

Low power quad operational amplifier

LM124

FEATURES

- Internally frequency compensated for unity gain
- Large DC voltage gain (100dB)
- Wide bandwidth (unity gain) — 1MHz (temperature compensated)
- Wide power supply range — Single supply (3V_{DC} to 30V_{DC}) or Dual supplies ($\pm 1.5V_{DC}$ to $\pm 15V_{DC}$)
- Very low supply current drain — essentially independent of supply voltage (1mW/op amp at +5V_{DC})
- Low input biasing current (45nA_{DC} temperature compensated)
- Low input offset voltage (2mV_{DC}) and offset current (5nA_{DC})
- Differential input voltage range equal to the power supply voltage
- Large output voltage (0V_{DC} to V₊ — 1.5V_{DC} swing)

UNIQUE FEATURES

In the linear mode the input common-mode voltage range includes ground and the output voltage can also swing to ground, even though operated from only a single power supply voltage

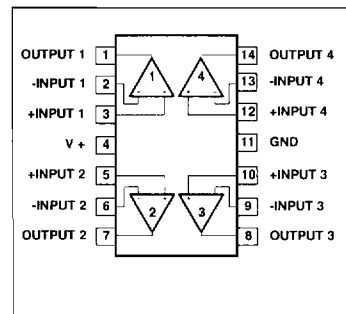
The unity gain cross frequency is temperature compensated.

The input bias current is also temperature compensated.

DESCRIPTION

The LM124 is an independent, high-gain, internally frequency-compensated operational amplifier designed specifically to operate from a single power supply over a wide range of voltages.

PIN CONFIGURATION

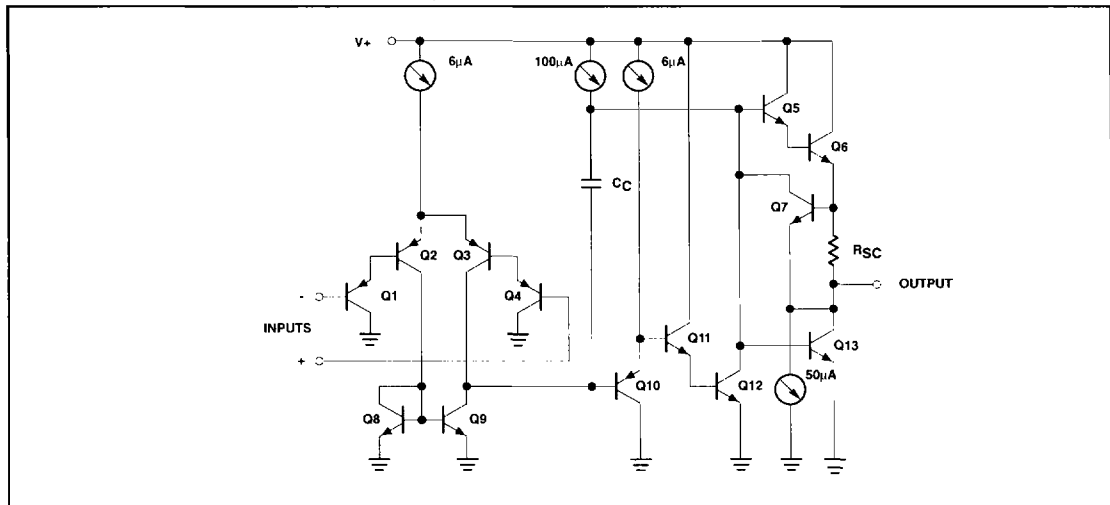


ORDERING INFORMATION

DESCRIPTION	ORDER CODE	PACKAGE DESIGNATOR*
14-Pin Ceramic DIP	LM124/BCA	GDIP1-T14
14-Pin FLAT Ceramic	LM124/BDA	GDFFP-F14

* MIL-STD 1835 or Appendix A of 1995 Military Data Handbook

EQUIVALENT SCHEMATIC (One circuit only)



