LM2900/3900 Current Mode Single Supply Quad Operational Amplifier

Features

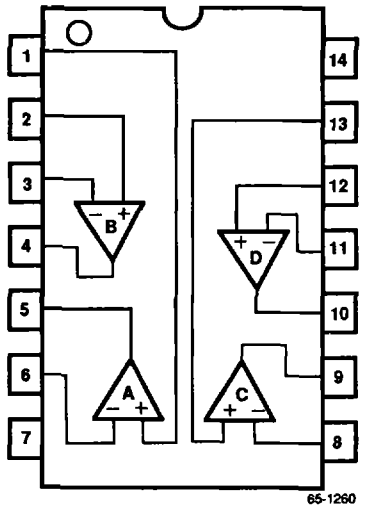
- Wide single supply voltage range — 4.0V to 36V
- Supply current drain independent of supply voltage
- Low input biasing current — 30 nA
- High open-loop gain — 70 dB
- Wide bandwidth — 2.5 MHz (unity gain)
- Larger gain-bandwidth product in non-inverting mode (A_V = 100 at f = 1.0 MHz)
- Large output voltage swing (V_S -1.0) V_{P-P}
- Internally frequency compensated for unity gain
- Output short-circuit protection

Description

The LM2900 and LM3900 consist of four independent, dual input, internally compensated amplifiers designed specifically to operate off a single power supply voltage and to provide a large output voltage swing. These amplifiers make use of a current mirror to achieve the non-inverting input function. Application areas include: AC amplifiers, RC active filters, low frequency triangle, squarewave and pulse waveform generation circuits, tachometers and low speed, high voltage digital logic gates.

Connection Information

14-Lead Dual In-Line Package
(Top View)



65-1260

Pin	Function	Pin	Function
1	+Input (A)	8	-Input (C)
2	+Input (B)	9	Output (C)
3	-Input (B)	10	Output (D)
4	Output (B)	11	-Input (D)
5	Output (A)	12	+Input (D)
6	-Input (A)	13	+Input (C)
7	Ground	14	$+V_S$

Ordering Information

Part Number	Package	Operating Temperature Range
LM3900N	N	0°C to +70°C
LM2900N	N	-25°C to +85°C

Notes:
N = 14-lead plastic DIP
Contact a Raytheon sales office or representative for ordering information on special package/temperature range combinations.

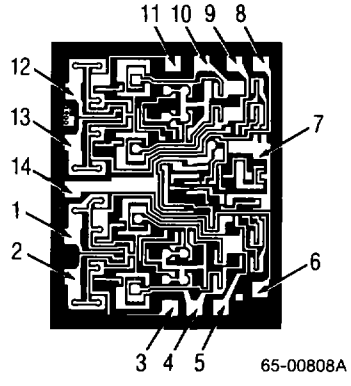
Absolute Maximum Ratings

Supply Voltage
- LM2900 ..... +36V
- LM3900 ..... +32V

Supply Voltage ..... ±18V
Input Currents, I_{IN+} or I_{IN-} ..... 20 mA
Output Short Circuit Duration ..... Continuous
One Amplifier, T_A = +25°C
Storage Temperature
Range ..... -65°C to +150°C
Operating Temperature Range
- LM2900 ..... -25°C to +85°C
- LM3900 ..... 0°C to +70°C

Lead Soldering Temperature
(60 Sec) ..... +300°C

Mask Pattern



Die Size: 56 x 70 mils
Min. Pad Dimensions: 4 x 4 mils

Thermal Characteristics

	14-Lead Plastic DIP
Max. Junc. Temp.	+125°C
Max. P_D T_A < 50°C	468 mW
Therm. Res. θ_{JC}	—
Therm. Res. θ_{JA}	160°C/W
For T_A > 50°C Derate at	6.25 mW/°C

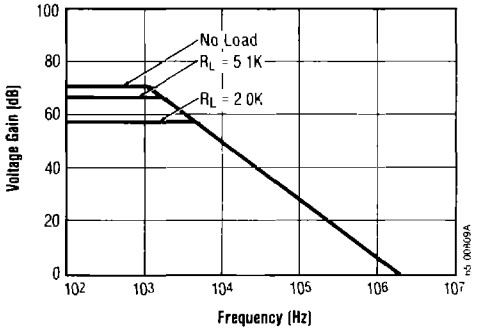
Electrical Characteristics (V_S = +15V and T_A = +25°C unless otherwise noted)

