

FEATURES

- Single Supply Operation
 Input Voltage Range Extends to Ground
 Output Swings to Ground while Sinking Current
- *Guaranteed* Offset Voltage 400 μ V Max.
- *Guaranteed* Low Drift 3.5 μ V/ $^{\circ}$ C Max.
- *Guaranteed* Offset Current 0.9nA Max.
- *Guaranteed* High Gain
 5mA Load Current 1.2 Million Min.
 17mA Load Current 0.5 Million Min.
- *Guaranteed* Low Supply Current 570 μ A Max.
- Supply Current can be Reduced by a Factor of 4
- Low Voltage Noise, 0.1Hz to 10Hz 0.55 μ Vp-p
- Low Current Noise—
 Better than OP-07 0.08pA/ $\sqrt{\text{Hz}}$ at 10Hz
- High Input Impedance 100M Ω Min.
- *Guaranteed* Minimum Supply Voltage 2.7V Min.

APPLICATIONS

- Low Power Sample and Hold Circuits
- Battery Powered Precision Instrumentation
 Strain Gauge Signal Conditioners
 Thermocouple Amplifiers
- 4mA–20mA Current Loop Transmitters
- Active Filters

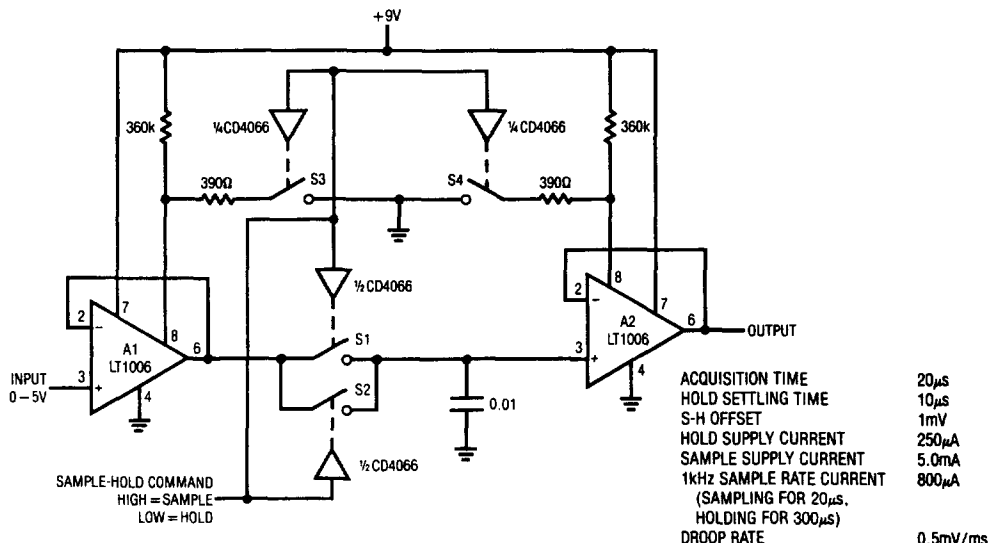
DESCRIPTION

The LT1006S8 is the first precision single supply operational amplifier. Its design has been optimized for single supply operation with a full set of specifications at 5V. Specifications at ± 15 V are also provided.

The LT1006S8 has low offset voltage of 80 μ V, drift of 0.7 μ V/ $^{\circ}$ C, offset current of 150pA, gain of 2 million, common-mode rejection of 112dB, and power supply rejection of 126dB.

Although supply current is only 350 μ A, a novel output stage can source or sink in excess of 20mA while retaining high voltage gain. Common-mode input range includes ground to accommodate low ground-referenced inputs from strain gauges or thermocouples, and output can swing to within a few millivolts of ground. If higher slew rate (in excess of 1V/ μ s) or micropower operation (supply current down to 90 μ A) is required, the operating currents can be modified by connecting an external optional resistor to Pin 8.

