



HyComp, Inc.



HC1437

Fast-Settling Operational Amplifier

FEATURES

- Clean settling
- Easy compensation
- True differential inputs
- ± 20 mA output
- FET inputs
- 350 MHz GBW product

DESCRIPTION

The HC1437 high-speed operational amplifier provides an exceptionally clean, fast-settling pulse response, with the notable absence of such undesirable phenomena as high-frequency ringing and long thermal tails. Its classic, straightforward design does not use speed-enhancing (but difficult-to-compensate) feedforward techniques — it is thus easy to compensate with a single external capacitor. The clean settling characteristics make the HC1437 ideally suited for such demanding applications as current-DAC output amplifiers and low-glitch, high-speed video processing.

The use of a single thin-film substrate — incorporating all ultra-stable nickel-chromium resistors — in the HC1437's construction ensures excellent tracking characteristics (over temperature and with life) for all circuit elements. A functional laser trim before package sealing gives the HC1437 its low (± 0.5 mV) initial-offset characteristic. The same high-reliability construction techniques are used for both industrial and military versions, assuring the user of complete confidence in using the HC1437 for the most rigorous applications.

APPLICATIONS

- IDAC outputs
- Pulse amplifiers
- Digital signal processing
- Video signal treatment
- Fast transients
- ADC buffers

Fast-settling amplifiers such as the HC1437 are needed, for example, for current-to-voltage conversions encountered with a variety of high-speed, current-output DACs. One example is the industry-standard, 50-nsec-settling, ECL-configured HC4000. An HC4000/HC1437 combination typically provides 155 nsec settling time to within a ± 1 LSB error band: an impressive figure for a 12-bit DAC. Moreover, the clean-settling HC1437 contributes no degradation to this DAC's exceptionally low-glitch output.

The FET input stage provides high input impedance ($10^6 \Omega$), wide ± 12 V common-mode range and low (200 pA) driver-circuit loading. Open-loop gain is a guaranteed 88 dB with the full ± 20 mA rated load. An enhanced-output version — Model HC1438, housed in a TO-8 package will provide a fully guaranteed ± 50 mA output.

The HC1437 is housed in a hermetically sealed 8-pin TO-78 package. The full MIL-temperature model (suffix: -883) receives complete MIL-STD-883B screening, including pre-seal visual inspection, acceleration, stabilization bake, gross- and fine-leak tests and 160 hours operating burn-in.

HCMP5001

HC1437 FAST-SETTLING OPERATIONAL AMPLIFIER

ABSOLUTE MAXIMUM RATINGS (all models unless otherwise noted)

Supply Voltage	± 20V
Differential Input Voltage	± 20V
Operating Temperature	
HC1437	0°C to +70°C
HC1437-883	-55°C to +125°C
Storage Temperature	-65°C to +150°C
Lead Soldering Temperature (10 sec)	300°C

ORDERING INFORMATION

PART NUMBER	HC1437-883
Model Selection	_____
Add "-883" for Screening to MIL-STD-883B,	_____
Method 5008	

EXAMPLES

0°C to +70°C Operation: HC1437
 -55°C to +125°C Operation;
 MIL-STD-883B Screening: HC1437-883

SPECIFICATIONS (25°C, ± 15V supplies, 500Ω load unless otherwise noted)