Parameter	Test Conditions	LM2900/3900 Min	Typ	Max	Units
Large Signal Voltage Gain	f = 100Hz	1200	2800		V/V
Input Resistance (Differential Mode)	Inverting Input		1.0		MΩ
Output Resistance			8.0		kΩ
Unity Gain Bandwidth[1]	Inverting Input		2.5		MHz
Input Bias Current	Inverting Input		30	200	nA
Slew Rate	Positive Output Swing		0.5		V/μS
	Negative Output Swing		20		
Supply Current	R_L = ∞ On All Amplifiers		6.2	10	mA
Output Voltage Swing V_{OUT} High	R_L = 2k, I_{IN-} = 0, I_{IN+} = 0	13.5	14.2		V
V_{OUT} Low	I_{IN-} = 10μA, I_{IN+} = 0		0.09	0.2	V
Output Current	Source	6.0	18		mA
	Sink[2]	0.5	1.3		
Power Supply Rejection Ratio	f = 100Hz		70		dB
Mirror Gain[3]	I_{IN+} = 200μA	0.90	1.0	1.1	μA/μA
Mirror Current[4]			10	500	μA
Negative Input Current[5]			1.0		mA

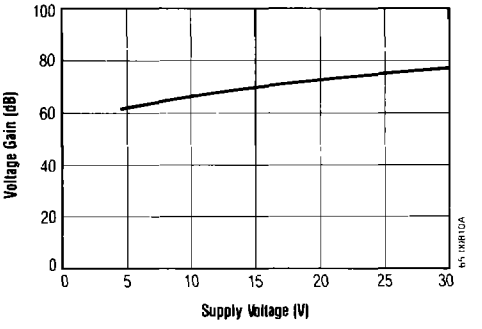
Notes:
1. When used as a "non-inverting amplifier", the gain-bandwidth product is not limited to 2.5MHz. The isolation provided by the "current mirror" allows a constant unity voltage gain feedback for the main inverting amplifier. This means that large values of gain can be achieved at high frequencies and the dominant limit is due to the slew rate of the amplifier. For example: a voltage gain of 100 is easily obtained at 1MHz and an output voltage swing of 160mV_{p-p} can be achieved prior to slew rate limiting. This operational mode is useful for signal frequencies in the 50kHz to 1MHz range as would be encountered in IF or carrier frequency applications.
2. The output current sink capability can be increased for large signal conditions by overdriving the inverting input.
3. This spec indicates the current gain of the current mirror which is used as the non-inverting input.
4. Input V_{BE} match between the non-inverting and the inverting inputs occurs for a mirror-current (non-inverting input current) of approximately 10μA. This is therefore a typical design center for many of the application circuits.
5. Clamp transistors are included on the IC to prevent the input voltages from swinging below ground more than approximately -0.3V. The negative input currents which may result from large signal overdrive with capacitance input coupling need to be externally limited to values of approximately 1.0mA. Negative input currents in excess of 4.0mA will cause the output voltage to drop to a low voltage. This maximum current applies to any one of the input terminals. If more than one of the input terminals are simultaneously driven, negative smaller maximum currents are allowed. Common mode current biasing can be used to prevent negative input voltages; for example, see the "Differentiator Circuit" in the applications section.

