L144
Low-Power Triple Operational Amplifier

Siliconix

FEATURES

- 3 Amplifiers in One Package
- Programmable Supply Current
- Operates From ±1.5 to ±15 V
- Drives Large Capacitive Leads (<1000 pF)
- Continuous Short Circuit Protection

BENEFITS

- Low Cost and Compact
- Easily Tailored to Optimize Circuit Performance
- Very Rugged

APPLICATIONS

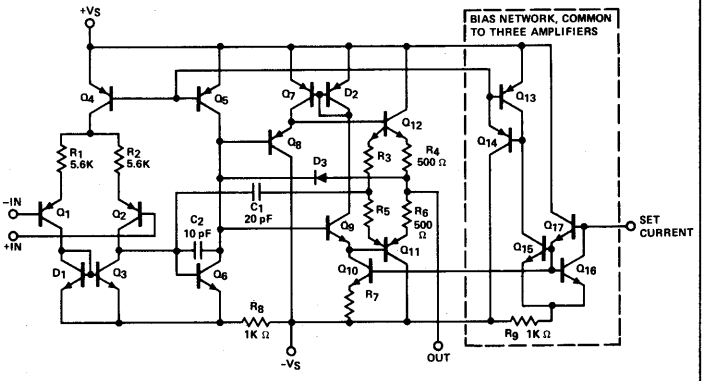
- Instrumentation Amplifiers
- Buffer Amplifiers
- Voltage Comparators
- Low-Drift Sample and Hold Circuits
- Active Filters
- Battery-Powered Circuits

DESCRIPTION

The Siliconix L144 is a low cost triple operational amplifier designed for general purpose applications where low-power is a primary consideration. Features include operation with supply voltages as low as ±1.5 VDC, programmable supply current (with single resistor), and internal compensation to insure stability under all conditions of resistive feedback. L144 will drive capacitive loads to 1000 pF and is short circuit protected. Package options include the popular 14 pin side braze and plastic DIP, and the flat pack. The L144A is specified for operation from −55°C to +125°C, the L144B for −20°C to +85°C, and the L144C for 0°C to +70°C.

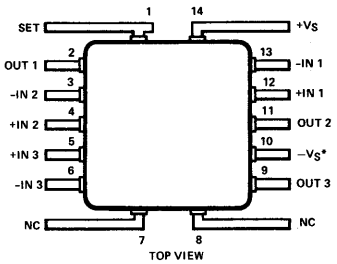
FUNCTIONAL BLOCK DIAGRAM

(One Amplifier)



PIN CONFIGURATION

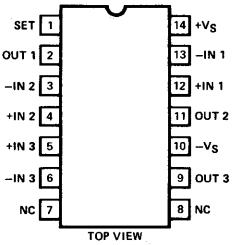
Flat Package



*COMMON TO SUBSTRATE AND BASE OF PACKAGE

Order Numbers: L144AL or L144BL
See Package 5

Dual-In-Line Package



Order Numbers: L144AP or L144BP
See Package 11
L144CJ
See Package 7

ABSOLUTE MAXIMUM RATINGS

Supply Voltage ..... ±18 V
Differential Input Voltage ..... ±30 V
Input Voltage* (A Suffix) ..... ±18 V
(C Suffix) ..... ±15 V
Output Short Circut Duration** ..... Indefinite
Operating Temperature (A Suffix) ..... −55 to 125°C
(B Suffix) ..... −25 to 85°C
(C Suffix) ..... 0 to 70°C
Storage Temperature (A and B Suffix)... −65 to 150°C
(C Suffix) ..... −65 to 125°C
Lead Temperature (Soldering 60 Sec) ..... 300°C
Power Dissipation (Package)***

Flat Package ..... 750 mW
14 Pin Ceramic DIP ..... 825 mW
Plastic DIP ..... 470 mW

*For supply voltages < ±18 V, maximum input voltage is equal to the supply voltage.
**Continuous short circuit is allowed for case temperatures to +125°C and ambient temperature to +70°C.
***All Leads welded or soldered to P.C. board. Derate 10 mW/°C for the flat package, 11 mW/°C for the 14 pin DIP above +75°C and 6.3 mW/°C above 25°C for the plastic DIP.