MODEL	HC1437			HC1437-883			UNITS
	MIN	TYP	MAX	MIN	TYP	MAX	
Input Characteristics							
Common Mode for Rated Specs		± 12		± 10	± 12		Volts
Common Mode Rejection Ratio		78		60	78		dB
Power Supply Rejection Ratio		76			76		dB
Differential Input Resistance		10 ⁸			10 ⁸		MΩ
Differential Input Capacitance		3			3		pF
Bias Current		± 200			± 200		pA
Bias Current Drift		(1)			(1)		
Offset Current		± 20			± 20		pA
Offset Voltage (untrimmed)		± 0.5			± 0.5	± 1	mV
Offset Voltage Drift (unloaded)		± 15			± 15	± 50	μV/°C
Output Characteristics							
Peak Voltage		± 12		± 10	± 12		Volts
Peak Current (2)		± 24		± 20	± 24		mA
Voltage Gain (10 Hz)		95		88	95		dB
Impedance (open-loop)		90			90		Ω
Short Circuit Current		50			50		mA
Noise (referred to input)							
0.1 Hz to 100 Hz		4			4		μV p-p
		0.5			0.5		μV RMS
100 Hz to 10kHz		5			5		μV p-p
		1			1		μV RMS
10 kHz to 1MHz		50			50		μV p-p
		6			6		μV RMS
Dynamic Characteristics							
Gain-Bandwidth Product (3)		350			350		MHz
Unity-Gain Bandwidth		40			40		MHz
Full-Power Bandwidth							
(0 pF compensation)		6			6		MHz
(15 pF compensation)		3.1			3.1		MHz
Settling Time (10V step) (4)							
to ± 1% error band		85			85		nsec
to ± 0.1% error band		110			110	140	nsec
to ± 0.025% error band		150			150		nsec
Rise Time (15 pF compensation)		9			9		nsec
Slew Rate							
(0 pF compensation)		400			400		V/μsec
(15 pF compensation)		225			225		V/μsec
Power Supplies							
Nominal Voltage		± 15			± 15		Volts
Supply Range	± 12		± 20	± 12		± 20	Volts
Quiescent Current		± 12			± 12	± 15	mA
Temperature Characteristics							
Operating Temperature	0		+ 70	- 55		+ 125	°C
Thermal Resistance							
junction-to-ambient		150			150		°C/watt
junction-to-case		70			70		°C/watt

- SPECIFICATION NOTES:**
1. Doubles for every 10°C increase.
 2. Indefinitely protected against short circuits (current limited to 50mA) with heat sink applied. 10-second max short circuit allowed with no heat sink. Heat sink recommended-Wakefield Eng. models 205-CB and 204-CB.
 3. Measured at 10MHz; no compensation.
 4. Consult factory for settling-time test circuit.

HC1437 FAST-SETTLING OPERATIONAL AMPLIFIER

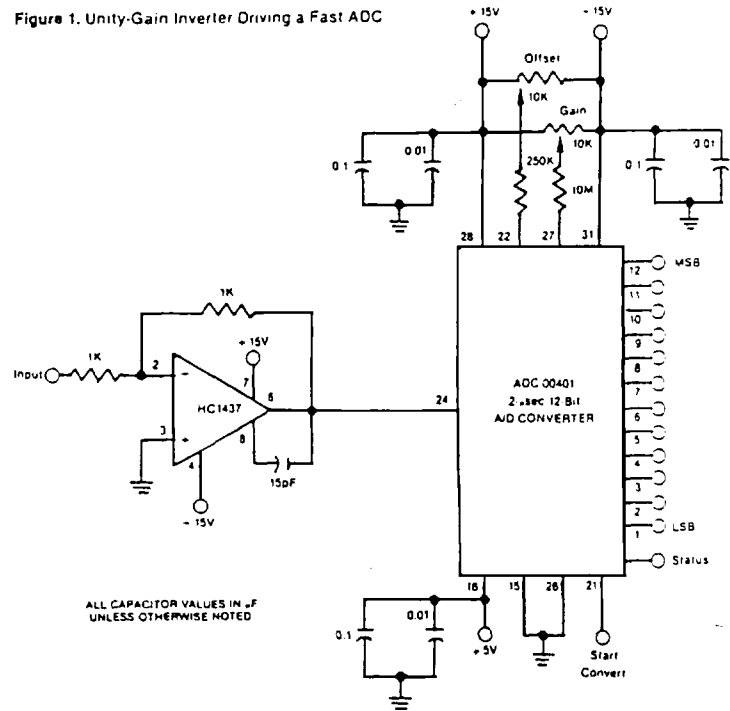
TYPICAL APPLICATIONS

ADC DRIVER

Modern high-speed A/D converters using the successive approximation principle often present driving problems to the circuitry preceding them. Each time the SAR makes a decision, it commands the ADC's internal current-output DAC to either retain its code or change codes. And every time the DAC changes codes, it presents a high-speed current front (either rising or falling) to the comparator's input. As this input takes no current, it's necessary for whatever circuitry is connected to the ADC's input to absorb this current transition.

