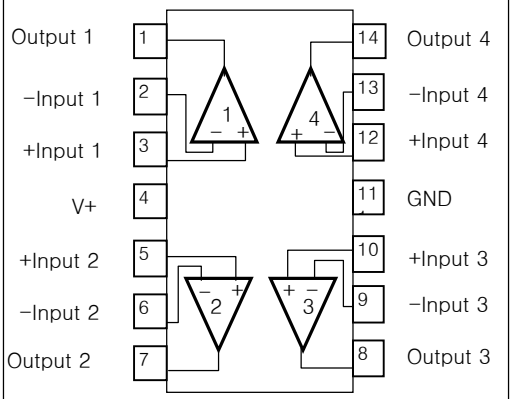
FEATURES

- Internally frequency compensated for unity gain
- Large DC voltage gain : 100dB
- Wide power supply range : 3V~32V(or±1.5V~15V)
- Input common-mode voltage range includes ground
- Large output voltage swing : 0V DC to V_{CC}-1.5V DC
- Power drain suitable for battery operation

14 SOP/ 14 DIP PIN FUNCTION



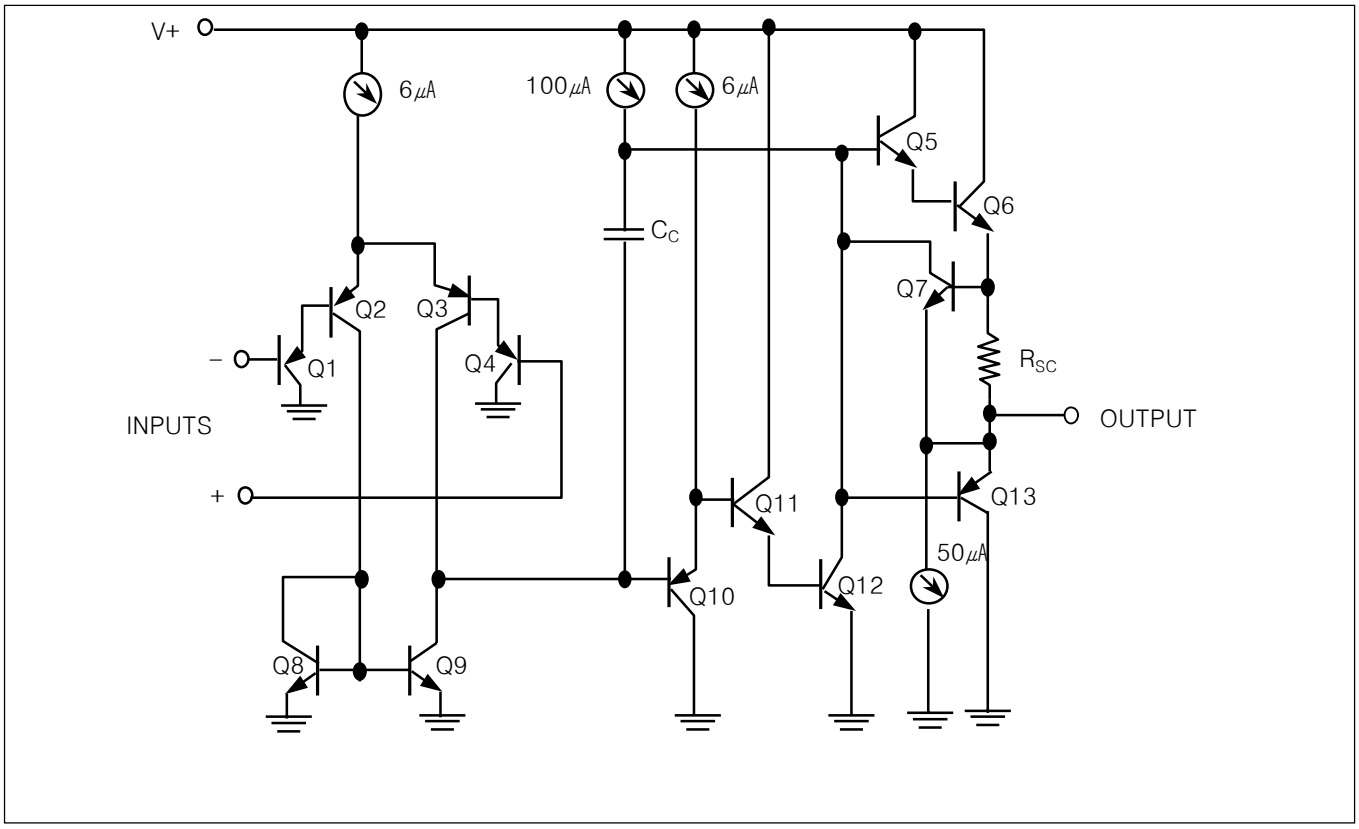
ORDERING INFORMATION

Device	Package
LM324D	14 SOP
LM324N	14 DIP

QUAD OPERATION AMPLIFIERS

LM324 is 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 32 volts voltage.
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 systems.

EQUIVALENT CIRCUIT



ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	VALUE	UNIT
Power Supply Voltage	V_{CC}	±18 or 32	V
Differential Input Voltage	$V_{I(DIFF)}$	32	V
Input Voltage	V_I	−0.3 to +32	V
Output Short Circuit to GND		Continuous	
V_{CC}≤15V T_A=25℃ (One Amp)			
Power Dissipation	P_D	570	mW
Operating Temperature Range	T_{OPR}	0~+70	℃
Storage Temperature Range	T_{STG}	−65 to +150	℃

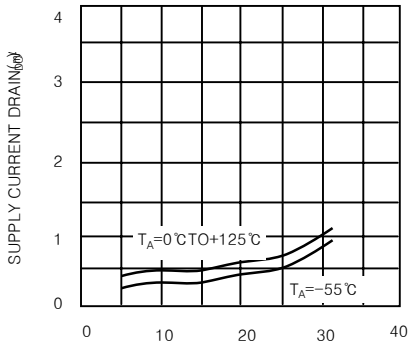
Electrical characteristics at specified free-air temperature, V_{CC}=5V(unless otherwise noted)

PARAMETER	*TEST CONDITIONS		LM324D			UNIT
			MIN	TYP	MAX	
V_{IO} Input Offset Voltage	V_{CC}=5V to MAX, V_{IC}=V_{ICR}MIN, V_O=1.4V	25℃		3	7	mV
		Full Range			9	
