

**QUAD OPERATIONAL AMPLIFIERS**

**DESCRIPTION**

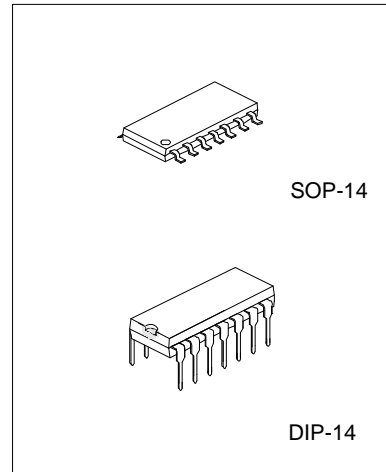
The LM324 consists of four independent, high gain internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide voltage range.

Operation from split power supplies is also possible so long as the difference between the two supplies is 3 Volts to 3.2 volts.

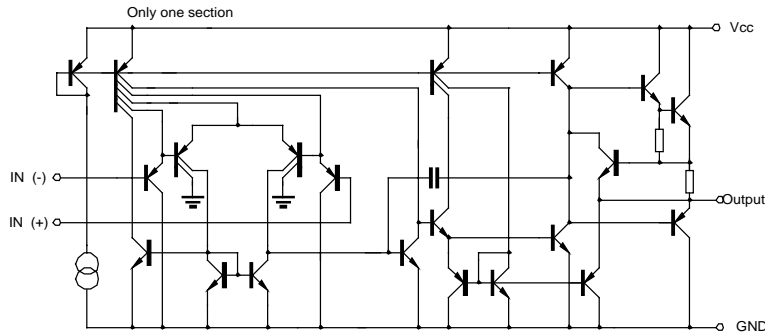
Application areas include transducer amplifier, DC gain blocks and all the conventional OP amp circuits which now can be easily implemented in single power supply system.

**FEATURES**

- \*Internally frequency compensated for unity gain
- \*Large DC voltage gain :100dB
- \*Wide operating supply range ( $V_{CC}=3V\sim 32V$ )
- \*Input common-mode voltage includes ground
- \*Large output voltage swing: From 0V to  $V_{CC}-1.5V$
- \*Power drain suitable for battery operation



**BLOCK DIAGRAM**



**ABSOLUTE MAXIMUM RATINGS** ( $T_a=25^{\circ}C$ )

Characteristic	Symbol	Value	Unit
Supply Voltage	$V_{CC}$	$\pm 16$	V
Differential input voltage	$V_{i(diff)}$	32	V
Input Voltage	$V_I$	-0.3~32V	V
Power Dissipation	$P_d$	570	mW
Operating Temperature	$T_{opr}$	0 to +70	$^{\circ}C$
Storage Temperature	$T_{stg}$	-65 to 150	$^{\circ}C$

# LM324

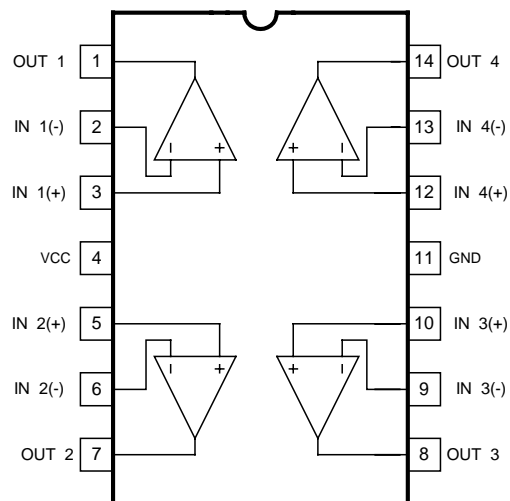
# LINEAR INTEGRATED CIRCUIT

## ELECTRICAL CHARACTERISTICS (Ta=25°C)

(Vcc=5.0V, All voltage referenced to GND unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Input offset voltage	V <sub>IO</sub>	V <sub>CM</sub> =0 to V <sub>CC</sub> -1.5 V <sub>O(p)</sub> =1.4V, R <sub>S</sub> =0		1.5	7.0	mV
Input offset current	I <sub>IO</sub>			3.0	50	nA
Input Bias current	I <sub>b</sub>			40	250	nA
Input Common-mode voltage range	V <sub>I(R)</sub>	V <sub>CC</sub> =30V	0	V <sub>CC</sub> -1.5		V
Supply Current	I <sub>CC</sub>	R <sub>L</sub> =∞, V <sub>CC</sub> =30V		1.0	3	mA
		V <sub>CC</sub> =5V		0.7	1.2	mA
Large signal Voltage Gain	G <sub>V</sub>	V <sub>CC</sub> =15V, R <sub>L</sub> >2kΩ V <sub>O(p)</sub> =1V to 11V	25	100		V/mV
Output voltage Swing	V <sub>(OH)</sub>	V <sub>CC</sub> =30V, R <sub>L</sub> =2kΩ	26			V
		V <sub>CC</sub> =30V, R <sub>L</sub> =10kΩ	27	28		V
	V <sub>(OL)</sub>	V <sub>CC</sub> =5, R <sub>L</sub> >10kΩ		5	20	mV
Common-mode rejection Ratio	CMRR		65	75		dB
Power supply rejection Ratio	PSRR		65	100		dB
Channel Separation	CS	f=1kHz to 20kHz		5	20	mV
Short circuit to GND	I <sub>SC</sub>			40	60	mA
Output current	I <sub>source</sub>	V <sub>I(+)</sub> =1V, V <sub>I(-)</sub> =0 V <sub>CC</sub> =15V, V <sub>O(p)</sub> =2V	20	40		mA
	I <sub>sink</sub>	V <sub>I(+)</sub> =0V, V <sub>I(-)</sub> =1V V <sub>CC</sub> =15V, V <sub>O(p)</sub> =2V	10	13		mA
		V <sub>I(+)</sub> =1V, V <sub>I(-)</sub> =0 V <sub>CC</sub> =15V, V <sub>O(p)</sub> =200V	12	45		μA
Differential input voltage	V <sub>I(diff)</sub>				V <sub>CC</sub>	V