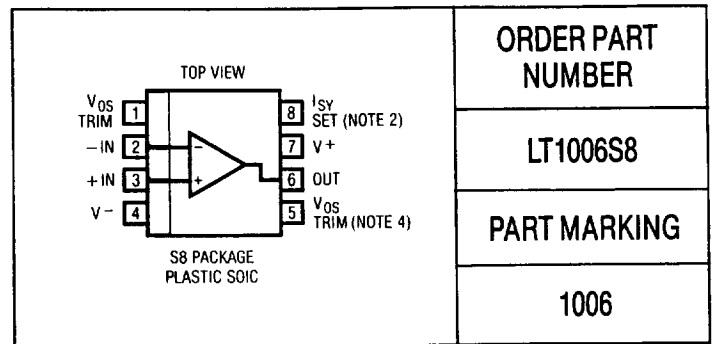
For a similar single supply precision dual op amp in the SO package, please see the LT1013DS8 data sheet.

2
LT1006 Single Supply, Micropower Sample and Hold


ABSOLUTE MAXIMUM RATINGS

Supply Voltage $\pm 22V$
 Input Voltage Equal to Positive Supply Voltage
 5V Below Negative Supply Voltage
 Differential Input Voltage..... 30V
 Output Short Circuit Duration Indefinite
 Operating Temperature Range $0^{\circ}C$ to $70^{\circ}C$
 Storage Temperature Range $-65^{\circ}C$ to $150^{\circ}C$
 Lead Temperature (Soldering, 10 sec) $300^{\circ}C$

PACKAGE/ORDER INFORMATION



ELECTRICAL CHARACTERISTICS

$V_S = 5V, 0V, V_{CM} = 0V, V_{OUT} = 1.4V, T_A = 25^{\circ}C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	LT1006S8			UNITS
			MIN	TYP	MAX	
V_{OS}	Input Offset Voltage			80	400	μV
$\frac{\Delta V_{OS}}{\Delta Time}$	Long Term Input Offset Voltage Stability			0.7		$\mu V/Mo$
I_{OS}	Input Offset Current			0.15	0.9	nA
I_B	Input Bias Current			10	25	nA
e_n	Input Noise Voltage	0.1Hz to 10Hz		0.55		$\mu Vp-p$
	Input Noise Voltage Density	$f_o = 10Hz$ (Note 3) $f_o = 1000Hz$ (Note 3)		23 22	32 25	nV/\sqrt{Hz} nV/\sqrt{Hz}
i_n	Input Noise Current Density	$f_o = 10Hz$		0.08		pA/\sqrt{Hz}
	Input Resistance	(Note 1)				
	Differential Mode		100	300		M Ω
	Common-Mode			4		G Ω
	Input Voltage Range		3.5 0	3.8 -0.3		V V
CMRR	Common-Mode Rejection Ratio	$V_{CM} = 0V$ to $3.5V$	97	112		dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 2V$ to $\pm 18V, V_O = 0V$	103	124		dB
A_{VOL}	Large Signal Voltage Gain	$V_O = 0.03V$ to $4V, R_L = 10k$ $V_O = 0.03V$ to $3.5V, R_L = 2k$	0.7 0.3	2.0 1.8		$V/\mu V$ $V/\mu V$
V_{OUT}	Maximum Output Voltage Swing	Output Low, No Load Output Low, 600Ω to GND Output Low, $I_{SINK} = 1mA$ Output High, No Load Output High, 600Ω to GND		15 5 220 4.0 3.4	25 10 350 4.4 4.0	mV mV mV V V
SR	Slew Rate		0.25	0.4		$V/\mu s$
I_S	Supply Current	$R_{SET} = \infty$ $R_{SET} = 180k$ Pin 8 to Pin 7 (Note 2)		350 90	570	μA μA
	Minimum Supply Voltage		2.7			V

