Micropower, Rail-to-Rail Input and Output Operational Amplifiers

OP196/OP296/OP496

FEATURES
Rail-to-Rail Input and Output Swing
Low Power: 60 μA/Amplifier
Gain Bandwidth Product: 450 kHz
Single-Supply Operation: +3 V to +12 V
Low Offset Voltage: 300 μV max
High Open-Loop Gain: 500 V/mV
Unity-Gain Stable
No Phase Reversal

APPLICATIONS
Battery Monitoring
Sensor Conditioners
Portable Power Supply Control
Portable Instrumentation

GENERAL DESCRIPTION

The OP196 family of CBCMOS operational amplifiers features micropower operation and rail-to-rail input and output ranges.

The extremely low power requirements and guaranteed operation from +3 V to +12 V make these amplifiers perfectly suited to monitor battery usage and to control battery charging. Their dynamic performance, including 26 nV/√Hz voltage noise density, recommends them for battery-powered audio applications. Capacitive loads to 200 pF are handled without oscillation.

The OP196/OP296/OP496 are specified over the HOT extended industrial (–40°C to +125°C) temperature range. +3 V operation is specified over the 0°C to +125°C temperature range.

The single OP196 and the dual OP296 are available in 8-pin plastic DIP and SO-8 surface mount packages. The quad OP496 is available in 14-pin plastic DIP and narrow SO-14 surface mount packages. Check factory for availability of the OP296 and OP496 in TSSOP packages.

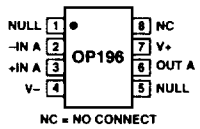
ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option*
OP196GP	–40°C to +125°C	8-Pin Plastic DIP	N-8
OP196GS	–40°C to +125°C	8-Pin SOIC	SO-8
OP296GP	–40°C to +125°C	8-Pin Plastic DIP	N-8
OP296GS	–40°C to +125°C	8-Pin SOIC	SO-8
OP296HRU	–40°C to +125°C	8-Pin TSSOP	RU-8
OP296GBC	+25°C	DICE	
OP496GP	–40°C to +125°C	14-Pin Plastic DIP	N-14
OP496GS	–40°C to +125°C	14-Pin SOIC	SO-14
OP496HRU	–40°C to +125°C	14-Pin TSSOP	RU-14
OP496GBC	+25°C	DICE	

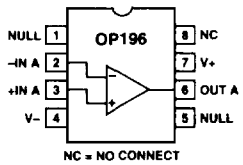
*For outline information see Package Information section.

PIN CONFIGURATIONS

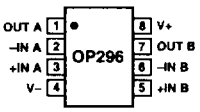
8-Lead Narrow-Body SO (S Suffix)



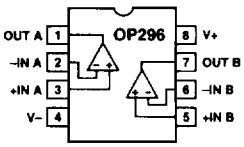
8-Lead Epoxy DIP (P Suffix)



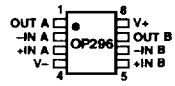
8-Lead Narrow-Body SO (S Suffix)



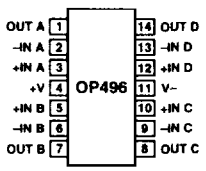
8-Lead Epoxy DIP (P Suffix)



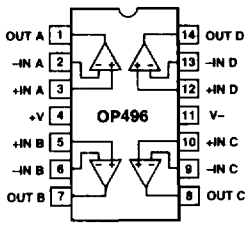
8-Lead TSSOP (RU Suffix)



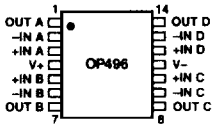
14-Lead Narrow-Body SO (S Suffix)



14-Lead Epoxy DIP (P Suffix)



14-Lead TSSOP (RU Suffix)



10

OP196/OP296/OP496–SPECIFICATIONS

ELECTRICAL SPECIFICATIONS (@ V_S = +5.0 V, V_{CM} = +2.5 V, T_A = +25°C unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	OP196G, OP296G, OP496G		35	300	μV
		$-40°C \le T_A \le +125°C$			650	μV
		OP296H, OP496H			800	μV
		$40°C \le T_A \le +125°C$			1.2	mV
Input Bias Current	I_B	$40°C \le T_A \le +125°C$		±10	±35	nA
Input Offset Current	I_{OS}			±1.5	±5	nA
		$40°C \le T_A \le +125°C$			±15	nA
Input Voltage Range	V_{CM}		0		+5.0	V
Common-Mode Rejection Ratio	CMRR	$0 V \le V_{CM} \le 5.0 V$,				
		$40°C \le T_A \le +125°C$	65			dB
Large Signal Voltage Gain	A_{VO}	R_L = 100 kΩ,				
		$0.30 V \le V_{OUT} \le 4.7 V$,				
		$-40°C \le T_A \le +125°C$	150	200		V/mV
Long-Term Offset Voltage	V_{OS}	G Grade, Note 1			550	μV
		H Grade, Note 1			1	mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	G Grade, Note 2		1.5		μV/°C
		H Grade, Note 2		2		μV/°C
OUTPUT CHARACTERISTICS						
Output Voltage Swing High	V_{OH}	I_L = 100 μA	4.85	4.92		V
		I_L = 1 mA	4.30	4.56		V
		I_L = 2 mA		4.1		V
Output Voltage Swing Low	V_{OL}	I_L = 100 μA		36	70	mV
		I_L = 1 mA		350	450	mV
		I_L = 2 mA		750		mV
Output Current	I_{OUT}			±4		mA
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	$\pm 2.5 V \le V_S \le \pm 6 V$,				
		$40°C \le T_A \le +125°C$	85			dB
Supply Current per Amplifier	I_{SY}	V_{OUT} = 2.5 V, R_L = ∞			60	μA
		$-40°C \le T_A \le +125°C$		45	80	μA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 100 kΩ		0.3		V/μs
Gain Bandwidth Product	GBP			350		kHz
Phase Margin	ϕ_m			47		Degrees
NOISE PERFORMANCE						
Voltage Noise	e_n p-p	0.1 Hz to 10 Hz		0.8		μV p-p
Voltage Noise Density	e_n	f = 1 kHz		26		$nV/\sqrt{Hz}$
Current Noise Density	i_n	f = 1 kHz		0.19		$pA/\sqrt{Hz}$

NOTES

[1]Long-term offset voltage is guaranteed by a 1000 hour life test performed on three independent lots at +125°C, with an LTPD of 1.3.

[2]Offset voltage drift is the average of the -40°C to +25°C delta and the +25°C to +125°C delta

Specifications subject to change without notice.