

Precision Low-voltage Amplifier

Features

- Low Offset:
 - 10 μ V Max.
- Low Drift:
 - 0.05 μ V/°C Max.
- Low Noise:
 - 17 nV/ $\sqrt{\text{Hz}}$
- Open-loop Voltage Gain:
 - 150 dB Typ.
- Rail-to-Rail Inputs
- Rail-to-Rail Output Swing
 - to within 10 mV of supply voltage
- 2.1 mA Supply Current
- Slew rate:
 - 0.25 V/ μ s

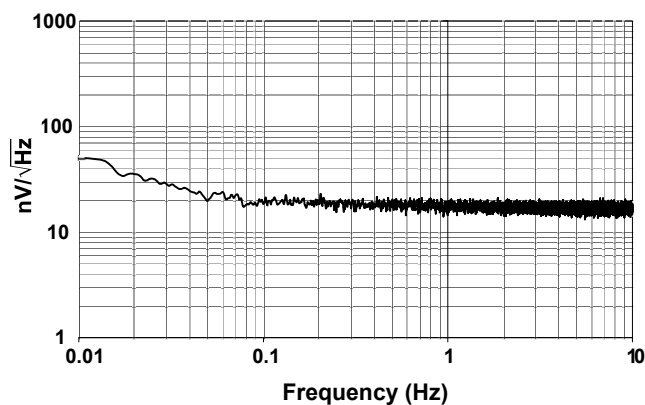
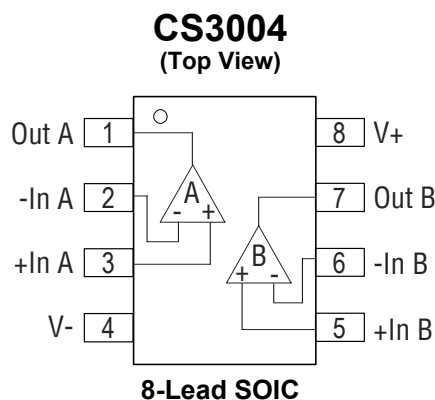
Applications

- Thermocouple/Thermopile Amplifiers
- Load Cell and Bridge Transducer Amplifiers
- Precision Instrumentation
- Battery-powered Systems

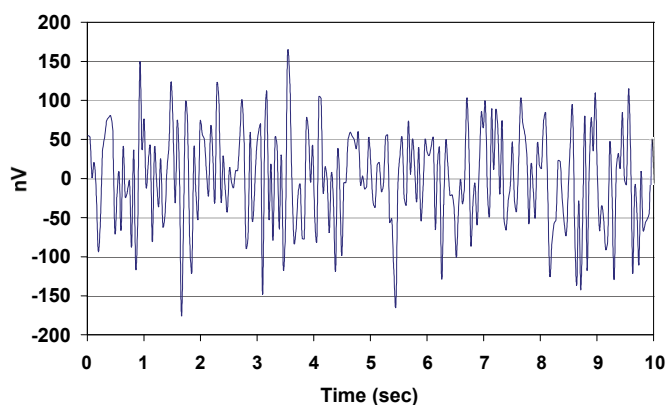
Description

The CS3004 dual amplifier is designed for precision amplification of low-level signals. These amplifiers achieve excellent offset stability, high open loop gain, and low noise. The devices also exhibit excellent CMRR and PSRR. The common mode input range includes the supply rails. The amplifiers operate with any supply voltage from 2.7 V to 5 V (± 1.35 V to ± 2.50 V).

Pin Configuration



Noise vs. Frequency (Measured)



0.01 Hz to 10 Hz Noise Performance

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1. CHARACTERISTICS AND SPECIFICATIONS

1.1 5 V Electrical Characteristics

V+ = +5 V, $\pm 5\%$; V- = 0V; VCM = 2.5 V; Unless otherwise noted, T_A = 25° C (See Note 1).