The basic problem is that the ADC's driving source must be fast enough to absorb and settle these large, fast current fronts before the comparator and SAR make their decision on the next bit to be weighed—if not, a wrong decision can result. So, even if the ADC's input is dc, it needs a fast amplifier to drive it—a 741, for example, will not do the job for a fast ADC. The HC1437, however, is ideally suited for the role—its 150-nsec settling times makes it capable of driving the fastest ADCs. Figure 1 gives a typical connection to a 2 μ sec, 12-bit A/D converter.

Figure 1. Unity-Gain Inverter Driving a Fast ADC

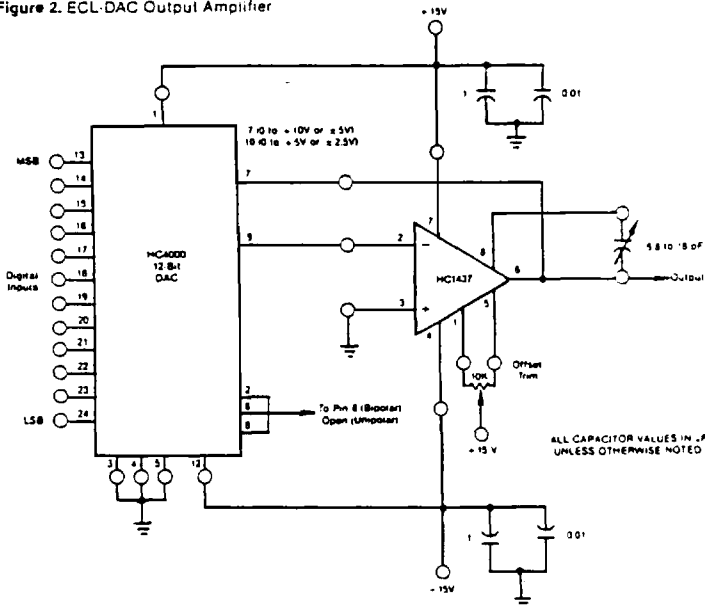


DAC OUTPUT

The HC1437's fast settling characteristic makes it an ideal current-to-voltage converter for high-speed, current-output D/A converters, such as ECL DAC's. Many of these converters—for example, the HC4000—settle extremely fast (in approximately 50nsec); to convert their outputs to a useful voltage range demands a very special, clean-settling amplifier—for example, the HC1437.

Figure 2 shows a typical ECL-DAC/HC1437 connection. Note the absence of resistors—most high-speed D/A converters contain feedback resistors that are closely matched to the internal ladder-network resistors. This matching and tracking ensures accurate output voltage, as well as excellent stability over temperature. To trim the compensation capacitor, use the DAC manufacturer's suggested settling-time test circuit and adjust for optimum settling time.

Figure 2. ECL-DAC Output Amplifier



Typical Performance Characteristics

Figure 3

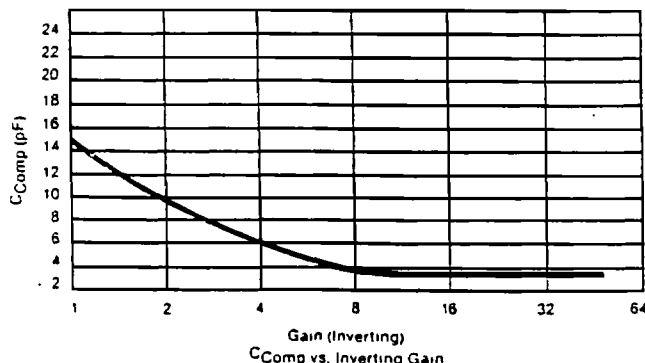
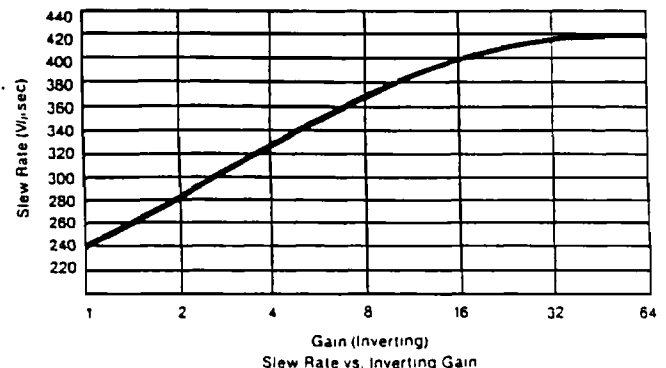


