

ECG[®] Semiconductors

ECG938, ECG938M Operational Amplifier

Features

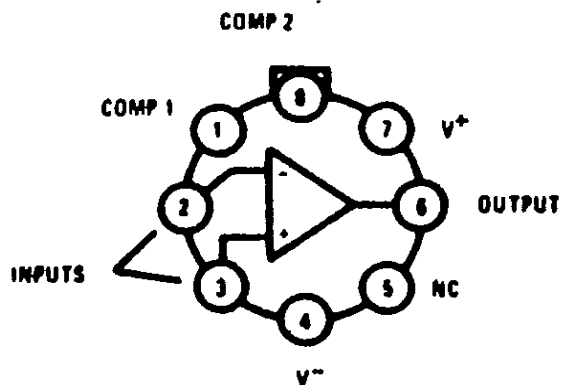
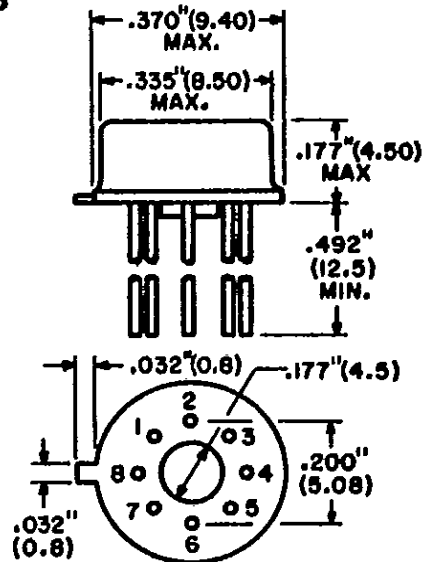
- Maximum input bias current of 3.0nA over temperature
- Offset current less than 400pA over temperature
- Supply current of only 300μA, even in saturation
- Guaranteed drift characteristics

ECG938 and ECG938M are precision operational amplifiers having specifications a factor of ten better than FET amplifiers over a -0°C to $+70^{\circ}\text{C}$ temperature range.

The devices operate with supply voltages from $\pm 2\text{V}$ to $\pm 20\text{V}$ and have sufficient supply rejection to use unregulated supplies. An alternate compensation scheme can be used to make the circuit particularly insensitive to power supply noise and to make supply bypass capacitors unnecessary.

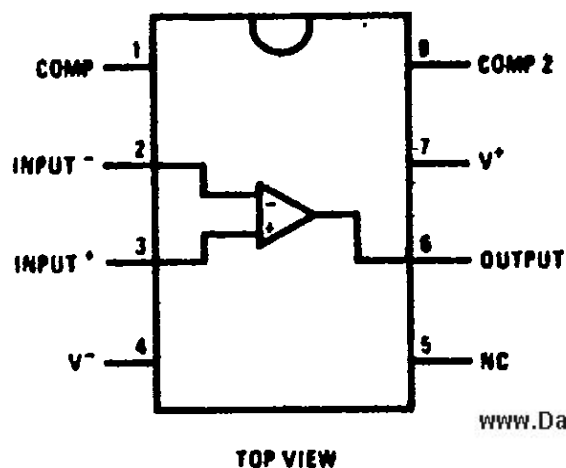
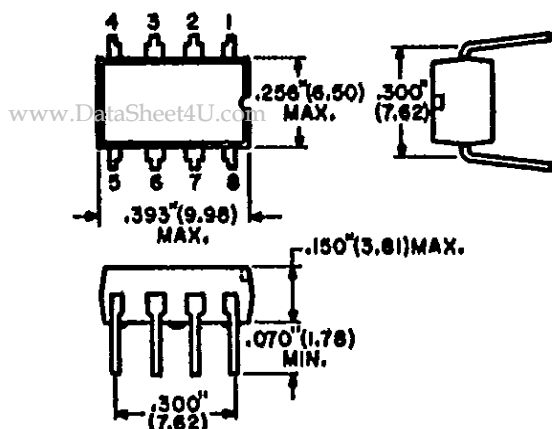
The low current error makes possible many designs that are not practical with conventional amplifiers. In fact, it operates from $10\text{M}\Omega$ source resistances introducing less error than devices with $10\text{k}\Omega$ sources. Integrators with drifts less than $500\mu\text{V}/\text{sec}$ and analog time delays in excess of one hour can be made using capacitors no larger than $1\mu\text{F}$.