Typical Performance Characteristics

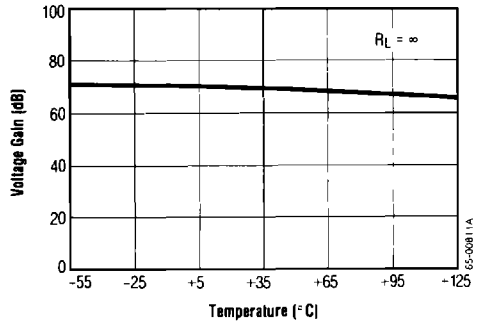
Open Loop Gain



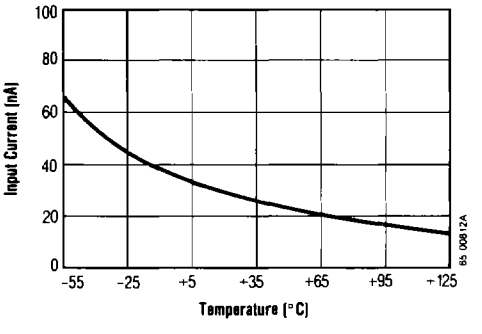
Voltage Gain vs. Supply Voltage



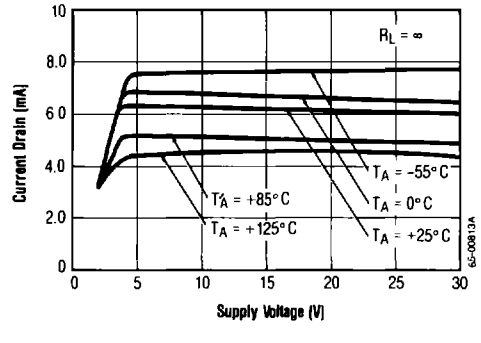
Voltage Gain vs. Temperature



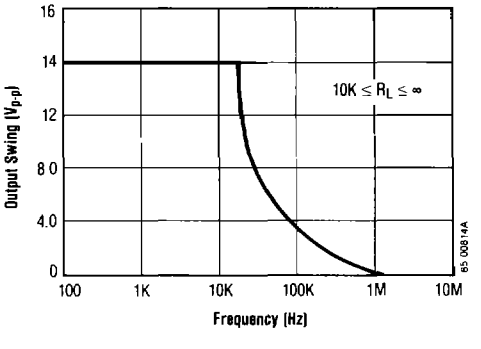
Input Current vs. Temperature



Supply Current

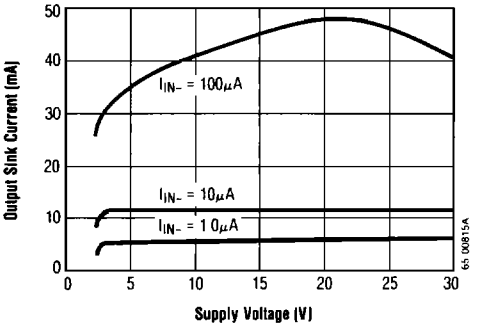


Large Signal Frequency Response

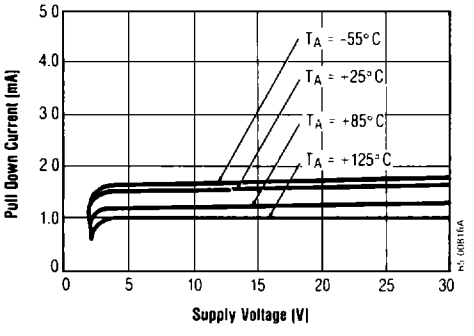


Typical Performance Characteristics (Continued)

