90MHz, 22V/µs 16-Bit Accurate Operational Amplifier

August 1998

FEATURES

- **90MHz Gain Bandwidth, f = 100kHz**
- **22V/µs Slew Rate**
- **Settling Time: < 1µs** (A_V = –1, 150µV, 10V Step)
- Maximum Input Offset Voltage: 75µV
- Maximum Input Offset Voltage Drift: 2µV/°C
- Maximum (–) Input Bias Current: 10nA
- Minimum DC Gain: 1000V/mV
- Minimum Output Swing into 2k: ±12.8V
- Unity Gain Stable
- Input Noise Voltage: 5nV/√Hz
- Input Noise Current: 0.6pA/√Hz
- Low Distortion, –96dBc for 100kHz, $10V_{P-P}$
- Specified at ±5V and ±15V

APPLICATIONS

- 16-Bit DAC Current-to-Voltage Converter
- Precision Instrumentation
- ADC Buffer
- Low Distortion Active Filters
- High Accuracy Data Acquisition Systems
- Photodiode Amplifiers

DESCRIPTION

The LT®1468 is a precision high speed operational amplifier with 16-bit accuracy and less than 1µs settling to 150µV for 10V signals. This unique blend of precision and AC performance makes the LT1468 the optimum choice for high accuracy data acquisition applications and current-to-voltage conversion. The initial accuracy and drift characteristics of the input offset voltage and inverting input bias current are tailored for inverting applications.

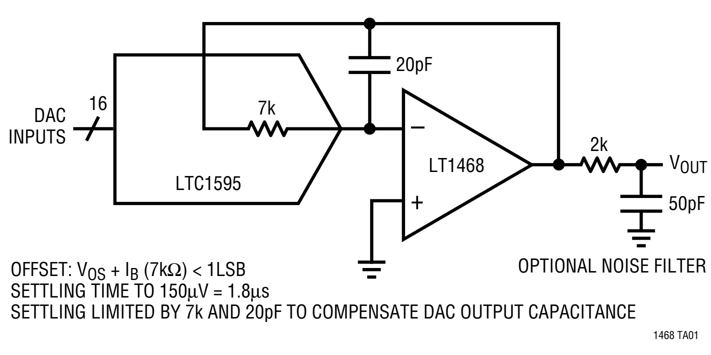
The 90MHz gain bandwidth ensures high open-loop gain at frequency for reducing distortion. In noninverting applications such as an ADC buffer, the low distortion and DC accuracy allow full 16-bit AC and DC performance.

The 22V/µs slew rate of the LT1468 improves large signal performance in applications such as active filters and instrumentation amplifiers compared to other precision op amps.

The LT1468 is manufactured on Linear Technology's complementary bipolar process.

TYPICAL APPLICATION

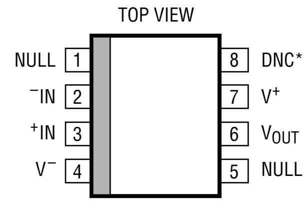
16-Bit DAC I-to-V Converter



ABSOLUTE MAXIMUM RATINGS

Total Supply Voltage (V^+ to V^-) 36V
Maximum Input Current (Note 1) 10mA
Output Short Circuit Duration (Note 2) .... Indefinite
Operating Temperature Range .... –40°C to 85°C
Specified Temperature Range (Note 3)... –40°C to 85°C
Junction Temperature .... 150°C
Storage Temperature Range .... –65°C to 150°C
Lead Temperature (Soldering, 10 sec.)................. 300°C

PACKAGE/ORDER INFORMATION



S8 PACKAGE
8-LEAD PLASTIC SO
* DO NOT CONNECT
T_{JMAX} = 150°C, θ_{JA} = 190°C/W

ORDER PART NUMBER
LT1468CS8
S8 PART MARKING
1468

Consult factory for Industrial and Military Grade parts.

