

## Precision Low Voltage Amplifier; DC to 1 kHz

### Features

- Low Offset: 10  $\mu$ V Max
- Low Drift: 0.05  $\mu$ V/ $^{\circ}$ C Max
- Low Noise
  - 12 nV/ $\sqrt{\text{Hz}}$  @ 1.0 Hz
  - 0.1 to 10 Hz = 250 nVp-p
  - 1/f corner @ 0.08 Hz
- Open-Loop Voltage Gain
  - 1000 Trillion Typ
  - 10 Billion Min
- Rail-to-Rail Output Swing
- 750  $\mu$ A Supply Current
- Slew rate: 2 V/ $\mu$ s

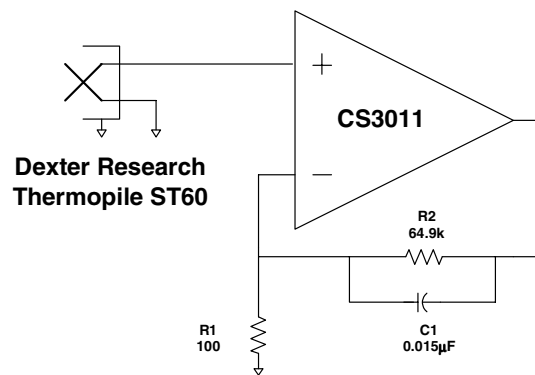
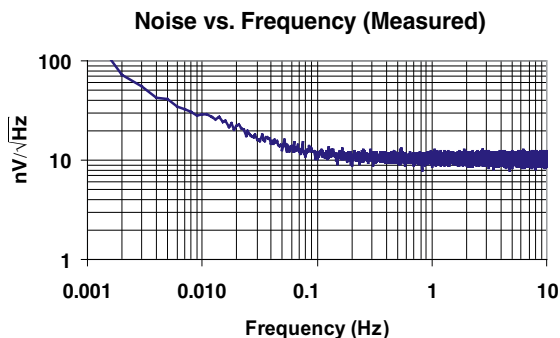
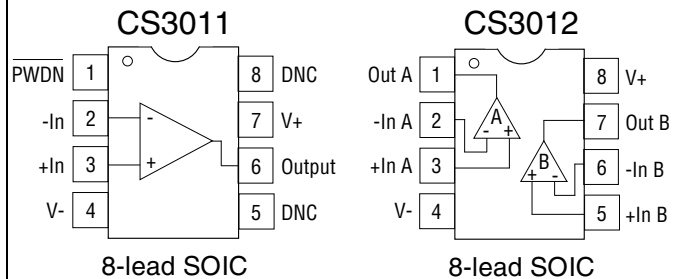
### Applications

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

### Description

The CS3011 single amplifier and the CS3012 dual amplifier are designed for precision amplification of low level signals and are ideally suited to applications that require very high closed loop gains. These amplifiers achieve excellent offset stability, super high open loop gain, and low noise over time and temperature. The devices also exhibit excellent CMRR and PSRR. The common mode input range includes the negative supply rail. The amplifiers operate with any total supply voltage from 2.7 V to 6.7 V ( $\pm 1.35$  V to  $\pm 3.35$  V).

### Pin Configurations



**Thermopile Amplifier with a Gain of 650 V/V**

## 1. CHARACTERISTICS AND SPECIFICATIONS

### 1.1 ELECTRICAL CHARACTERISTICS

V<sub>+</sub> = +5 V, V<sub>-</sub> = 0V, V<sub>CM</sub> = 2.5 V (Note 1)

Parameter		CS3011/CS3012			Unit	
		Min	Typ	Max		
Input Offset Voltage	(Note 2)	•	-	-	±10	μV
Average Input Offset Drift	(Note 2)	•	-	±0.01	±0.05	μV/°C
Long Term Input Offset Voltage Stability			(Note 3)			
Input Bias Current	T <sub>A</sub> = 25° C	•	-	±50	±100 ±1000	pA
Input Offset Current	T <sub>A</sub> = 25° C	•	-	±100	±200 ±2000	pA
Input Noise Voltage Density	R <sub>S</sub> = 100 Ω, f <sub>0</sub> = 1 Hz		-	12		nV/√Hz
	R <sub>S</sub> = 100 Ω, f <sub>0</sub> = 1 kHz		-	12		nV/√Hz
Input Noise Voltage	0.1 to 10 Hz		-	250		nV <sub>p-p</sub>
Input Noise Current Density	f <sub>0</sub> = 1 Hz		-	2		pA/√Hz
Input Noise Current	0.1 to 10 Hz		-	40		pA <sub>p-p</sub>
Input Common Mode Voltage Range		•	-0.1	-	(V <sub>+</sub> )-1.25	V
Common Mode Rejection Ratio (dc)	(Note 4)	•	115	120	-	dB
Power Supply Rejection Ratio		•	120	136	-	dB
Large Signal Voltage Gain	R <sub>L</sub> = 2 kΩ to V <sub>+</sub> /2 (Note 5)	•	200	300	-	dB
Output Voltage Swing	R <sub>L</sub> = 2 kΩ to V <sub>+</sub> /2	•	+4.7	-	-	V
	R <sub>L</sub> = 100 kΩ to V <sub>+</sub> /2			+4.99		V
Slew Rate	R <sub>L</sub> = 2 k, 100 pF			2	-	V/μs
Overload Recovery Time			-	600	-	μs
Supply Current per Amplifier		•	-	0.75	1.0	mA
	PWDN active (CS3011 Only) (Note 6)	•			15	μA
PWDN Threshold	(Note 6)	•	(V <sub>+</sub> ) -1.0			
Start-up Time	(Note 7)	•	-	9	12	ms

- Notes:
1. Symbol “•” denotes specification applies over -40 to +85 ° C.
  2. This parameter is guaranteed by design and laboratory characterization. Thermocouple effects prohibit accurate measurement of these parameters in automatic test systems.
  3. 1000-hour life test data @ 125 °C indicates randomly distributed variation approximately equal to measurement repeatability of 1 μV.
  4. Measured within the specified common mode range limits.
  5. Guaranteed within the output limits of (V<sub>+</sub> -0.3 V) to (V<sub>-</sub> +0.3 V). Tested with proprietary production test method.
  6. PWDN input has an internal pullup resistor to V<sub>+</sub> of approximately 800 kΩ and is the major source of current consumption when PWDN is pulled low.
  7. The device has a controlled start-up behavior due to its complex open loop gain characteristics. Start-up time applies to when supply voltage is applied or when PDWN is released.

## 1.2 ABSOLUTE MAXIMUM RATINGS

Parameter	Min	Typ	Max	Unit
Supply Voltage [(V+) - (V-)]			6.8	V
Input Voltage	V- -0.3		V+ +0.3	V
Storage Temperature Range	-65		+150	°C

## 2. ORDERING INFORMATION

Part #	Temperature Range	Package Description
CS3011-IS	-40 °C to +85 °C	8-lead SOIC
CS3012-IS	-40 °C to +85 °C	8-lead SOIC

Note: Add the letter R to the Part # to order reels, 2000 pieces per reel.

## 3. AVAILABILITY

**Samples: November 1, 2002**

**Production: December 1, 2002**

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## 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/corporate/contacts/sales.cfm>

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