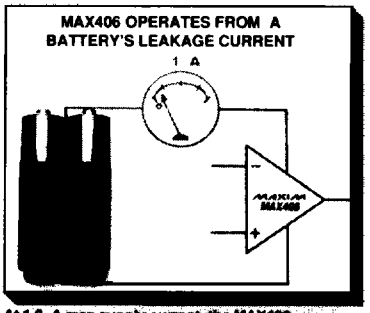
1μA Op Amp Extends Battery Life 15X

Output Swings Rail-to-Rail, Drives 2000 Times Supply Current



At 1.2μA max supply current, the MAX406 operates with a current as low as a battery's typical leakage current.

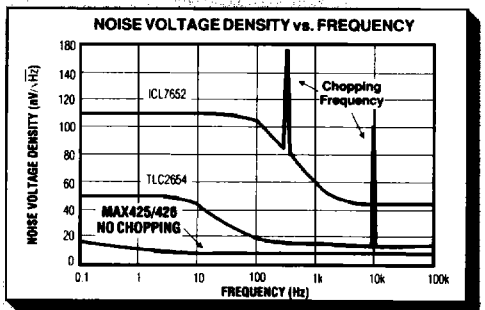
Before the MAX406, 15μA supply current was considered the state-of-the-art for a micropower op amp. Operating at only 1μA, the MAX406 has now redefined the term micropower. If batteries had an indefinite shelf-life, the MAX406 could operate up to 250,000 hours (28 years) from a 250mA-hr lithium coin cell. Drawing no more than a battery's leakage current, the MAX406 enables battery-powered systems to operate over 15 times longer. It works off a single 2.5V to 10V supply, or a dual ±1.25V to ±5V supply.

The MAX406 is unity gain stable and offers superior stability compared to other micropower CMOS op amps—it remains stable while driving capacitive loads as high as 1μF without oscillating. For high-speed applications, pin 8 can be connected to the positive supply for a 20V/ms slew rate and a 40kHz gain bandwidth (A_{VCL} ≥ 2V/V), without drawing any extra supply current.

★ FUTURE PRODUCTS ★

Lowest Noise & Drift, Highest Gain Op Amps—No Chopping

250nV$_{pp}$ Noise, 0.005μV/°C Drift, 0.5μV Offset, 190dB Gain



MAX425/426 eliminates clock ripple noise and offer a 6 to 10 times improvement in noise (0.1Hz to 10Hz) over chopper op amps.

The new MAX425 and MAX426 are the first op amps to provide the lowest noise ***and*** "zero" drift (TCV_{OS}) in an 8-pin DIP. A unique non-chopper error-correction technique virtually eliminates input offset voltage, drift, noise, and common mode errors without the drawbacks associated with chopper stabilized op amps such as external capacitors, clock ripple noise, and external filtering.

The MAX425 and MAX426 250nV$_{PP}$ (0.1Hz-10Hz) noise and 0.005μV/°C drift represent a 6-times improvement over the lowest noise chopper stabilized op amp, and 40-times lower drift than the lowest noise precision bipolar op amp. The improvement in noise alone translates to a significant increase in system accuracy and resolution.

The MAX425 is unity-gain stable. The MAX426 is stable for gains ≥ 30V/V and offers a 15MHz gain-bandwidth product, 12V/μs slew rate, and DC performance equivalent to the MAX425. Applications include weigh-scales, sensors, low frequency active filters, current-to-voltage converters, and S/H amplifiers.

ANALOG DESIGN GUIDE

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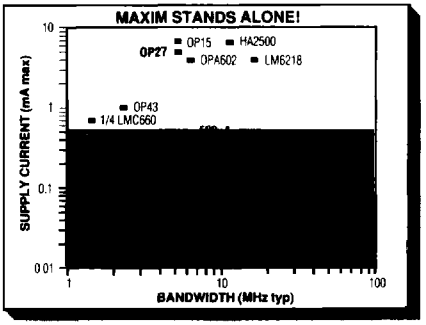
3

Fastest 10MHz Micropower Op Amps

40V/µs Slew Rate at Less Than 375µA Supply Current



Best speed/power combination: 1.7MHz at 75µA MAX402 or 10MHz at 375µA MAX403

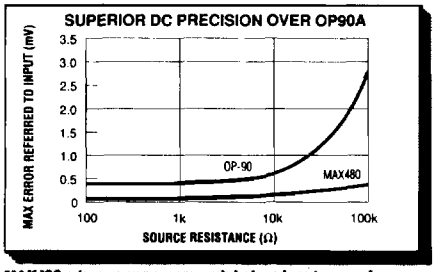
No other op amps match the new MAX402 and MAX403's combination of high-speed and micropower operation. The MAX403 guarantees a 7MHz (10MHz typ) bandwidth and a 25V/µs (40V/µs typ) slew rate from less than 375µA supply current—14 times faster than the industry standard OP27 at less than 1/10th the supply current (see graph). MAX403 power consumption is under 3.75mW at ±5V. For applications requiring even lower power, the MAX402 guarantees a 1.7MHz bandwidth and a 5V/µs slew rate while drawing less than 75µA supply current which results in a power consumption of less than 750µW at ±5V. Both op amps are unity gain stable and operate from ±3V to ±5V supplies, or a single 6V to 10V supply. Applications include low power signal processing, portable or handheld instruments, and remote sensors.