ECG938



Note: Pin 4 connected to case.

ECG938M



Absolute Maximum Ratings

Supply Voltage	± 18V
Power Dissipation (Note 1)	500mW
Differential Input Current (Note 2)	± 10mA
Input Voltage (Note 3)	± 15V
Output Short-Circuit Duration	Indefinite
Operating Temperature Range	0°C to + 70°C
Storage Temperature Range	- 65°C to + 150°C
Lead Temperature (Soldering, 10 seconds)	300°C

Electrical Characteristics (Note 4)

Parameter	Conditions	Min	Typ	Max	Units
Input Offset Voltage	$T_A = 25^\circ\text{C}$		2.0	7.5	mV
Input Offset Current	$T_A = 25^\circ\text{C}$		0.2	1	nA
Input Bias Current	$T_A = 25^\circ\text{C}$		1.5	7	nA
Input Resistance	$T_A = 25^\circ\text{C}$	10	40		MΩ
Supply Current	$T_A = 25^\circ\text{C}$		0.3	0.8	mA
Large Signal Voltage Gain	$T_A = 25^\circ\text{C}$, $V_S = \pm 15\text{V}$ $V_{\text{out}} = \pm 10\text{V}$, $R_L \geq 10\text{k}\Omega$	25	300		V/mV
Input Offset Voltage				10	mV
Average Temperature Coefficient of Input Offset Voltage Input Offset Current			6.0	30 1.5	$\mu\text{V}/^\circ\text{C}$ nA
Average Temperature Coefficient of Input Offset Current Input Bias Current			2.0	10 10	$\text{pA}/^\circ\text{C}$ nA
Large Signal Voltage Gain	$V_S = \pm 15\text{V}$, $V_{\text{OUT}} = \pm 10\text{V}$ $R_L \geq 10\text{k}\Omega$	15			V/mV
Output Voltage Swing	$V_S = \pm 15\text{V}$, $R_L = 10\text{k}\Omega$	± 13	± 14		V
Input Voltage Range	$V_S = \pm 15\text{V}$	± 14			V
Common-Mode Rejection Ratio		80	100		dB
Supply Voltage Rejection Ratio		80	96		dB

Note 1: The maximum junction temperature is 85°C. For operating at elevated temperatures, devices in the TO-5 package must be derated based on a thermal resistance of 150°C/W, junction to ambient, or 45°C/W, junction to case. The thermal resistance of the dual-in-line package is 100°C/W, junction to ambient.

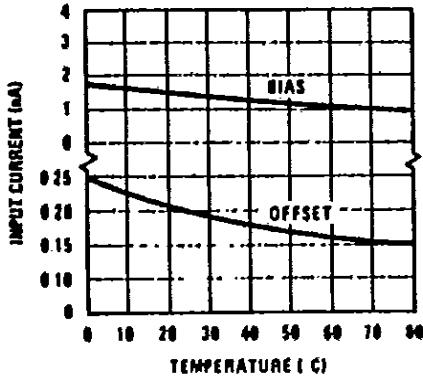
Note 2: The inputs are shunted with back-to-back diodes for overvoltage protection. Therefore, excessive current will flow if a differential input voltage in excess of 1V is applied between the inputs unless some limiting resistance is used.

Note 3: For supply voltages less than ± 15V, the absolute maximum input voltage is equal to the supply voltage.