ELECTRICAL CHARACTERISTICS

T_A = 25°C, V_{CM} = 0V unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	V_{SUPPLY}	MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage		±15V ±5V		30 50	75 175	µV µV
I_{OS}	Input Offset Current		±5V to ±15V		15	50	nA
I_B-	Inverting Input Bias Current		±5V to ±15V		3	10	nA
I_B+	Noninverting Input Bias Current		±5V to ±15V		10	40	nA
e_n	Input Noise Voltage	f = 10kHz	±5V to ±15V		5		nV/√Hz
i_n	Input Noise Current	f = 10kHz	±5V to ±15V		0.6		pA/√Hz
R_{IN}	Input Resistance	V_{CM} = ±12.5V Differential	±15V ±15V	100 50	240 150		MΩ kΩ
C_{IN}	Input Capacitance		±15V		4		pF
	Positive Input Voltage Range		±15V ±5V	12.5 2.5	13.5 3.5		V V
	Negative Input Voltage Range		±15V ±5V		–14.5 –4.5	–12.5 –2.5	V V
CMRR	Common Mode Rejection Ratio	V_{CM} = ±12.5V V_{CM} = ±2.5V	±15V ±5V	96 96	110 112		dB dB
PSRR	Power Supply Rejection Ratio	V_S = ±4.5V to ±15V		100	112		dB
A_{VOL}	Large-Signal Voltage Gain	V_{OUT} = ±12.5V, R_L = 10k V_{OUT} = ±12.5V, R_L = 2k V_{OUT} = ±2.5V, R_L = 10k V_{OUT} = ±2.5V, R_L = 2k	±15V ±15V ±5V ±5V	1000 500 1000 500	9000 5000 6000 3000		V/mV V/mV V/mV V/mV
V_{OUT}	Output Swing	R_L = 10k, V_{IN} = ±1mV R_L = 2k, V_{IN} = ±1mV R_L = 10k, V_{IN} = ±1mV R_L = 2k, V_{IN} = ±1mV	±15V ±15V ±5V ±5V	±13.0 ±12.8 ±3.0 ±2.8	±13.6 ±13.5 ±3.6 ±3.5		V V V V
I_{OUT}	Output Current	V_{OUT} = ±12.5V V_{OUT} = ±2.5V	±15V ±5V	±15 ±15	±22 ±22		mA mA
I_{SC}	Short-Circuit Current	V_{OUT} = 0V, V_{IN} = ±0.2V	±15V	±25	±40		mA
SR	Slew Rate	A_V = –1, R_L = 2k (Note 4)	±15V ±5V	15 11	22 17		V/µs V/µs
	Full-Power Bandwidth	10V peak, (Note 5) 3V peak, (Note 5)	±15V ±5V		350 900		kHz kHz

ELECTRICAL CHARACTERISTICS $T_A = 25°C$, $V_{CM} = 0V$ unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	V_{SUPPLY}	MIN	TYP	MAX	UNITS
GBW	Gain Bandwidth	f = 100kHz, R_L = 2k	±15V ±5V	60 55	90 85		MHz MHz
t_r, t_f	Rise Time, Fall Time	A_V = 1, 10% to 90%, 0.1V	±15V ±5V		11 12		ns ns
	Overshoot	A_V = 1, 0.1V	±15V ±5V		30 35		% %
	Propagation Delay	A_V = 1, 50% V_{IN} to 50% V_{OUT}, 0.1V	±15V ±5V		9 10		ns ns
t_s	Settling Time	10V Step, 0.01%, A_V = –1 10V Step, 150μV, A_V = –1 5V Step, 0.01%, A_V = –1	±15V ±15V ±5V		760 900 780		ns ns ns
R_O	Output Resistance	A_V = 1, f = 100kHz	±15V		0.02		Ω
I_S	Supply Current		±15V ±5V		3.9 3.6	5.2 5.0	mA mA