70µV Op Amp Minimizes Input Errors

Single Supply Operation From 1.6V to 36V at Only 15µA Supply Current

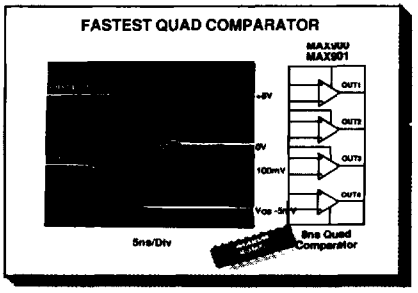
The MAX480's precision DC specifications minimize input referred errors (see graph). Guaranteed 70µV offset voltage and 1.5µV/°C drift, independent of package type or supply voltage range, represents a greater than two times improvement over the highest grade industry standard OP90A. Similarly, input bias current and offset current are improved over the OP90.

The MAX480 input and output voltage range include the negative supply rail. With single or dual supply capability ranging from +1.6V to +36V or ±0.8V to ±18V, applications include micropower voltage references, remote thermocouple conditioners, and current monitors.



MAX480 micropower op amp minimizes input errors by offering superior DC performance over the highest grade industry standard OP90A.

8ns, 18mW Comparator Family



MAX900 high-speed, lower power comparator family offers an 8ns response time while consuming only 18mW/comparator.

Fastest Low Power Comparators Operate From a Single +5V Supply

Maxim's growing MAX900 family of high-speed comparators offer single, dual, and quad devices with unparalleled performance. No other comparators offer the combination of an 8ns response time while drawing only 3.6mA (18mW) per comparator from a +5V supply. And since many low-power applications operate from a single supply, the MAX900 family's input voltage range extends all the way to ground to provide a wide common mode input voltage range.

Whether it's a 1.7ns ECL or 9ns TTL output comparator with industry standard pinouts, Maxim provides the high-speed comparator solution for your application.

Part Number	Vos (mV) max	TCVos (µV/°C) max	IBIAS (nA) max	Unity GBW (MHz)	Supply Voltage (V)	Supply Current (mA) max	Features	Price† 1000-up ($)
MAX400	10 - 15µV	0.3	2	0.4	±3 to ±18	4	Ultra-low Vos & drift non-chopper stabilized	5.16
MAX402	2	25	5	2	±5	75µA	High-speed, 7V/µs slew rate, micropower	1.98
MAX403	2	33	25	10	±5	375µA	High-speed, 40V/µs slew rate, micropower	2.75
MAX406	0.5 - 2.0	10	10pA	0.008-0.040	+2.5 to +10	1.2µA	Lowest-power, single supply output swings rail-to-rail	2.54
MAX408/28/48	6 - 12	15 - 20	1.1µA	100 (Av ≥ 3)	±5	10/amp.	Single/dual/quad high-speed, high output current	3.02/4.06/6.74
MAX420/422	5 - 10µV	0.05	0.03 - 0.10	0.125 - 0.5	±15	0.5 - 2	±15V chopper stabilized	3.77/4.21
MAX421/423	5 - 10µV	0.05	0.03 - 0.10	0.125 - 0.5	±15	0.5 - 2	±15V chopper stabilized with clamped output and INT/EXT clock option	4.21/4.57
MAX425/426	5µV	0.05	10pA	0.35 - 12	±5	1.4	Lowest noise & drift, superior non-chopper error correction, no clock ripple noise	††
MAX430/432	5µV	0.05	0.1	0.125 - 0.5	±15	0.5 - 2	±15V chopper stabilized with internal caps	4.80/5.29
MAX480	70µV	1.5	3	0.02	±0.8 to ±18	15µA	Low Vos & drift, micropower, single supply, input/output extend to negative rail	3.68
ICL7611	2 - 15	10 - 25	0.05	0.044 - 1.4	±1.0 to ±8	0.02 - 2.5	Programmable quiescent current	1.58
ICL7612	5 - 15	15 - 25	0.05	0.044 - 1.4	±1.0 to ±8	0.02 - 2.5	Programmable quiescent current, CMVR > negative rail	1.81
ICL7614	2 - 15	15 - 25	0.05	0.48*	±1.0 to ±8	0.25	External compensation	0.95
ICL7616	2 - 15	15 - 25	0.05	0.044 - 1.4	±1.0 to ±8	0.02 - 2.5	Programmable quiescent current, CMVR > negative rail	1.62
ICL7621/7622	5 - 15	15 - 25	0.05	0.48	±1.0 to ±8	0.25	Dual low IBIAS & Ios	1.55/1.48
ICL7631/7632	5 - 20	15 - 30	0.05	0.044 - 1.4	±1.0 to ±8	0.022 - 2.5	Triple op amp, programmable quiescent current–ICL7632 is externally compensated	2.27/2.12
ICL7641/7642	5 - 25	15 - 30	0.05	0.044 - 1.4	±1.0 to ±8	0.015 - 2.5	Quad op amp	1.70/1.91
ICL7650	5 - 10µV	0.05 - 0.10	0.01 - 0.02	2	±5	2	Industry-standard chopper stabilized	2.39
ICL7652	5 - 10µV	0.05	0.03	0.45	±5	2	Low noise industry-standard chopper stabilized	3.06

Notes:
* External 39pF compensation capacitor added.
† Prices provided are for design guidance and are FOB USA. International prices will differ due to local duties, taxes, and exchange rates.
†† Future products – contact factory for pricing and availability.