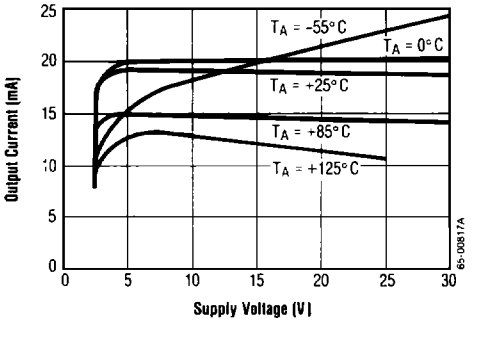
Output Sink Current vs. Supply Voltage



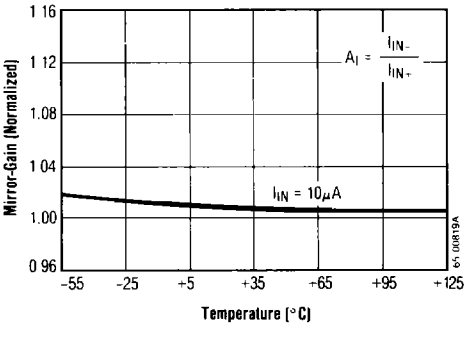
Output Class A Bias Current



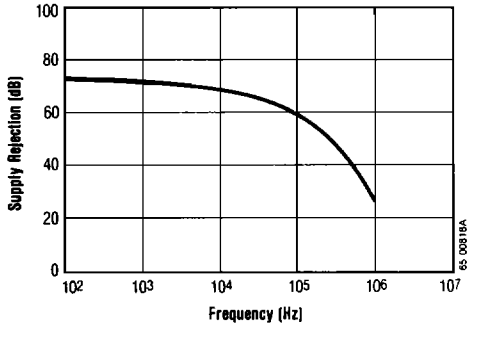
Output Source Current



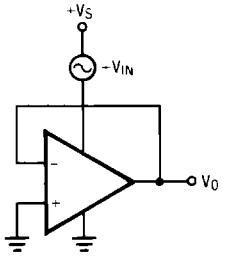
Mirror Gain vs. Temperature



Supply Rejection vs. Frequency

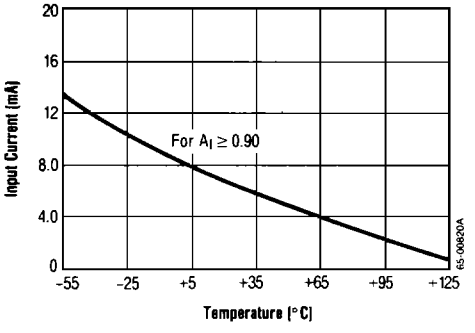


Test Circuit for Supply Rejection



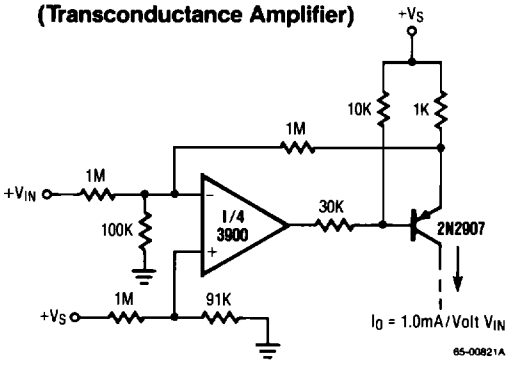
Typical Performance Characteristics (Continued)

Maximum Mirror Current

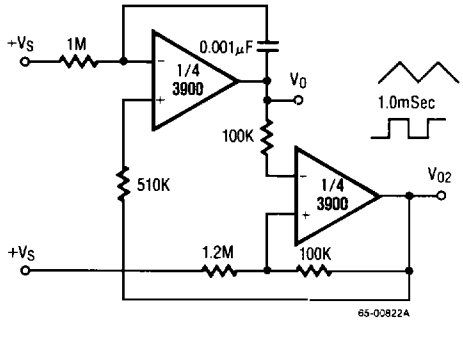


3900 Typical Applications (V_S = +15V)

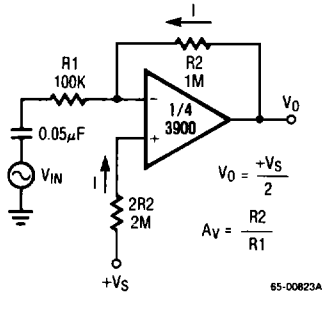
Voltage-Controlled Current Source (Transconductance Amplifier)



