1.2	2	600	ECL	16-QSOP/SO/PDIP



Industry's Best Speed vs. Power Ratios

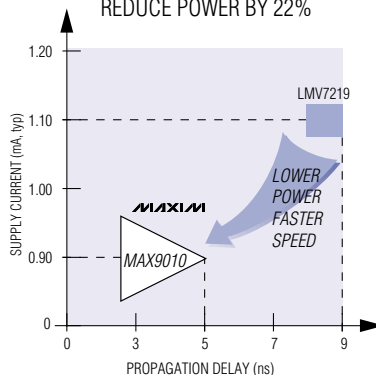
SMALLEST SIZE

1/2 THE SIZE OF A SOT23

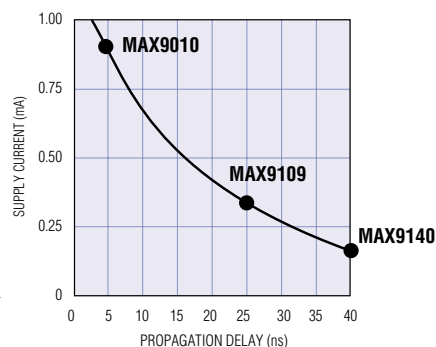


FASTEST PROP DELAY

INCREASE SPEED BY 80% AND
REDUCE POWER BY 22%



BEST SPEED/POWER CHOICES IN SC70 PACKAGE



- 5ns Propagation Delay from Only 900 μ A (MAX9010)
- Duals and Quads Available

- Low-Cost Functional Upgrades to Industry-Standard
MAX901-MAX903
MAX907-MAX909
MAX941-MAX944

- No Power Supply Current-Spiking While Switching
- Input Range Extends Below Ground

Versatile Speed/Power Choices in SC70 Package

Part	No. of Comparators	Latch Enable	Supply Current (μ A)	t_{PD} (ns)	Supply Voltage (V)	Pin-Package	Price (\$) [†]
MAX9010/11	1	No/Yes	900	5	4.5 to 5.5	6-SC70/SOT23	0.95/1.00
MAX9109	1	Yes	350	25	4.5 to 5.5	6-SC70/SOT23, 8-SO	0.65
MAX9140/41	4	No/Yes	150	40	2.7 to 5.5	5-SC70, 8-SOT23/SO	0.60/0.65

Best Speed/Power, Dual Comparators in 8-Pin SOT23 Package

Part	No. of Comparators	Latch Enable	Supply Current (μ A)*	t_{PD} (ns)	Supply Voltage (V)	Pin-Package	Price (\$) [†]
MAX9107	2	No	350	25	4.5 to 5.5	8-SOT23/50	0.98
MAX9142	2	No	150	40	2.7 to 5.5	8-SOT23/50	0.90

Best Speed/Power, Quad Comparators in TSSOP Package

Part	No. of Comparators	Internal Hysteresis	Supply Current (μ A)	t_{PD} (ns)	Supply Voltage (V)	Pin-Package	Price (\$) [†]
MAX9108	4	Yes	300	25	4.5 to 5.5	TSSOP/ SO	1.46
MAX9144	4	Yes	150	40	2.7 to 5.5	TSSOP/ SO	1.40
MAX9201	4	No	1200	7	4.5 to 10.5	TSSOP/ SO	2.25

[†]1000-up recommended resale, FOB USA.

*Supply current per comparator.

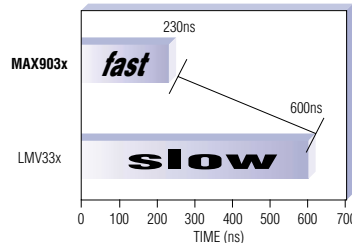


Micropower Comparators Set New Standards for Packaging, Speed, and Power

COMPARATORS

**2.5x Faster, 2x Less Current, and Shutdown Options
Optimized for High-Volume/Low-Cost Applications**

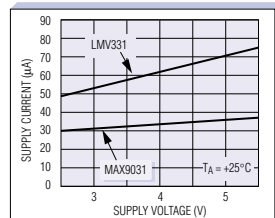
2.5x FASTER RESPONSE TIME



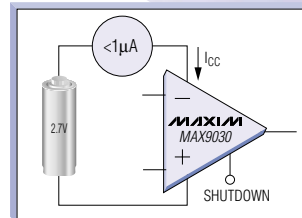
SPEC	MAX903X	LMV33X
tpd (ns) typ	230	600
I _{CC} at 5V	55μA	120μA
Shutdown Current	1μA	None
Hysteresis	4mV	None
Price*	\$0.26	\$0.26

*1000-up recommended resale for MAX9031, FOB USA.