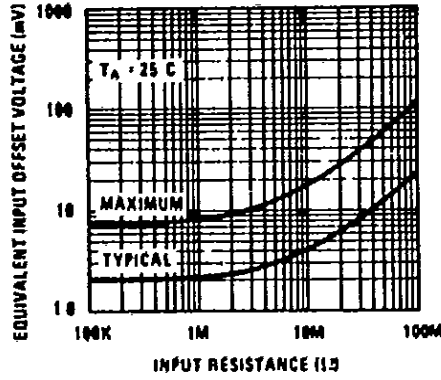
Note 4: These specifications apply for $\pm 5\text{V} \leq V_S \leq \pm 20\text{V}$, unless otherwise specified. However, all temperature specifications are limited to $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$.

Typical Performance Characteristics

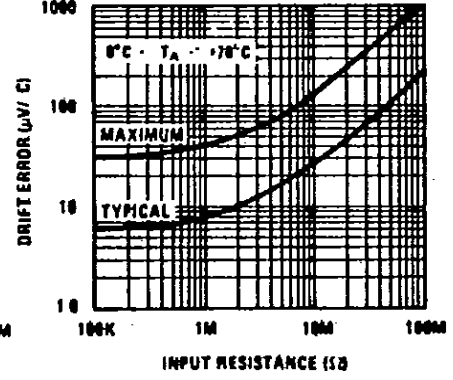
Input Currents



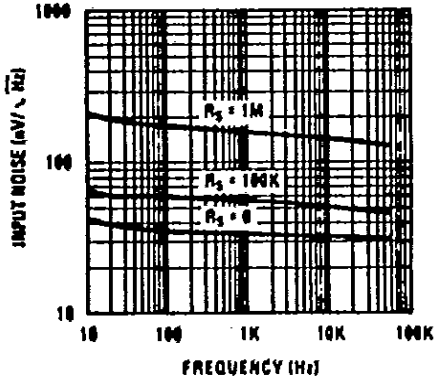
Offset Error



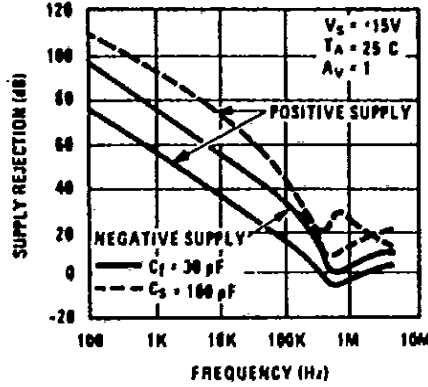
Drift Error



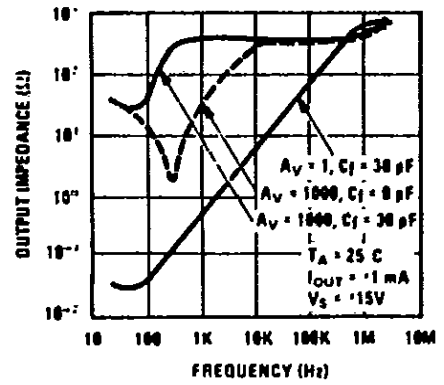