ELECTRICAL CHARACTERISTICS[1]

T_A = 25°C

	PARAMETER	SYMBOL	TEST CONDITIONS[2] UNLESS OTHERWISE NOTED: V_S = ±15 V, R_L = 50 kΩ, R_{SET} = 3 Ω (Pin 1 to 14)	A/B SUFFIX			C SUFFIX			UNIT
				MIN[3]	TYP[4]	MAX	MIN[3]	TYP[4]	MAX	
INPUT	Input Offset Voltage	V_{OS}	$R_S \leq 50$ kΩ		1	5		1	10	mV
	Average Temperature Coefficient Of Input Offset Voltage	dV_{DS}/dt			3.3			3.3		µV/C
	Input Offset Current	I_{OS}			2	50		5	70	nA
	Input Bias Current	I_{BIAS}		−200	−100		−250	−125		
OUTPUT	Output Voltage Swing	V_{OUT}		10	±14	−10	10	±14	−10	V
	Output Voltage Swing	V_{OUT}	V_S = ±1.5 V, R_{SET} = 120 kΩ		±0.5			±0.4		
	Output Short Circuit Current	I_{SC}	R_L = 0		1.5	15		1.5	15	mA
DYNAMIC	DC Open Loop Voltage Gain	A_{VOL}		3	30		1	30		V/mV
	Slew Rate	S_r			0.4			0.4		V/µs
	Unity Gain Bandwidth				0.6			0.6		MHz
	Crosstalk		f = 100 Hz		−100			−100		dB
	Common Mode Rejection Ratio	CMRR	V_{IN} = ± 12 V	80	90		70	80		
SUPPLY	Power Supply Rejection Ratio	PSRR		80	90		80	90		
	Source Current	I_S	Unity Gain V_{IN} = 0 On All Amps			350			400	µA

T_A = Over Temperature Range

	PARAMETER	SYMBOL	TEST CONDITIONS[2] UNLESS OTHERWISE NOTED: V_S = ±15 V, R_L = 50 kΩ, R_{SET} = 3 Ω (Pin 1 to 14)	A/B SUFFIX			C SUFFIX			UNIT
				MIN[3]	TYP[4]	MAX	MIN[3]	TYP[4]	MAX	
INPUT	Input Offset Voltage	V_{OS}	$R_S \leq 50$ kΩ			6				mV
	Input Bias Current	I_{BIAS}		−200			−250			nA
DYNAMIC	DC Open Loop Voltage Gain	A_{VOL}		3	30		1	30		V/mV

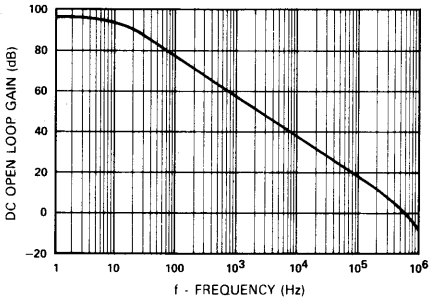
NOTES:

1. All DC parameters are 100% tested at 25°C. Lots are sample-tested for AC parameters and high and low temperature limits to assure conformance with specifications.
2. I_{SET} is adjustable. See typical characteristics.
3. The algebraic convention whereby the most negative value is a minimum, and the most positive value is a maximum, is used in this data sheet.
4. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