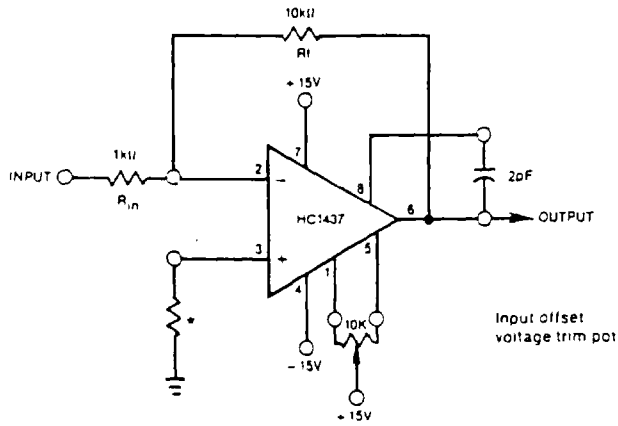
Figure 4



HC1437 FAST-SETTLING OPERATIONAL AMPLIFIER

Inverting Gain of -10 Amplifier

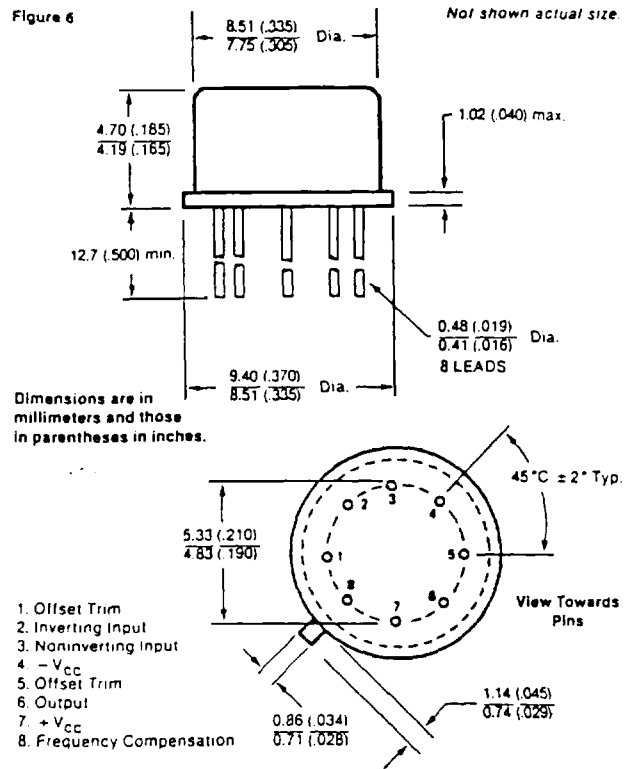
Figure 5



* For minimum offset drift, match to total parallel resistance seen by pin 2.

Mechanical Outline: TO-78 (similar to TO-99)

Figure 6



HyComp, Inc. reserves the right to make improvements and/or changes in the specifications to their products at any time, and cannot assume responsibility for circuits shown, or represent that they are free from patent infringement.

100% Screening According to MIL-STD-883, Method 5008, Class B

Test	Methods and Conditions	Purpose
* Internal Visual	Method 2017	Removes visually defective units and reduces failures due to materials, construction, and workmanship.
* Stabilization Bake	Method 1008, Condition C 24 hours at 150°C	Stabilizes circuit components prior to conducting further screening and testing.
Temperature Cycling	Method 1010, Condition C 10 cycles from -65°C +0°C to +150°C +3°C -5°C -0°C	Removes potential failures due to poor workmanship.
Constant Acceleration	Method 2001, Condition A Y, Axis, 5,000 g	Removes potential failures due to poor workmanship.
* Seal, Fine and Gross	Method 1014, Fine Leak condition A, Bomb time 2 hours at 60 psi; Leak Rate < 2 × 10 ⁻⁷ cc/sec; Gross Leak, Condition C, no bubbles	Ensures hermeticity.
Burn In	Method 1015, Condition B, 160 hours at 125°C	Removes devices subject to infant mortality.
* Electrical Test	Per Data Sheet (page 2)	Ensures electrical performance.
* External Visual	Method 2009	Removes visually defective units and reduces failures due to materials, construction, and workmanship.

*Standard tests for all HC1437 units.