## PIN CONFIGURATION



## TYPICAL CHARACTERISTICS PERFORMANCE

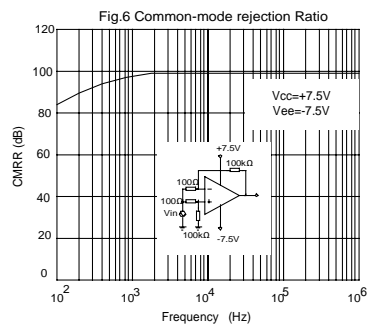
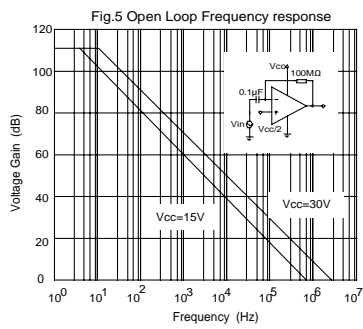
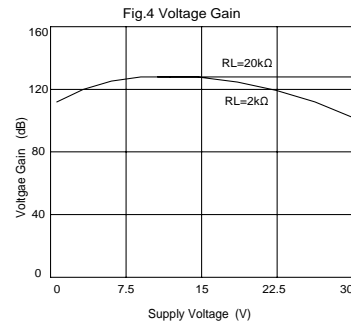
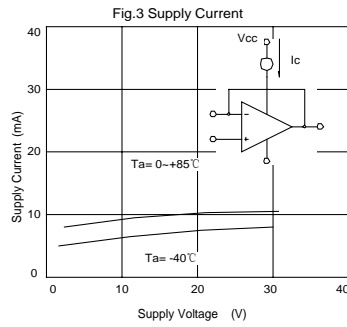
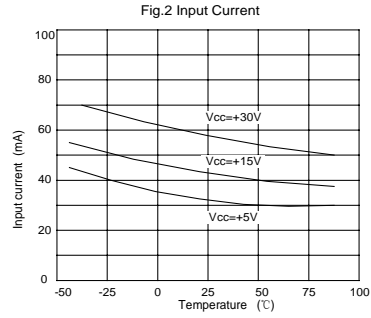
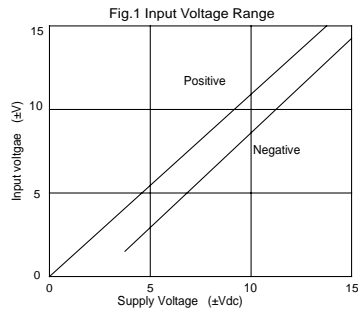


Fig.7

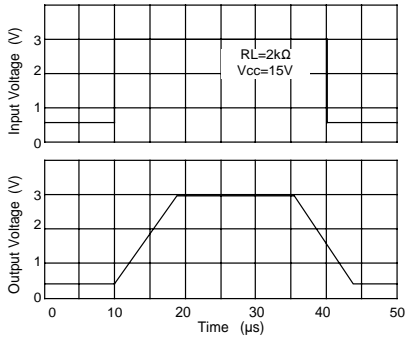


Fig.8 voltage Follower pulse response (small signal)

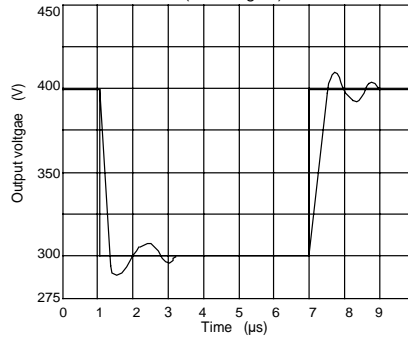


Fig.9 Large signal Frequency Response

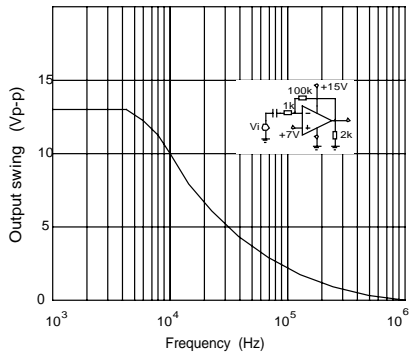


Fig.10 Output Characteristics current sourcing

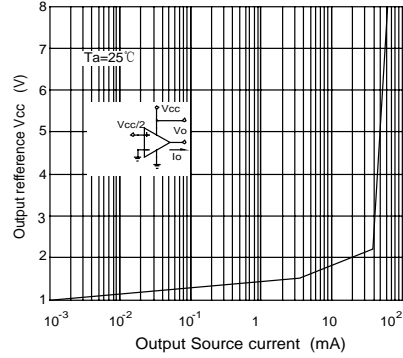


Fig.11 Output Characteristics Current sinking

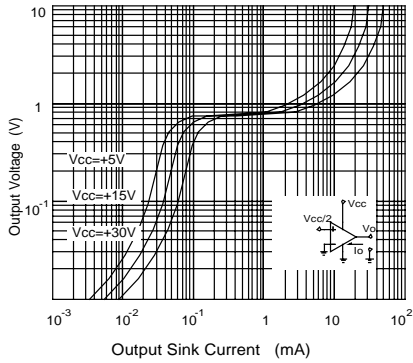


Fig.12 Current Limiting