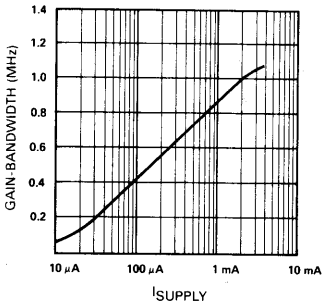
TYPICAL CHARACTERISTICS

$T_A = 25°C$

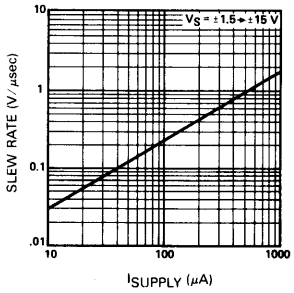
Open Loop Gain vs Frequency



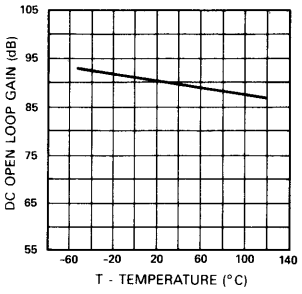
Gain-Bandwidth Product vs Supply Current



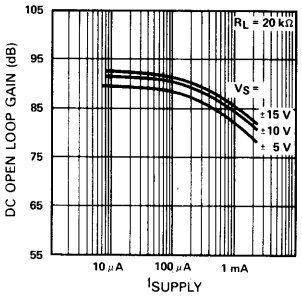
Slew Rate vs Supply Current



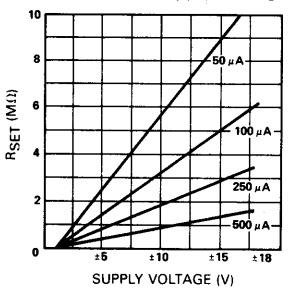
DC Open Loop Gain vs Temperature



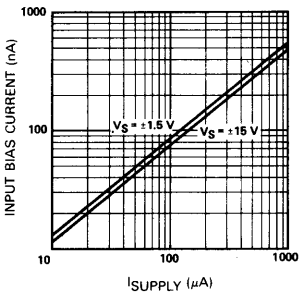
DC Open Loop Gain vs Supply Current



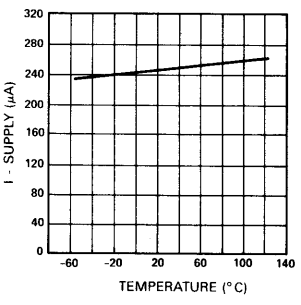
Supply Current vs Set Resistor and Supply Voltage