αV_{IO} Average Temperature Coefficient of Input Offset Voltage		Full Range		7		μV/℃
I_{IO} Input Offset Current	V_O=1.4V	25℃		2	50	nA
		Full Range			150	
αIIo Average Temperature Coefficient of Input Offset Current		Full Range		10		pA/℃
I_{IB} Input Bias Current	V_O=1.4V	25℃		−20	−250	nA
		Full Range			−500	
V_{ICR} Common-Mode Input Voltage Range	V_{CC}=5V to MAX	25℃	0toV_{CC}−1.5			V
		Full Range	0toV_{CC}−2			
V_{OH} High-Level Output Voltage	R_L≥2kΩ	25℃	V_{CC}−1.5			V
	V_{CC}=MAX, R_L=2kΩ	Full Range	26			
	V_{CC}=MAX, R_L≥10kΩ	Full Range	27	28		
V_{OL} Low-Level Output Voltage	R_L≥10kΩ	Full Range		5	20	mV
A_{VD} Large-Signal Differential Voltage Amplification	V_{CC}=15V, V_O=1V to 11V, R_L≥2kΩ	25℃	25	100		V/mV
		Full Range	15			
CMRR Common-Mode Rejection Ratio	V_{CC}=5V to MAX, VIC=VICR MIN,	25℃	65	80		dB
K_{SVR} Supply Voltage Rejection Ratio($\Delta V_{CC}/\Delta V_{IO}$)	V_{CC}=5V to MAX	25℃	65	100		dB
V_{01}/V_{02} Crosstalk Attenuation	f=1 kHz to 20kHz	25℃		120		dB
I_O Output Current	V_{CC}=15V, V_{ID}=1V, V_O=0	25℃	−20	−30		mA
		Full Range	−10			
	V_{CC}=15V, V_{ID}=1V, V_O=15V	25℃	10	20		
		Full Range	5			
	V_{ID}=1V, V_O=200mV	25℃	12	30		
I_{OS} Short-Circuit Output Current	V_{CC} at 5V, GND at −5V, V_O=0	25℃		±40	±60	mA
I_{CC} Supply Current (Four Amplifiers)	V_O−2.5V, No Load	Full Range		0.7	1.2	mA
	V_{CC}=MAX, V_O=0.5V_{CC}, No load	Full Range		1.1	3	

