LTC2051

Dual Zero-Drift Operational Amplifier

February 2000

FEATURES

- **Maximum Offset Voltage of 3μV**
- **Maximum Offset Voltage Drift of 30nV/°C**
- **Small Footprint, Low Profile MS8 Package**
- Noise: 1.5μV_{P-P} (0.1Hz to 10Hz Typ)
- Voltage Gain: 140dB (Typ)
- PSRR: 130dB (Typ)
- CMRR: 130dB (Typ)
- Supply Current: 0.75mA (Typ) per Amplifier
- Single Supply Operation: 2.7V to 11V
- Extended Common Mode Input Range
- Output Swings Rail-to-Rail
- Overload Recovery Time: 2ms (Typ)
- Operating Temperature Range –40°C to 85°C

APPLICATIONS

- Thermocouple Amplifiers
- Electronic Scales
- Medical Instrumentation
- Strain Gauge Amplifiers
- High Resolution Data Acquisition
- DC Accurate RC Active Filters

DESCRIPTION

The LTC®2051 is a dual zero-drift operational amplifier available in the MS8 and SO-8 packages. It operates from a single 2.7V supply while still supporting ±5V applications. The power consumption is 750μA per op amp.

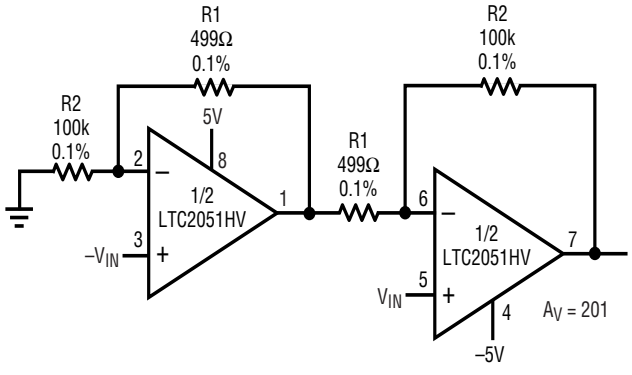
The LTC2051, despite its miniature size, features uncompromising DC performance. The typical input offset voltage and offset drift are 0.5μV and 10nV/°C. The almost zero DC offset and drift are supported with a power supply rejection ratio (PSRR) and common mode rejection ratio (CMRR) of more than 130dB.

The input common mode voltage ranges from the negative supply up to 1V from the positive supply. The LTC2051 also has an enhanced output stage capable of driving loads as low as 1kΩ to both supply rails. The open-loop gain, loaded with 1kΩ, is in excess of 140dB. The LTC2051 also features a 1.5μV_{P-P} DC to 10Hz noise and a 3MHz gain bandwidth product.

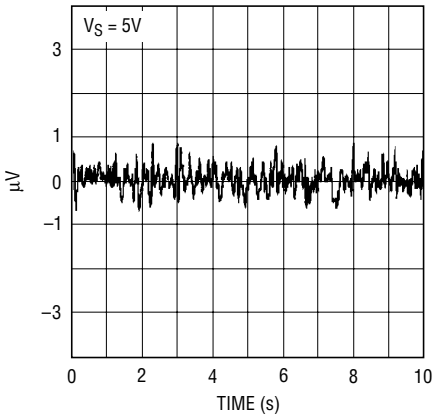
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TYPICAL APPLICATION

High Performance Low Cost Instrumentation Amplifier



Input Referred Noise 0.1Hz to 10Hz



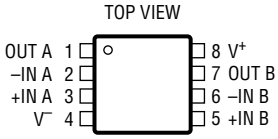
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ABSOLUTE MAXIMUM RATINGS (Note 1)

Total Supply Voltage (V^+ to V^-)
LTC2051 ..... 7V
LTC2051HV 12V
Input Voltage ..... (V^+ + 0.3V) to (V^- – 0.3V)
Output Short-Circuit Duration ..... Indefinite