Parameter		Min	Typ	Max	Unit
Input Offset Voltage (Note 2)	•	-	± 2	± 10	μV
Average Input Offset Drift (Note 2)	•	-	± 0.01	± 0.05	$\mu\text{V}/^\circ\text{C}$
Input Bias Current	•	-	± 170	± 250	pA
	•	-	-	± 1.5	nA
Input Offset Current	•	-	± 340	± 500	pA
	•	-	-	± 3.0	nA
Input Noise Voltage Density	$R_S = 100\ \Omega, f_0 = 1\ \text{Hz}$	-	17	-	$\text{nV}/\sqrt{\text{Hz}}$
	$R_S = 100\ \Omega, f_0 = 1\ \text{kHz}$	-	17	-	$\text{nV}/\sqrt{\text{Hz}}$
Input Noise Voltage	0.1 to 10 Hz	-	350	-	$\text{nV}_{\text{p-p}}$
Input Noise Current Density	$f_0 = 1\ \text{Hz}$	-	100	-	$\text{fA}/\sqrt{\text{Hz}}$
Input Noise Current	0.1 to 10 Hz	-	1.9	-	$\text{pA}_{\text{p-p}}$
Input Voltage Range (Note 2)	•	V-	-	V+	V
Common Mode Rejection Ratio (dc)	•	110	120	-	dB
Power Supply Rejection Ratio	•	110	130	-	dB
Large Signal Voltage Gain	•	-	150	-	dB
(Note 3) $R_L = 2\ \text{k}\Omega$ to V+/2	•	120	150	-	dB
Output Voltage Swing	$R_L = 2\ \text{k}\Omega$ to V+/2	(V+ - 100)	-	(V- + 100)	mV
(Note 4) $R_L = 100\ \text{k}\Omega$ to V+/2	•	(V+ - 10)	-	(V- + 10)	mV
Slew Rate	$R_L = 2\ \text{k}, 100\ \text{pF}$		0.25	-	V/ μs
Overload Recovery Time		-	25	-	μs
Supply Current	•	-	2.0	2.5	mA
Oscillator Frequency		-	150	-	kHz
Input Capacitance	Differential	-	1.5	-	pF
	Common Mode	-	10	-	pF

- Notes: 1. Symbol “•” denotes specification applies over -40 to +125 ° C.
2. This parameter is guaranteed by design and/or laboratory characterization.
3. Guaranteed within the output limits of (V+ - 0.2 V) to (V- + 0.2 V).
4. Specifies the worst case drive voltage relative to the supply rail under stated load conditions.

1.2 3 V Electrical Characteristics

V+ = +3 V, ±10%; V- = 0V; VCM = 2.5 V; Unless otherwise noted, T_A = 25° C (See Note 5).

Parameter		Min	Typ	Max	Unit
Input Offset Voltage (Note 6)	•	-	±2	±10	μV
Average Input Offset Drift (Note 6)	•	-	±0.01	±0.05	μV/°C
Input Bias Current	•	-	±110	±150	pA
	•	-	-	±1.0	nA
Input Offset Current	•	-	±220	±300	pA
	•	-	-	±2.0	nA
Input Noise Voltage Density R _S = 100 Ω, f ₀ = 1 Hz		-	17	-	nV/√Hz
R _S = 100 Ω, f ₀ = 1 kHz		-	17	-	nV/√Hz
Input Noise Voltage 0.1 to 10 Hz		-	350	-	nV _{p-p}
Input Noise Current Density f ₀ = 1 Hz		-	100	-	fA/√Hz
Input Noise Current 0.1 to 10 Hz		-	1.9		pA _{p-p}
Input Voltage Range (Note 6)	•	V-	-	V+	V
Common Mode Rejection Ratio (dc)	•	110	120	-	dB
Power Supply Rejection Ratio	•	110	130	-	dB
Large Signal Voltage Gain (Note 7) R _L = 2 kΩ to V+/2	•	-	160	-	dB
	•	120	150	-	dB
Output Voltage Swing R _L = 2 kΩ to V+/2	•	(V+ - 100)	-	(V- + 100)	mV
(Note 8) R _L = 100 kΩ to V+/2		(V+ - 10)	-	(V- + 10)	mV
Slew Rate R _L = 2 k, 100 pF			0.25	-	V/μs
Overload Recovery Time		-	25	-	μs
Supply Current	•	-	2.0	2.5	mA
Oscillator Frequency		-	150	-	kHz
Input Capacitance Differential		-	1.5	-	pF
Common Mode		-	10	-	pF

Notes: 5. Symbol “•” denotes specification applies over -40 to +125 ° C.

6. This parameter is guaranteed by design and/or laboratory characterization.

7. Guaranteed within the output limits of (V+ - 0.2 V) to (V- + 0.2 V).

8. Specifies the worst case drive voltage relative to the supply rail under stated load conditions.

1.3 Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit
Supply Voltage [(V+) – (V-)]	2.7	-	5.5	V
Input Voltage	(V-) – 0.3	-	(V+) + 0.3	V
Storage Temperature Range	-65	-	+150	°C

2. TYPICAL PERFORMANCE PLOTS

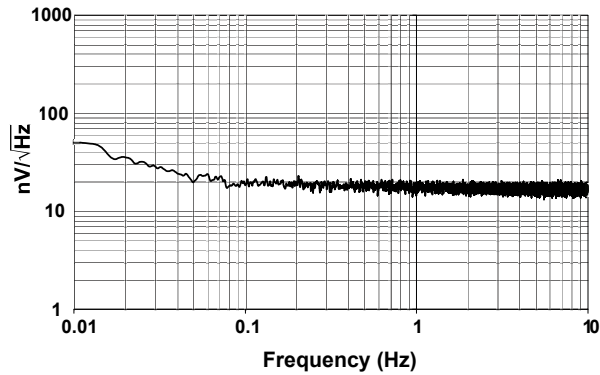


Figure 1. Noise vs Frequency (Measured)