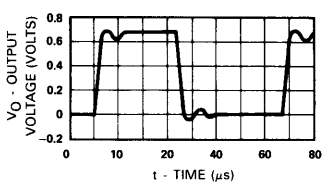
Input Bias Current vs Supply Current



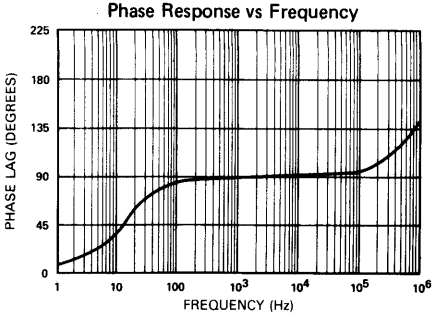
Supply Current vs Temperature



Voltage Follower Small Signal Pulse Response

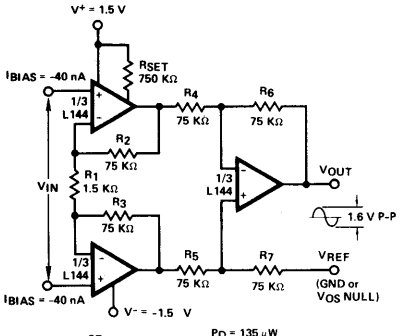


Phase Response vs Frequency



APPLICATIONS

Instrumentation Amplifier

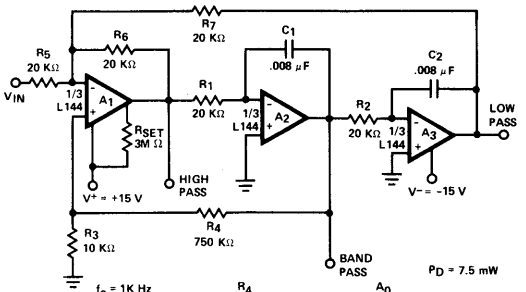


$A_V = 1 + \frac{2R_2}{R_1}$

P_D = 135 μW

V_{OS} (TYP) RTI = 0.45 mV

Active Filter



P_D = 7.5 mW

f_o = 1K Hz
Q = 26
H_o = 26

$Q_{max} < \frac{A_0}{5}$

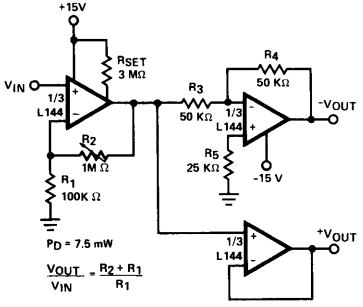
$C_1 = C_2$
$R_5 = R_6 = R_7$

$\frac{R_4}{R_3} = 3 H_o - 1$ $f_o, H_o << \frac{A_0}{3}$

$R_2 C_2 = \frac{H_o}{2\pi f_o Q}$

$R_1 C_1 = \frac{Q}{2\pi f_o H_o}$

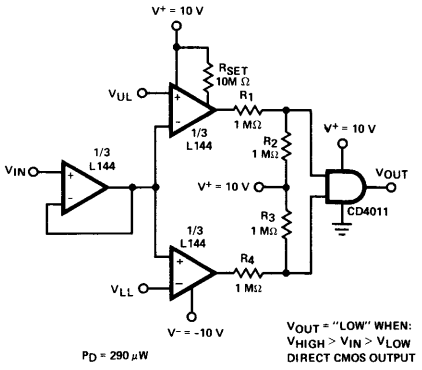
Precision Phase Splitter



P_D = 7.5 mW

$\frac{V_{OUT}}{V_{IN}} = \frac{R_2 + R_1}{R_1}$

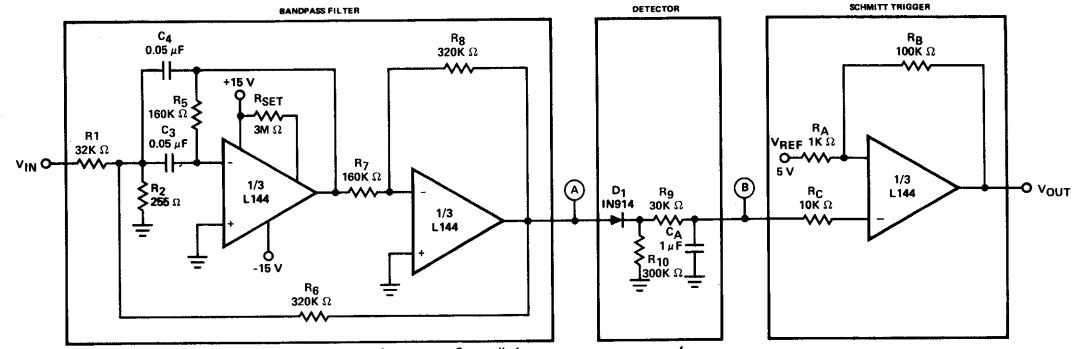
Double-Ended Limit Comparator



P_D = 290 μW

V_{OUT} = "LOW" WHEN:
$V_{HIGH} > V_{IN} > V_{LOW}$
DIRECT CMOS OUTPUT

500 Hz Tone Detector



GIVEN Q, f_o, C

LET $C = C_3 = C_4$
$1 \leq K \leq 10$

THEN $R_7 = R_5$ FOR CONVENIENCE

THEN

$R_5 = \frac{Q}{2\pi f_o C}$

$R_8 = R_6 = K R_5$

$R_1 = \frac{K R_5}{H_o}$

$R_2 = \frac{R_5}{Q2 - \frac{H_o + 1}{K}}$

Q normally from 10 to 50K chosen for component value convenience.

IN THIS CIRCUIT:

H_o = 10
f_o = 500 Hz
Q = 25

$f3db = \frac{f_o}{100}$

$V_{HIGH} = \frac{V_{ref} R_B + 14 R_A}{R_A + R_B}$

$V_{LOW} = \frac{V_{ref} R_B - 14 R_A}{R_A + R_B}$