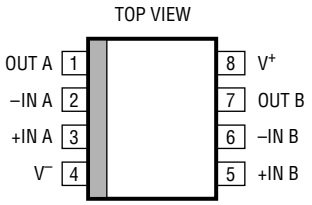
Operating Temperature Range ..... –40°C to 85°C
Specified Temperature Range (Note 3) .. –40°C to 85°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

PACKAGE/ORDER INFORMATION



MS8 PACKAGE
8-LEAD PLASTIC MSOP
T_{JMAX} = 125°C, θ_{JA} = 250°C/W

ORDER PART NUMBER	MS8 PART MARKING
LTC2051CMS8 LTC2051IMS8 LTC2051HVCMS8 LTC2051HVIMS8	LTMN LTMP LTPJ LTPK



S8 PACKAGE
8-LEAD PLASTIC SO
T_{JMAX} = 125°C, θ_{JA} = 190°C/W

ORDER PART NUMBER	S8 PART MARKING
LTC2051CS8 LTC2051IS8 LTC2051HVCS8 LTC2051HVIS8	2051 2051I 2051HV 051HVI

Consult factory for Military grade parts.

ELECTRICAL CHARACTERISTICS

: (LTC2051, LTC2051HV) The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. V_S = 3V, 5V unless otherwise noted. (Note 3)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Input Offset Voltage	(Note 2)			±0.5	±3	µV
Average Input Offset Drift	(Note 2)	●			±0.03	µV/°C
Long-Term Offset Drift				50		nV/√mo
Input Bias Current	V_S = 3V			±8	±50	pA
	V_S = 3V	●			±100	pA
	V_S = 5V			±25	±75	pA
	V_S = 5V	●			±150	pA
Input Offset Current	V_S = 3V				±100	pA
	V_S = 3V	●			±150	pA
	V_S = 5V				±150	pA
	V_S = 5V	●			±200	pA
Input Noise Voltage	R_S = 100Ω, DC to 10Hz			1.5		μV_{P-P}
Common Mode Rejection Ratio	V_{CM} = V^- to V^+ – 1.3, V_S = 3V		115	130		dB
		●	110	130		dB
	V_{CM} = V^- to V^+ – 1.3, V_S = 5V		120	130		dB
		●	115	130		dB
Power Supply Rejection Ratio			120	130		dB
		●	115	130		dB

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. V_S = 3V, 5V unless otherwise noted. (Note 3)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Large-Signal Voltage Gain	R_L = 10k, V_S = 3V		120	140		dB
		●	115	140		dB
	R_L = 10k, V_S = 5V		125	140		dB
		●	120	140		dB
Maximum Output Voltage Swing	R_L = 2k	●	V^+ – 0.15	V^+ – 0.06		V
	R_L = 10k	●	V^+ – 0.05	V^+ – 0.02		V
Slew Rate				2		V/µs
Gain Bandwidth Product				3		MHz
Supply Current (2 Amplifiers)	No Load, V_S = 3V	●		1.5	2.0	mA
	No Load, V_S = 5V	●		1.7	2.4	mA
Internal Sampling Frequency				7.5		kHz

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T_A = 25°C. V_S = ±5V unless otherwise noted. (Note 3) (LTC2051HV)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Input Offset Voltage	(Note 2)			±1	±3	µV
Average Input Offset Drift	(Note 2)	●			±0.03	µV/°C
Long-Term Offset Drift				50		nV/√mo
Input Bias Current				±90	±150	pA
		●			±300	pA
Input Offset Current					±300	pA
		●			±500	pA
Input Noise Voltage	R_S = 100Ω, DC to 10Hz			1.5		μV_{P-P}
Common Mode Rejection Ratio	V_{CM} = V^- to V^+ – 1.3		125	130		dB
		●	120	130		dB
Power Supply Rejection Ratio			120	130		dB
		●	115	130		dB
Large-Signal Voltage Gain	R_L = 10k		125	140		dB
		●	120	140		dB
Maximum Output Voltage Swing	R_L = 2k	●	4.80	4.92		V
	R_L = 10k	●	4.95	4.98		V
Slew Rate				2		V/µs
Gain Bandwidth Product				3		MHz
Supply Current (2 Amplifiers)	No Load	●		2	3	mA
Internal Sampling Frequency				7.5		kHz

Note 1: Absolute Maximum Ratings are those values beyond which the life of the device may be impaired.