Input Noise Voltage



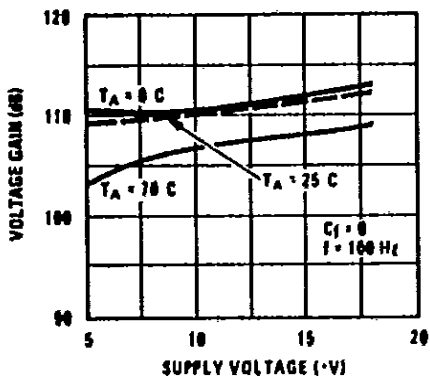
Power Supply Rejection



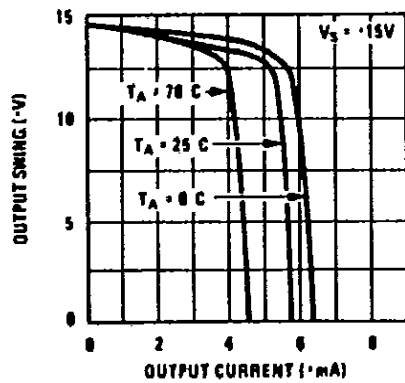
Closed Loop Output Impedance



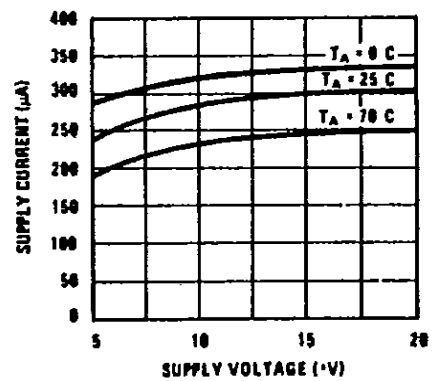
Voltage Gain



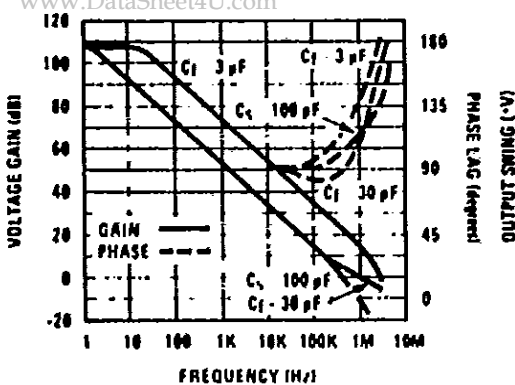
Output Swing



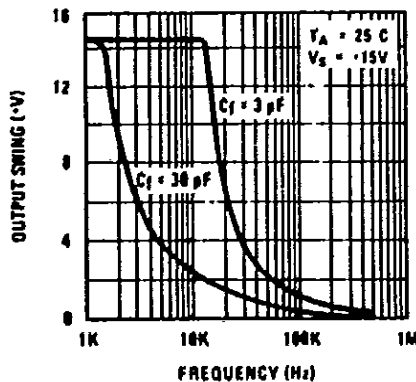
Supply Current



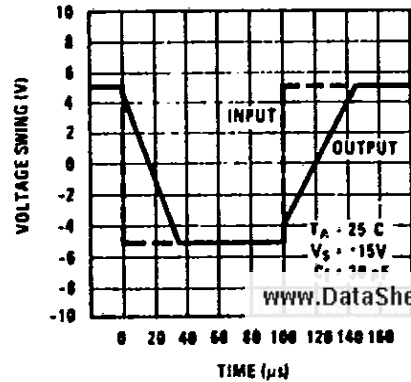
Open Loop Frequency Response



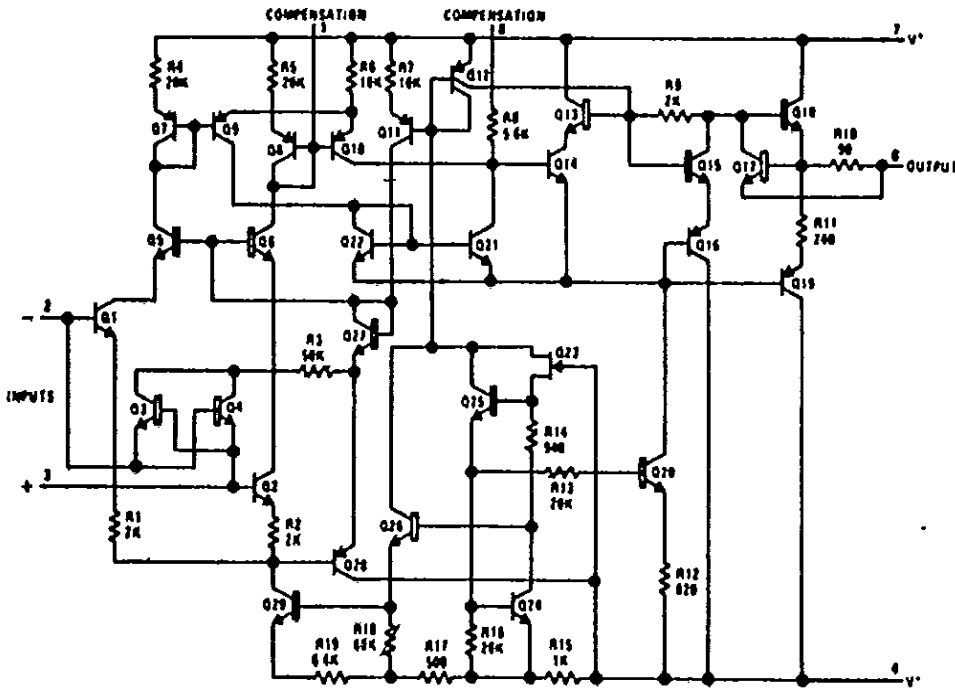
Large Signal Frequency Response