CONSUME 2x LESS CURRENT



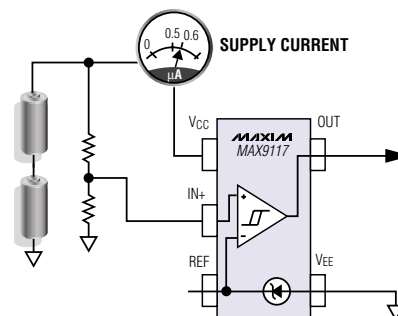
1μA SHUTDOWN



Part	No. of Comparators	Supply Voltage Range (V)	Supply Current (μA, max)	Propagation Delay (ns)	Rail-to-Rail Outputs	Shutdown Option
MAX919/920	1/2	1.8 to 5.5	0.8	30μs	Both	No
MAX9030	1	2.5 to 5.5	55	230	Yes	Yes
MAX9031/9032/9034	1/2/4	2.5 to 5.5	55	230	Yes	No
MAX9075/9077	1/2	2.1 to 5.5	5.2	580	Yes	No

World's Only SC70 Comparator Plus Reference Draws Just 750nA from 1.8V

- Space-Saving SC70 Package Is Half the Size of a SOT23
- Ideal for 2-Cell Battery Monitoring in Portable Equipment



Part	No. of Comparators	Output Type	1.245V ±2% Internal Reference	Supply Voltage Range (V)	Supply Current (μA)	Rail-to-Rail Output	Beyond-the-Rails™ Inputs	Pin-Package
MAX917/9117	1	Push-Pull	Yes	1.8 to 5.5	0.75	Yes	Yes	5-SOT23/SC70
MAX918/9118	1	Open Drain	Yes	1.8 to 5.5	0.75	Yes	Yes	5-SOT23/SC70
MAX919/9119	1	Push-Pull	No	1.8 to 5.5	0.38	Yes	Yes	5-SOT23/SC70
MAX920/9120	1	Open Drain	No	1.8 to 5.5	0.38	Yes	Yes	5-SOT23/SC70

Beyond-the-Rails is a trademark of Maxim Integrated Products.



Audio Solutions for Portable and Wireless Applications

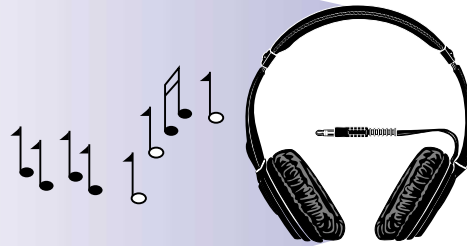
Headphone Drivers

MAX4410

- Unique Design Eliminates Bulky Output Capacitors
- Tiny (2mm x 2mm) UCSP Package

MAX4335-MAX4338

- 90dB PSRR
- Tiny SC70-Packaged Speaker Drivers



Speaker Driver

MAX4295

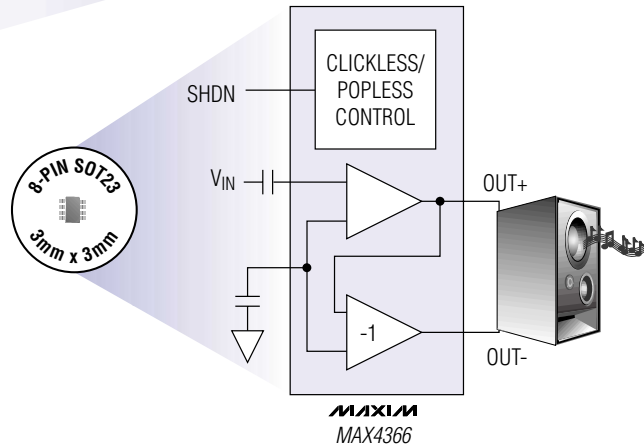
- 400mW Filterless Class-D Optimizes Power Savings