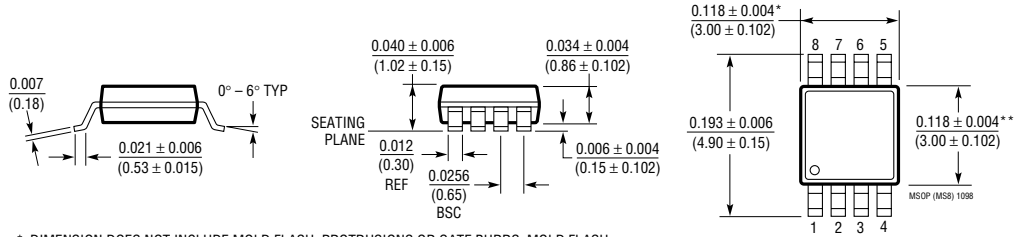
Note 2: These parameters are guaranteed by design. Thermocouple effects preclude measurements of these voltage levels during automated testing.

Note 3: The LTC2051C, LTC2051HVC is guaranteed to meet specified performance from 0°C to 70°C and is designed, characterized and expected to meet these extended temperature limits, but is not tested at –40°C and 85°C. The LTC2051I, LTC2051HVI is guaranteed to meet the extended temperature limits.

PACKAGE DESCRIPTION

Dimensions in inches (millimeters) unless otherwise noted.

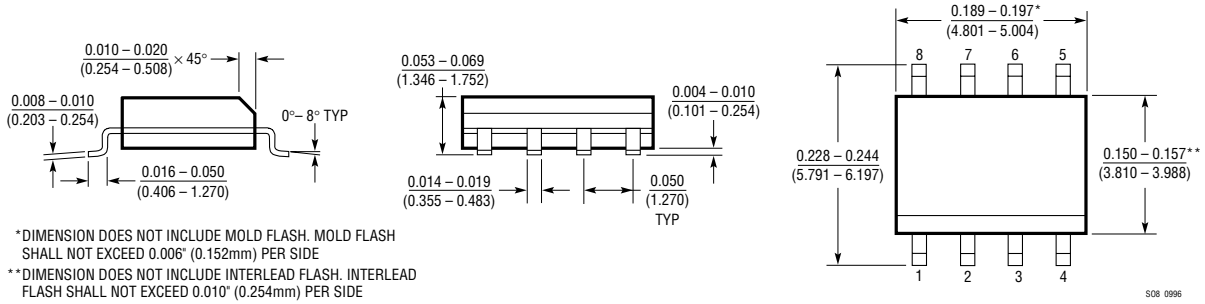
MS8 Package
8-Lead Plastic MSOP
(LTC DWG # 05-08-1660)



* DIMENSION DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

** DIMENSION DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS. INTERLEAD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

S8 Package
8-Lead Plastic Small Outline (Narrow 0.150)
(LTC DWG # 05-08-1610)



*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LTC1051/LTC1053	Precision Zero-Drift Op Amp	Dual/Quad
LTC1151	±15V Zero-Drift Op Amp	Dual High Voltage Operation ±18V
LTC1152	Rail-to-Rail Input and Output Zero-Drift Op Amp	Single Zero-Drift Op Amp with Rail-to-Rail Input and Output and Shutdown
LTC2050	Zero-Drift Op Amp in SOT-23	Single Supply Operation 2.7V to 6V, Shutdown

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