$0°C \le T_A \le 70°C$, $V_{CM} = 0V$ unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	V_{SUPPLY}	MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage		±15V ±5V			150 250	μV μV
	Input V_{OS} Drift	(Note 6)	±5V to ±15V		0.7	2.0	μV/°C
I_{OS}	Input Offset Current		±5V to ±15V			65	nA
	Input Offset Current Drift				60		pA/°C
I_B-	Inverting Input Bias Current		±5V to ±15V			15	nA
	Negative Input Current Drift				40		pA/°C
I_B+	Noninverting Input Bias Current		±5V to ±15V			50	nA
CMRR	Common Mode Rejection Ratio	V_{CM} = ±12.5V V_{CM} = ±2.5V	±15V ±5V	94 94			dB dB
PSRR	Power Supply Rejection Ratio	V_S = ±4.5V to ±15V		98			dB
A_{VOL}	Large-Signal Voltage Gain	V_{OUT} = ±12.5V, R_L = 10k V_{OUT} = ±12.5V, R_L = 2k V_{OUT} = ±2.5V, R_L = 10k V_{OUT} = ±2.5V, R_L = 2k	±15V ±15V ±5V ±5V	500 250 500 250			V/mV V/mV V/mV V/mV
V_{OUT}	Output Swing	R_L = 10k, V_{IN} = ±1mV R_L = 2k, V_{IN} = ±1mV R_L = 10k, V_{IN} = ±1mV R_L = 2k, V_{IN} = ±1mV	±15V ±15V ±5V ±5V	±12.9 ±12.7 ±2.9 ±2.7			V V V V
I_{OUT}	Output Current	V_{OUT} = ±12.5V V_{OUT} = ±2.5V	±15V ±5V	±12.5 ±12.5			mA mA
I_{SC}	Short-Circuit Current	V_{OUT} = 0V, V_{IN} = ±0.2V	±15V	±17			mA
SR	Slew Rate	A_V = –1, R_L = 2k (Note 4)	±15V ±5V	13 9			V/μs V/μs
GBW	Gain Bandwidth	f = 100kHz, R_L = 2k	±15V ±5V	55 50			MHz MHz
I_S	Supply Current		±15V ±5V			6.5 6.3	mA mA

ELECTRICAL CHARACTERISTICS –40°C ≤ T_A ≤ 85°C, V_{CM} = 0V unless otherwise noted (Note 3).

SYMBOL	PARAMETER	CONDITIONS	V_{SUPPLY}	MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage		±15V ±5V			230 330	µV µV
	Input V_{OS} Drift	(Note 6)	±5V to ±15V		0.7	2.5	µV/°C
I_{OS}	Input Offset Current		±5V to ±15V			80	nA
	Input Offset Current Drift				120		pA/°C
I_B–	Inverting Input Bias Current		±5V to ±15V			30	nA
	Negative Input Current Drift				80		pA/°C
I_B+	Noninverting Input Bias Current		±5V to ±15V			60	nA
CMRR	Common Mode Rejection Ratio	V_{CM} = ±12.5V V_{CM} = ±2.5V	±15V ±5V	92 92			dB dB
PSRR	Power Supply Rejection Ratio	V_S = ±4.5V to ±15V		96			dB
A_{VOL}	Large-Signal Voltage Gain	V_{OUT} = ±12V, R_L = 10k V_{OUT} = ±10V, R_L = 2k V_{OUT} = ±2.5V, R_L = 10k V_{OUT} = ±2.5V, R_L = 2k	±15V ±15V ±5V ±5V	300 150 300 150			V/mV V/mV V/mV V/mV
V_{OUT}	Output Swing	R_L = 10k, V_{IN} = ±1mV R_L = 2k, V_{IN} = ±1mV R_L = 10k, V_{IN} = ±1mV R_L = 2k, V_{IN} = ±1mV	±15V ±15V ±5V ±5V	±12.8 ±12.6 ±2.8 ±2.6			V V V V
I_{OUT}	Output Current	V_{OUT} = ±12.5V V_{OUT} = ±2.5V	±15V ±5V	±8 ±8			mA mA
I_{SC}	Short-Circuit Current	V_{OUT} = 0V, V_{IN} = ±0.2V	±15V	±12			mA
SR	Slew Rate	A_V = –1, R_L = 2k (Note 4)	±15V ±5V	10 7			V/µs V/µs
GBW	Gain Bandwidth	f = 100kHz, R_L = 2k	±15V ±5V	45 40			MHz MHz
I_S	Supply Current		±15V ±5V			7.0 6.8	mA mA

Note 1: The inputs are protected by back-to-back diodes and two 100Ω series resistors. If the differential input voltage exceeds 0.7V, the input current should be limited to 10mA. Input voltages outside the supplies will be clamped by ESD protection devices and input currents should also be limited to10mA.

Note 2: A heat sink may be required to keep the junction temperature below absolute maximum when the output is shorted indefinitely.

Note 3: The LT1468 is designed, characterized and expected to meet these extended temperature limits, but is not tested at –40°C and at 85°C. Consult factory for guaranteed I grade parts.

Note 4: Slew rate is measured between ±8V on the output with ±12V input for ±15V supplies and ±2V on the output with ±3V input for ±5V supplies.

Note 5: Full power bandwidth is calculated from the slew rate measurement: $FPBW = SR/2\pi V_P$

Note 6: This parameter is not 100% tested.

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1468i LT/TP 0898 4K • PRINTED IN USA

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