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ABSOLUTE MAXIMUM RATINGS⁶

SYMBOL	PARAMETER	RATING	UNIT
V+	Supply voltage	32 or ± 16	V _{DC}
V _{DIFF}	Differential input voltage	32	V _{DC}
V _{IN}	Input voltage	-0.3 to +32	V _{DC}
P _D	Power dissipation ¹	900	mW
I _{SC}	Output short-circuit to GND 1 amplifier ² V+ < 15V _{DC} and T _A = 25°C	Continuous	
I _{IN}	Input current (V _{IN} < -0.3V) ³	50	mA
T _{STG}	Storage temperature range	-65 to +150	°C

DC ELECTRICAL CHARACTERISTICS

V+ = +5V, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	T _{amb} = +25°C			T _{amb} = -55°C–+125°C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage ⁴	R _S = 0Ω		2	5			7	mV
ΔV _{IO} /ΔT	Input offset voltage drift	R _S = 0Ω					7		μV/°C
I _B	Input bias current ³	R _S = 10kΩ I _{IN} (+) or I _{IN} (-)		45	150			300	nA
ΔI _B /ΔT	Input bias drift						50		pA/°C
I _{IO}	Offset current	I _{IN} (+) - I _{IN} (-)		3	30			100	nA
ΔI _{IO} /ΔT	Offset current drift						10		pA/°C
V _{ICR}	Common-mode voltage range	V+ = 30V	0		V+ - 1.5	0		V+ - 2	V
CMRR	Common-mode rejection ratio ⁵	V+ = 30V	70	85		70			dB
V _O	Output voltage swing ⁷	R _L = 2kΩ, V+ = +30V	26			26			V
V _{OH}	Output High voltage	R _L ≥ 10kΩ, V+ = 30V	27	28		27			V
V _{OL}	Output Low voltage	R _L ≥ 10kΩ		5	20			20	mV
I _{CC}	Supply current	R _L = ∞, V+ = 30V R _L = ∞, V+ = 5.0V		1.5 0.7	3.0 1.2			3.0 1.2	mA mA
A _V	Large signal voltage gain	V+ = +15V (for large V _O swing) R _L ≥ 2kΩ	50	100		25			V/mV
CS	Amplifier-to-amplifier coupling	f = 1kHz to 20kHz, input referred		120					dB
PSRR	Power supply rejection ratio	R _S ≤ 0Ω	65	100		65			dB
I _{OH}	Output current source	V _{IN+} = +1V, V _{IN-} = 0V, V+ = 15V	20	40		10			mA
I _{OL}	Output current sink	V _{IN-} = +1V, V _{IN+} = 0V, V+ = 15V, V _O = 4.4V	10	20		5			mA
		V _{IN+} = 0V _{DC} , V _{IN-} = +1V _{DC} , V _O = 200mV	12	50					μA
I _{SC}	Short-circuit current ²	V+ = 10V	-10	-40	-60				mA
V _{IDR}	Differential input voltage ⁵				V+				V

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AC ELECTRICAL CHARACTERISTICS