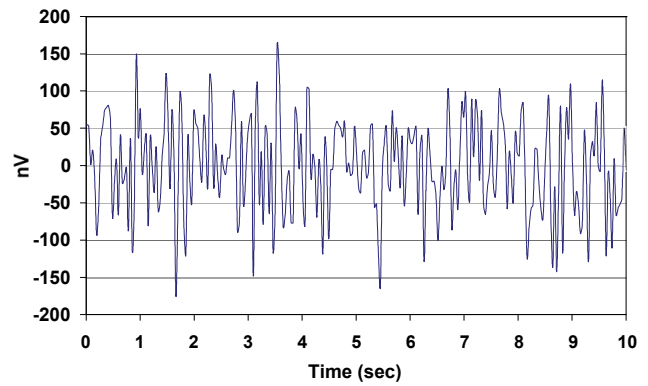


Figure 2. 0.01 Hz to 10 Hz Noise

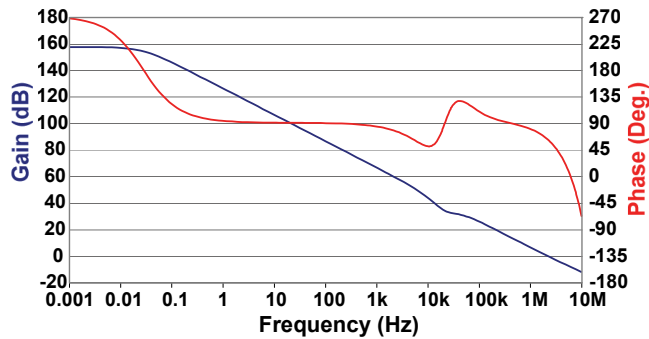


Figure 3. Gain & Phase vs. Frequency (2.7 V)

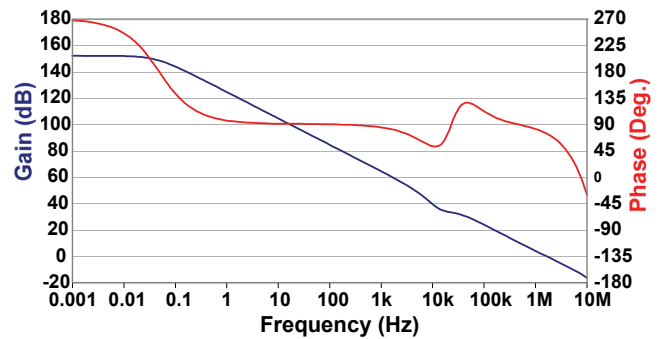


Figure 4. Gain & Phase vs. Frequency (5 V)

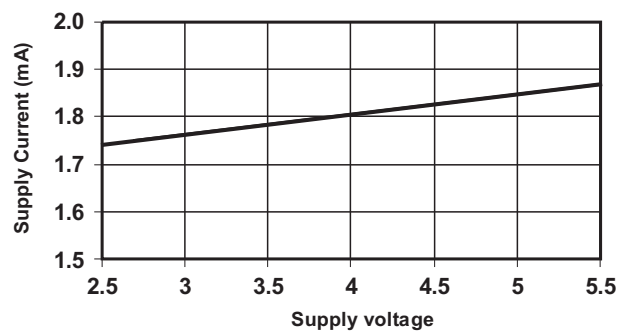


Figure 5. Supply Current vs. Supply Voltage

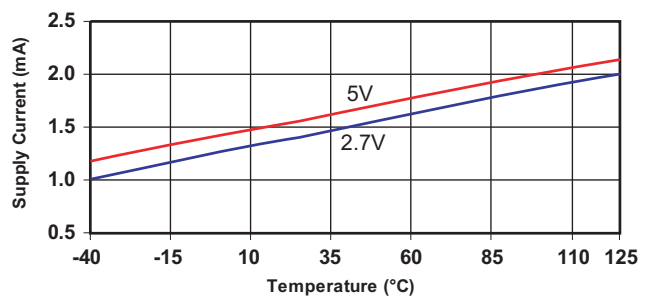


Figure 6. Supply Current vs. Temperature

Typical Performance Plots (Cont.)