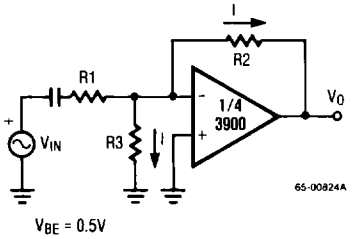
Triangle/Square Generator



Inverting Amplifier



V_{BE} Biasing



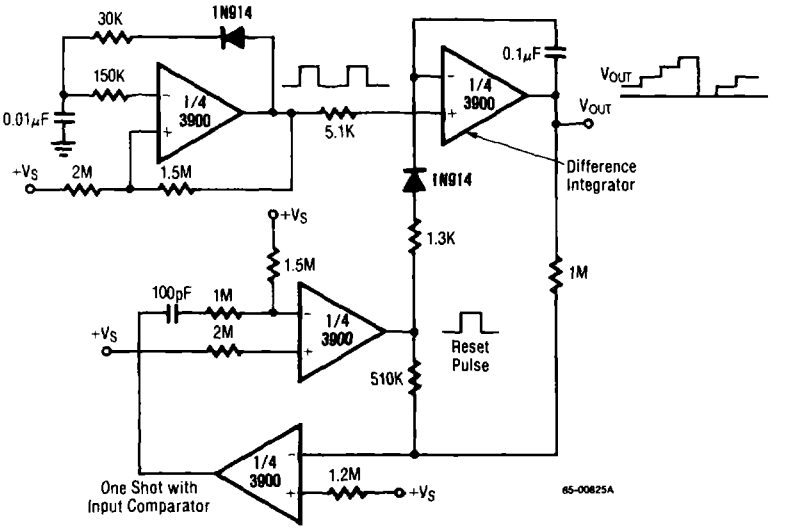
V_{BE} = 0.5V

$V_O = V_{BE}\left(1 + \frac{R2}{R3}\right)$

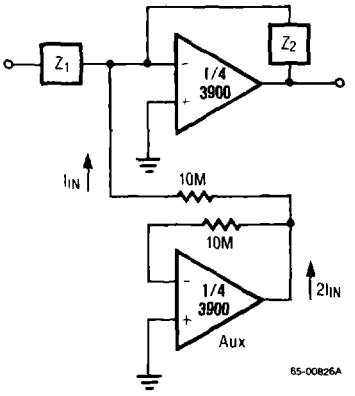
$A_V = \frac{-R2}{R1}$

3900 Typical Applications (Continued)

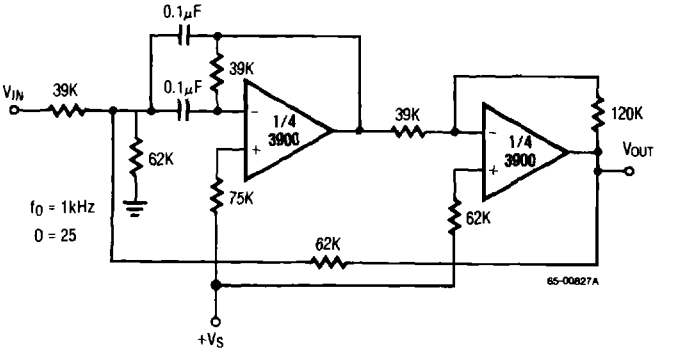
Free-Running Staircase Generator/Pulse Counter



Supplying I_{IN} With Auxiliary Amplifier (to Allow High Z Feedback Networks)

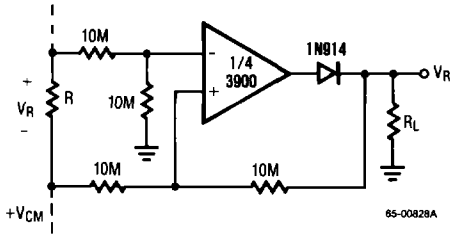


Bandpass Active Filter

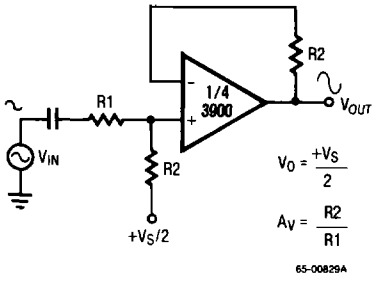


3900 Typical Applications (Continued)

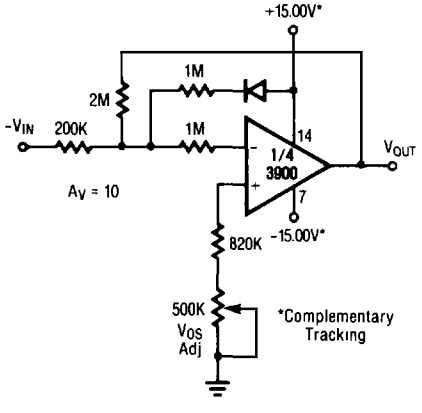
Ground Referencing a Differential Input Signal

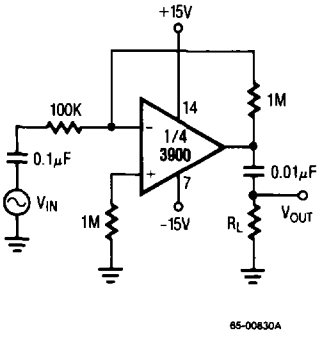


Non-Inverting Amplifier

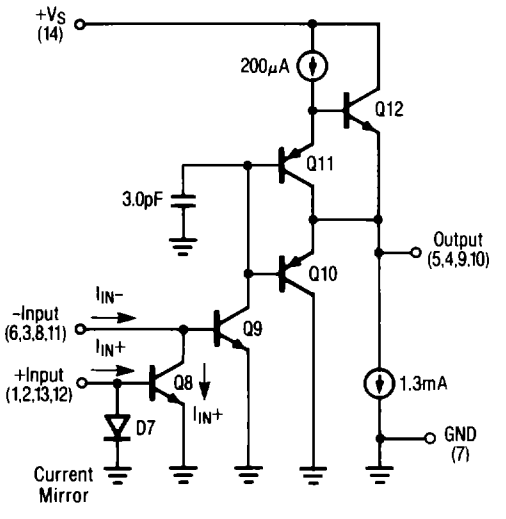


Split Supply ($+V_S$ = +15V and $-V_S$ = -15V)





Schematic Diagram



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