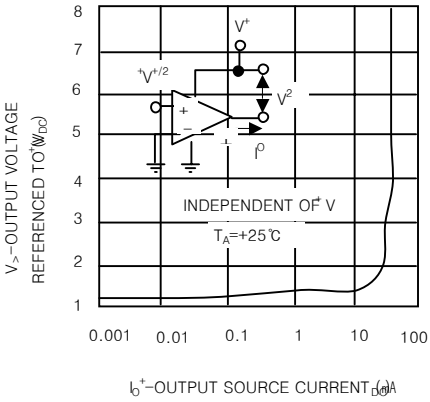
* All characteristics are measured under open loop conditions with zero common-mode input voltage unless otherwise specified <<MAX>> V_{CC} for testing purpose is 30V. Full range is 0℃ to 70℃.

TYPICAL PERFORMANCE CHARACTERISTICS

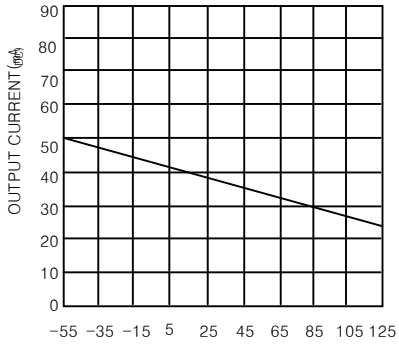
SUPPLY CURRENT



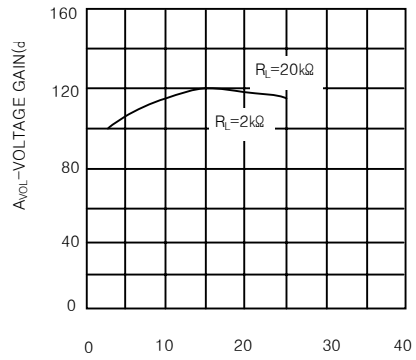
OUTPUT CHARACTERISITICS
CURRENT SOURCING