ELECTRICAL CHARACTERISTICS $V_S = \pm 15V, T_A = 25^\circ C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	LT1006S8			UNITS
			MIN	TYP	MAX	
V_{OS}	Input Offset Voltage			100	525	μV
I_{OS}	Input Offset Current			0.15	0.9	nA
I_B	Input Bias Current			8.0	20.0	nA
	Input Voltage Range		13.5 -15.0	13.8 -15.3		V V
CMRR	Common-Mode Rejection Ratio	$V_{CM} = +13.5V, -15V$	97	116		dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 2V$ to $\pm 18V, V_O = 0V$	103	124		dB
A_{VOL}	Large Signal Voltage Gain	$V_O = \pm 10V, R_L = 2k$ $V_O = \pm 10V, R_L = 600\Omega$	1.2 0.5	4.0 1.0		$V/\mu V$ $V/\mu V$
V_{OUT}	Maximum Output Voltage Swing	$R_L = 2k$	± 12.5	± 14		V
SR	Slew Rate	$R_{SET} = \infty$ $R_{SET} = 390\Omega$ Pin 8 to Pin 4	0.25 1.0	0.4 1.2		$V/\mu s$ $V/\mu s$
I_S	Supply Current			360	600	μA

2

ELECTRICAL CHARACTERISTICS

$V_S = 5V, 0V, V_{CM} = 0V, V_{OUT} = 1.4V, 0^\circ C \leq T_A \leq 70^\circ C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		LT1006S8			UNITS
				MIN	TYP	MAX	
V_{OS}	Input Offset Voltage		●		110	560	μV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Input Offset Voltage Drift		●		0.7	3.5	$\mu V/^\circ C$
I_{OS}	Input Offset Current		●		0.3	2.5	nA
I_B	Input Bias Current		●		12	30	nA
A_{VOL}	Large Signal Voltage Gain	$V_O = 0.04V$ to $3.5V, R_L = 2k$	●	0.25	1.2		$V/\mu V$
CMRR	Common-Mode Rejection Ratio	$V_{CM} = 0V$ to $3.4V$	●	92	108		dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 2V$ to $\pm 18V, V_O = 0V$	●	97	118		dB
V_{OUT}	Maximum Output Voltage Swing	Output Low, 600Ω to GND Output High, 600Ω to GND	● ●	3.2	6 3.9	13	mV V
I_S	Supply Current		●		360	620	μA

ELECTRICAL CHARACTERISTICS $V_S = \pm 15V, 0^\circ C \leq T_A \leq 70^\circ C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	LT1006S8			UNITS
			MIN	TYP	MAX	
V_{OS}	Input Offset Voltage	●		150	730	μV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Input Offset Voltage Drift	●		1.0	4.5	$\mu V/^\circ C$
I_{OS}	Input Offset Current	●		0.25	2.0	nA
I_B	Input Bias Current	●		10	23	nA
A_{VOL}	Large Signal Voltage Gain	$V_O = \pm 10V, R_L = 2k$	●	0.7	2.5	$V/\mu V$
CMRR	Common-Mode Rejection Ratio	$V_{CM} = 13V, -15V$	●	94	114	dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 2V$ to $\pm 18V, V_O = 0V$	●	97	118	dB
V_{OUT}	Maximum Output Voltage Swing	$R_L = 2k$	●	± 11.5	± 13.8	V
I_S	Supply Current	●		380	660	μA

The ● denotes the specifications which apply over the full operating temperature range.

Note 1: This parameter is guaranteed by design and is not tested.

Note 2: Regular operation does not require an external resistor. In order to program the supply current for low power or high speed operation, connect an external resistor from Pin 8 to Pin 7 or from Pin 8 to Pin 4, respectively. Supply current specifications (for $R_{SET} = 180k$) do not include current in R_{SET} .

Note 3: This parameter is tested on a sample basis only. All noise parameters are tested with $V_S = \pm 2.5V, V_O = 0V$.

Note 4: Optional offset nulling is accomplished with a potentiometer connected between the trim terminals and the wiper to V^- . A 10k pot (providing a null range of $\pm 6mV$) is recommended for minimum drift of nulled offset voltage with temperature. For increased trim resolution and accuracy, two fixed resistors can be used in conjunction with a smaller potentiometer. For example: two 4.7k resistors tied to pins 1 and 5, with a 500 Ω pot in the middle, will have a null range of $\pm 150\mu V$.