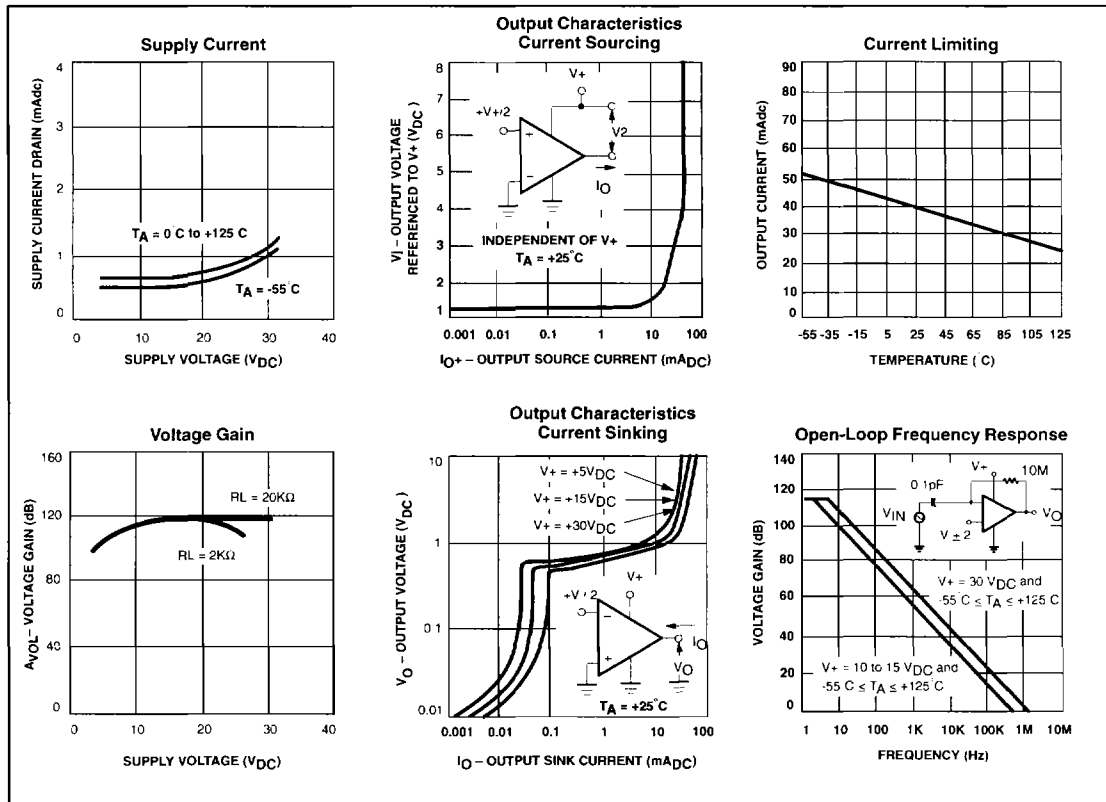
V+ = +5V, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	T _{amb} = +25°C			T _{amb} = -55°C to +125°C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
GBW	Unity gain bandwidth			1					MHz
S.R.	Slew rate			0.3					V/μs
Noise	Input noise voltage	f = 1kHz		40					nV/√Hz

NOTES:

- For operating at high temperatures, all devices must be derated based on a +150°C maximum junction temperature and a thermal resistance of 175°C/W which applies for the device soldered in a printed circuit board, operating in a still air ambient.
- Short circuits from the output to V+ can cause excessive heating and eventual destruction. The maximum output current is approximately 40mA independent of the magnitude of V+. At values of supply voltage in excess of +15Vdc continuous short-circuits can exceed the power dissipation ratings and cause eventual destruction.
- The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output, so no loading change exists on the input lines.
- V_O = 1.4V_{DC}, R_S = 0Ω with V+ from 5V to 30V and over full input common mode range (0V_{DC}+ to V+ -1.5V).
- The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is V+ -1.5, but either or both inputs can go to +32V without damage.
- Operation beyond limits of this table may impair the useful life of the device.
- For long term static operation above V_{CC} = 18V, derate the output load resistance to 3.2kΩ minimum.