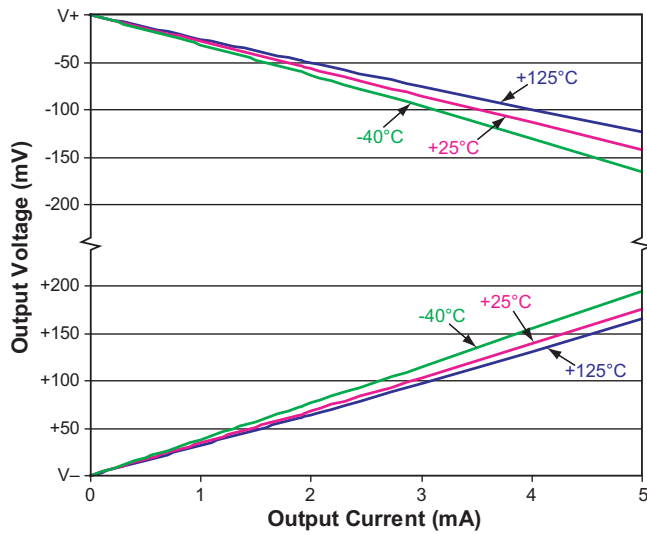


Figure 7. Voltage Swing vs. Output Current (2.7 V)

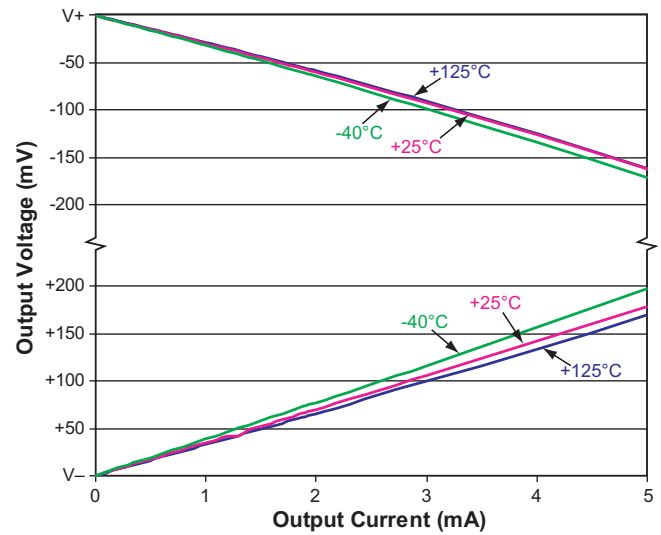
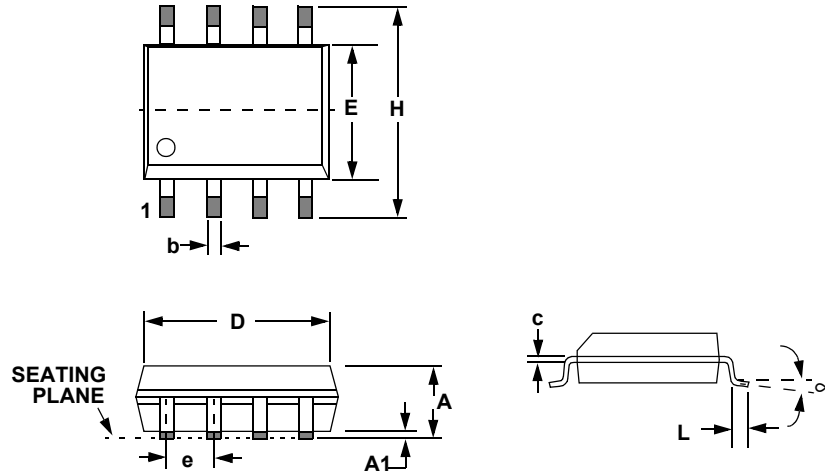


Figure 8. Voltage Swing vs. Output Current (5 V)

3. PACKAGE DRAWINGS

8L SOIC (150 MIL BODY) PACKAGE DRAWING



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.013	0.020	0.33	0.51
C	0.007	0.010	0.19	0.25
D	0.189	0.197	4.80	5.00
E	0.150	0.157	3.80	4.00
e	0.040	0.060	1.02	1.52
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27
∞	0°	8°	0°	8°

JEDEC # : MS-012

4. ORDERING INFORMATION

Part #	Temperature Range	Package Description
CS3004-FSZ	-40 °C to +125 °C	8-lead SOIC, Lead Free

5. ENVIRONMENTAL, MANUFACTURING, & HANDLING INFORMATION

Model Number	Peak Reflow Temp	MSL Rating*	Max Floor Life
CS3004-FSZ	260 °C	2	365 Days

* MSL (Moisture Sensitivity Level) as specified by IPC/JEDEC J-STD-020.

6. REVISION HISTORY

Revision	Date	Changes
PP4	FEB 2007	First public release.
F1	AUG 2007	Updated to "Final" per QPL process.
F2	JUL 2009	Removed lead-containing SOIC & QFN packages from ordering information.

Contacting Cirrus Logic Support

For all product questions and inquiries contact a Cirrus Logic Sales Representative.
To find one nearest you go to <http://www.cirrus.com>

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