Voltage Follower Pulse Response

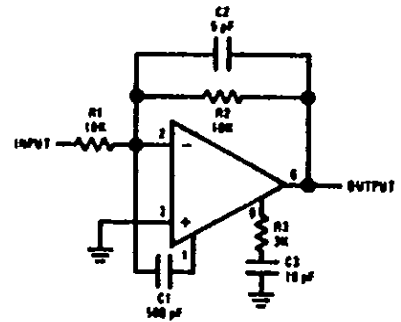


Schematic Diagram

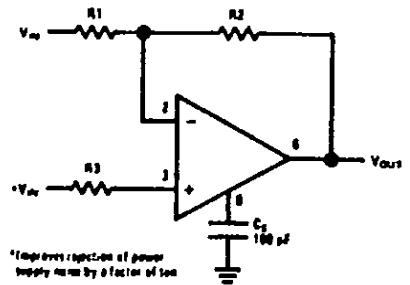


Compensation Circuits

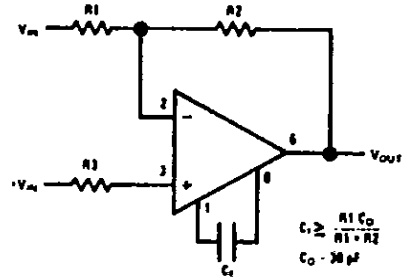
Feedforward Compensation



Alternate* Frequency Compensation

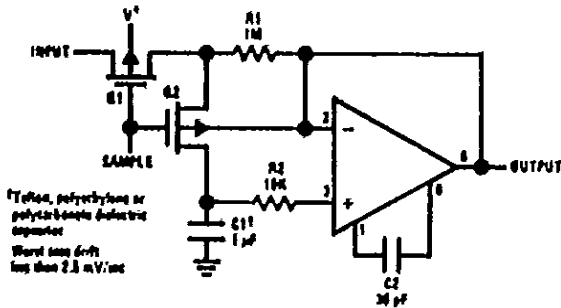


Standard Compensation Circuit

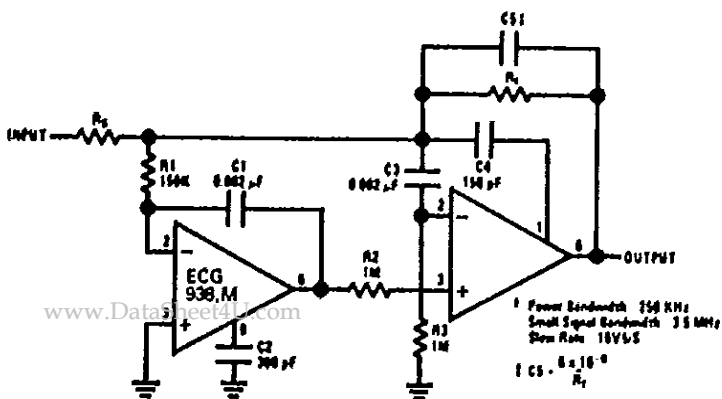


Typical Applications

Sample and Hold



Fast Summing Amplifier



High Speed Amplifier with Low Drift and Low Input Current