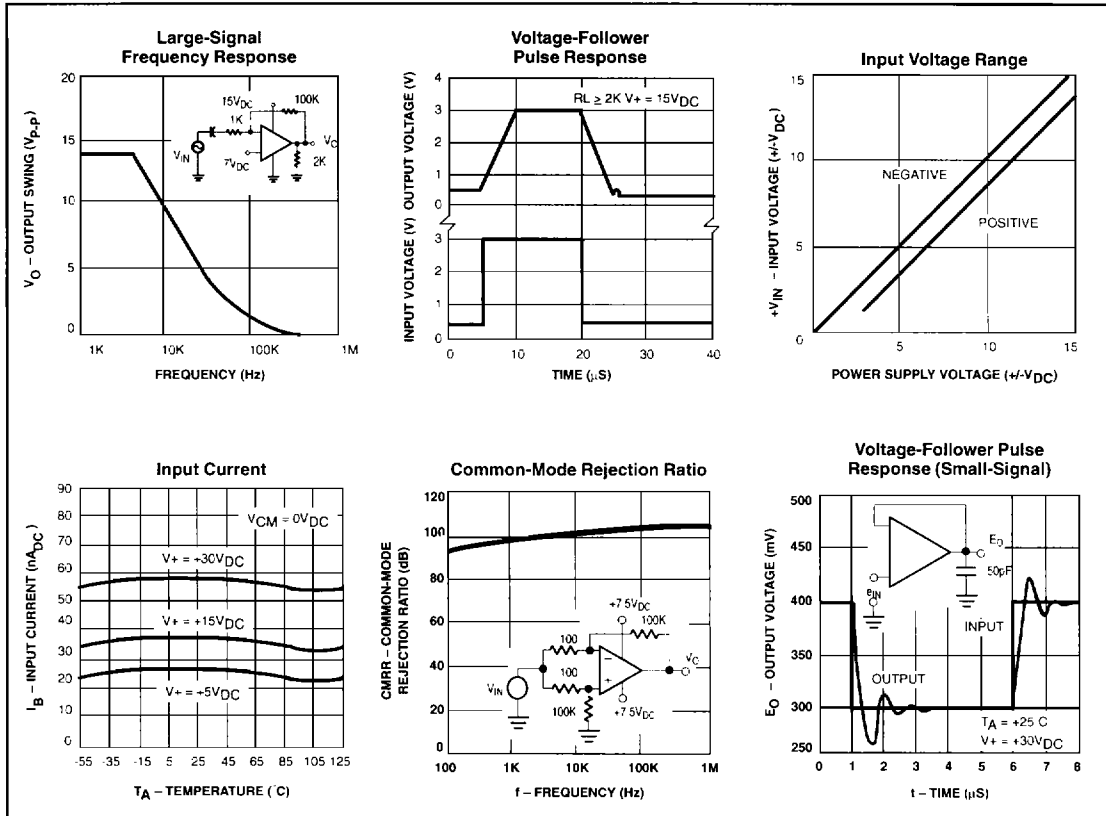
TYPICAL PERFORMANCE CHARACTERISTICS



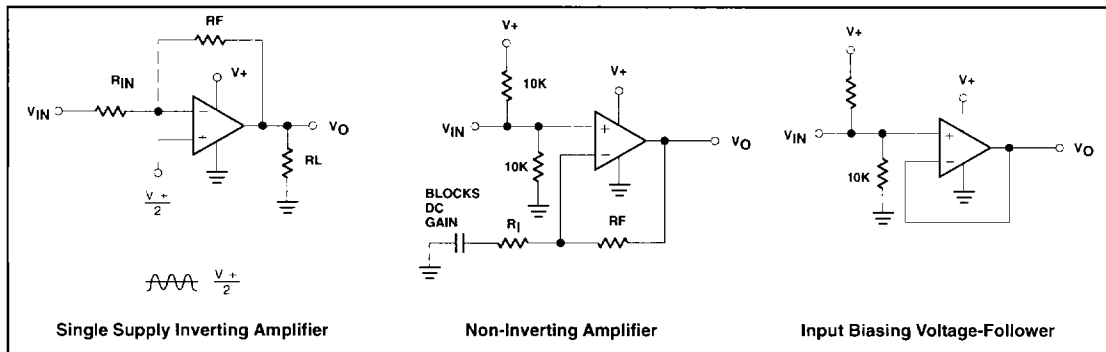
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TYPICAL PERFORMANCE CHARACTERISTICS (Continued)



TYPICAL APPLICATIONS



Single Supply Inverting Amplifier

Non-Inverting Amplifier

Input Biasing Voltage-Follower