Op Amps (continued)

Part Number	Vos (µV)	TCVos (µV/°C) max	I_{BIAS} (nA) max	Unity GBW (MHz)	Supply Voltage (V)	Supply Current (mA) max	Features	Price† 1000-up ($)
LT1001	15 - 60	0.6 - 1	2 - 4	0.8	±3 to ±18	2	Industry-standard precision	1.75
LT1028	40 - 80	0.8 - 1	90 - 180	75 (A_V > 2)	±4 to ±18	9.5 - 10.5	Lowest noise, high-speed	4.21
OP07	25 - 150	0.6 - 2.5	2 - 12	0.6	±3 to ±18	4	Industry-standard precision	0.97
OP27	25 - 100	0.6 - 1.8	40 - 80	8	±3 to ±18	4.6 - 5.6	Industry-standard low noise	††
OP37	25 - 100	0.6 - 1.8	40 - 80	63 ($A_V \geq 5$)	±3 to ±18	4.6 - 5.6	Industry-standard low noise	††
OP90	150 - 450	2 - 5	15 - 25	0.020	±0.8 to ±18	15 - 20µA	Industry-standard micropower	1.65

High-Speed Comparators

Part Number	# Comps	Logic	Latched Outputs	Supply Current (mA) max	Tpd (ns) typ	Features	Price† 1000-up ($)
MAX900	4	TTL	YES	33	8.0	Single +5V capability, low power, CMVR extends to neg. rail, separate analog & digital supplies, Internal pull-up resistors	7.01
MAX901	4	TTL	NO	33	8.0	MAX900 without output latch	5.98
MAX902	2	TTL	YES	17	8.0	Dual MAX900	††
MAX903	1	TTL	YES	8.5	8.0	Single MAX900	††
MAX910	1	TTL	YES	60	5.0	High-speed TTL-compatible comparator with 8-bit digitally programmable input voltage threshold and on-board reference	††
MAX911	1	ECL	YES	62	2.0	MAX910 with differential ECL outputs	††
MAX9685	1	ECL	YES	54	1.3	Higher speed industry-standard	3.38
MAX9686	1	TTL	YES	45	6.0	Higher speed industry-standard	2.31
MAX9687	2	ECL	YES	114	1.4	Higher speed industry-standard	5.12
MAX9690	1	ECL	NO	54	1.3	High speed, 8-lead PDIP, SO	3.29
MAX9698	2	TTL	YES	90	6.0	Higher speed industry-standard	3.92

Notes:
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Part Number	Unity GBW (MHz)	Slew Rate (V/µs)	V_{OS} (mV) max	Output Current (mA) max	Supply Voltage (V)	I_{BIAS} (nA) max	Features	Price† 1000-up ($)
VIDEO AMPLIFIERS								
MAX408/28/48	100($A_V \geq 3$)	90	6 - 12	50/amp	±5	1.1µA	Single, dual, quad op amps, high output drive	3.02/4.06/6.74
MAX452	50	300	5	14	±5	10	Unity gain stable, drives 75Ω coax cable	2.40
MAX457	70	300	5	15	±5	1	Dual, unity gain stable, drives 75Ω coax cable	4.45
VIDEO BUFFERS								
MAX405	180	650	4	60	±5	2µA	0.99V/V gain guaranteed over temp, 0.01°/0.03% diff phase/gain	4.25
MAX460	140	1500	5 - 10	100	±15	0.05 - 0.1	FET input, EL2005, LH0033 upgrade	19.78
LH0033	100	1400 - 1500	5 - 20	100	±15	0.1 - 0.5	FET input, improved industry-standard	13.67
LH0063/BB3553	300	2000	25 - 50	200	±15	0.2 - 0.5	FET input, industry-standard	23.51/24.99
VIDEO MULTIPLEXER/AMPLIFIER								
MAX453	50	300	5	14	±5	10	Video amplifier with 2-channel video mux	3.94
MAX454	50	300	5	14	±5	10	Video amplifier with 4-channel video mux	5.25
MAX455	50	300	5	14	±5	10	Video amplifier with 8-channel video mux	8.75

Part Number	Unity GBW (MHz)	Slew Rate (V/µs)	V_{OS} (mV) max	OFF Isolation (dB at 5MHz)	Crosstalk (dB at 5MHz)	Features	Price† 1000-up ($)
VIDEO CROSSPOINT SWITCH							
MAX456	35	250	5	80	70	8x8 crosspoint switch array with 8 output buffers, three-state capability	22.09

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