MAX4366-MAX4368

- 330mW BTL Amplifiers in 8-Pin SOT23

MAX4364/MAX4365

- 1W and 500mW BTL Amp in 8-Pin QFN



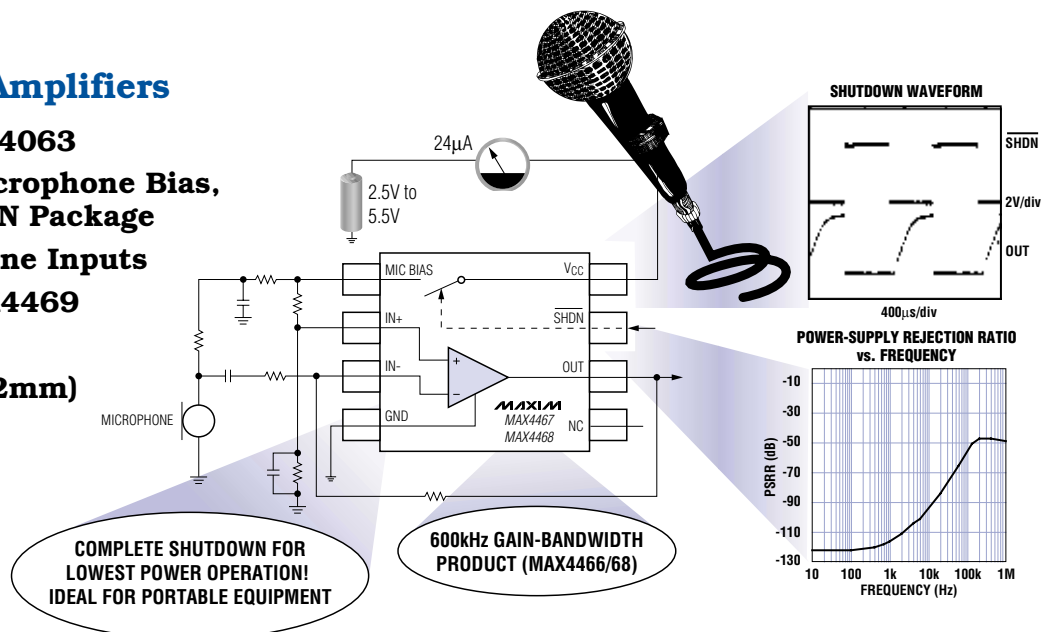
Microphone Amplifiers

MAX4060-MAX4063

- Integrated Microphone Bias, Tiny 8-Pin QFN Package
- Two Microphone Inputs

MAX4465/MAX4469

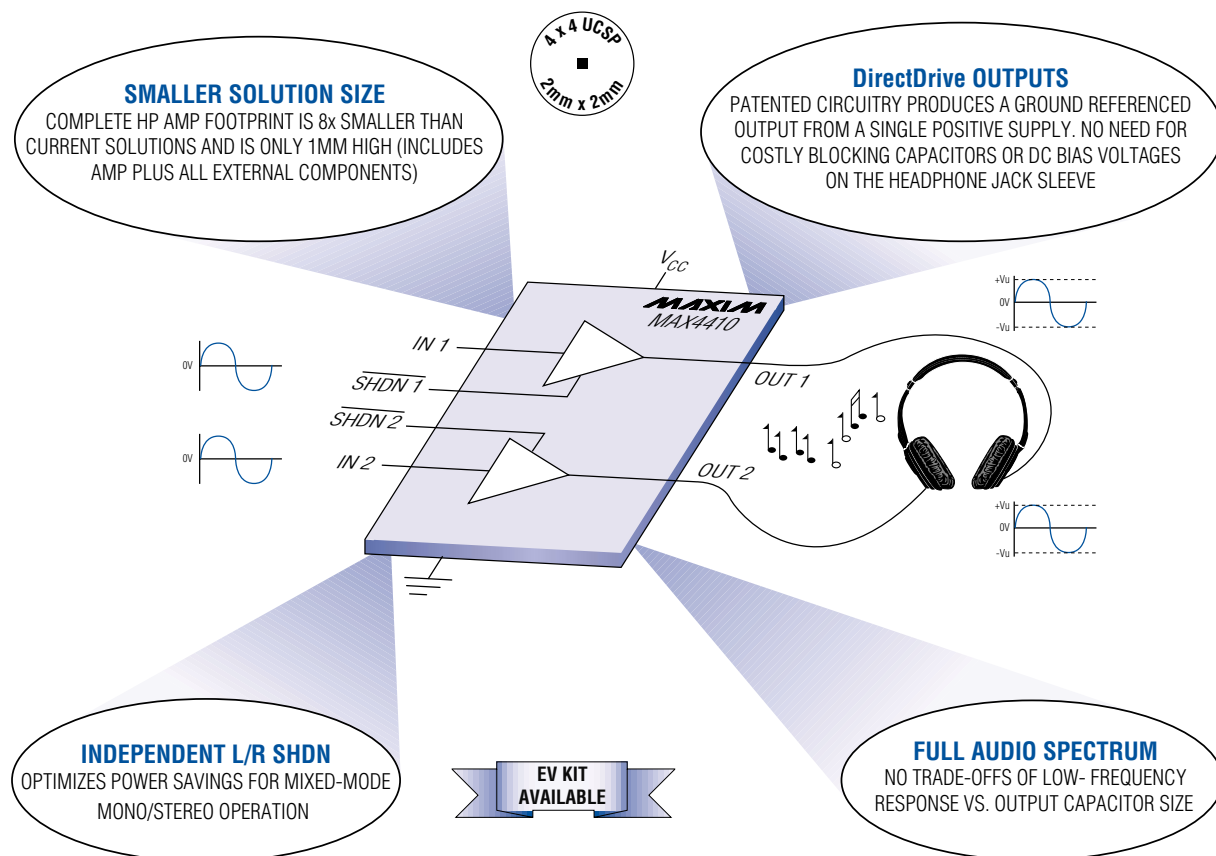
- 5nA SHDN,
- Tiny (2mm x 2mm) SC70 Package



Revolutionary DirectDrive Headphone Amp Eliminates Bulky DC-Blocking Capacitors

AUDIO
AMPS

The MAX4410 uses a unique patented architecture to produce a ground-referenced output from a single supply, eliminating the need for DC-blocking capacitors, saving cost and board space.



MAX4410 DirectDrive Headphone Amplifier

- 50mW at 0.05% THD+N into 32Ω
- UCSP (2mm x 2mm) and 14-Pin TSSOP Packages
- No Power or Shutdown Transients Produce Fast, Clickless Operation
- 90dB PSRR—Great Quality Audio from Noisy Supplies
- ±8kV ESD Protection on Outputs