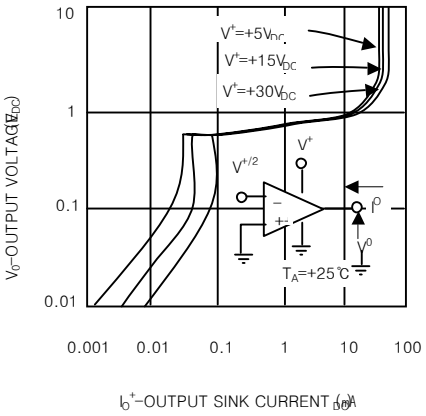
CURRENT LIMITING



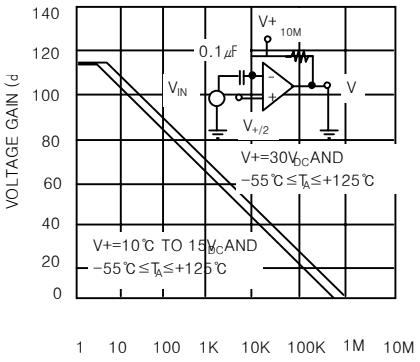
VOLTAGE GAIN



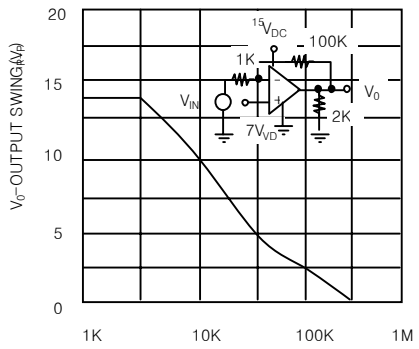
OUTPUT CHARACTERISITICS
CURRENT SINKING



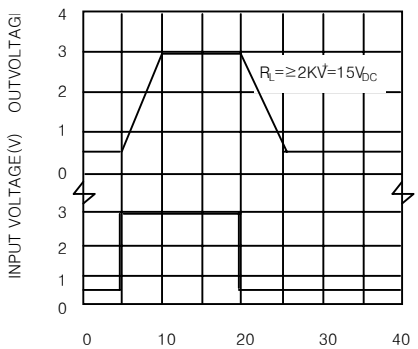
OPEN-LOOP FREQUENCY
RESPONSE



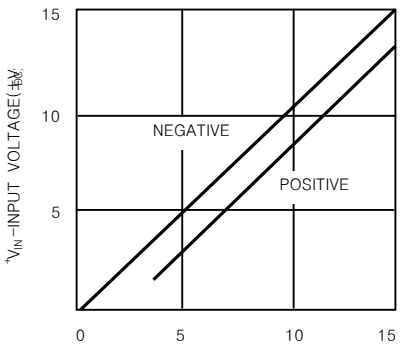
LARGE-SIGNAL FREQUENCY
RESPONSE



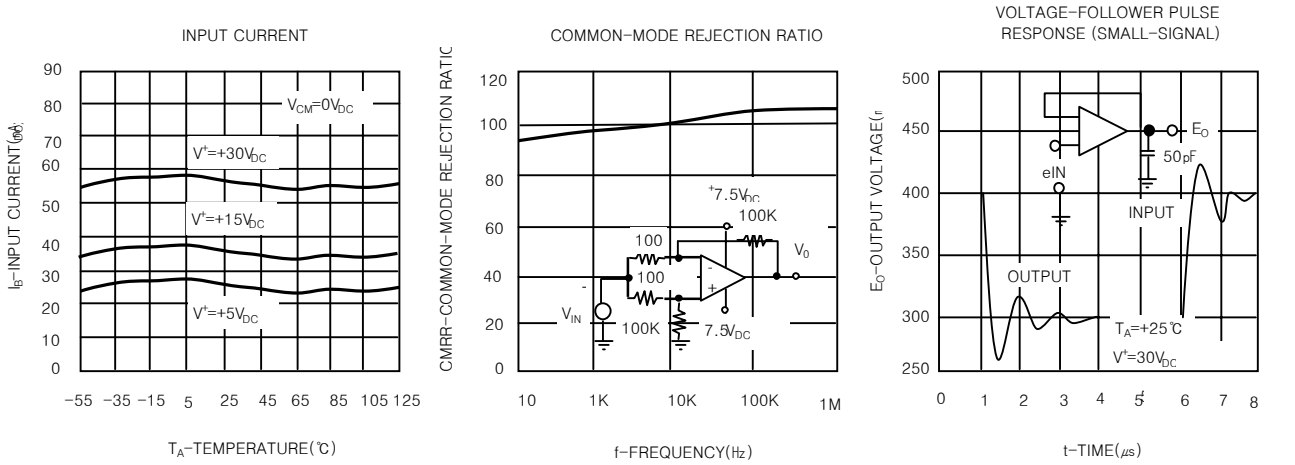
VOLTAGE-FOLLOWER PULSE
RESPONSE



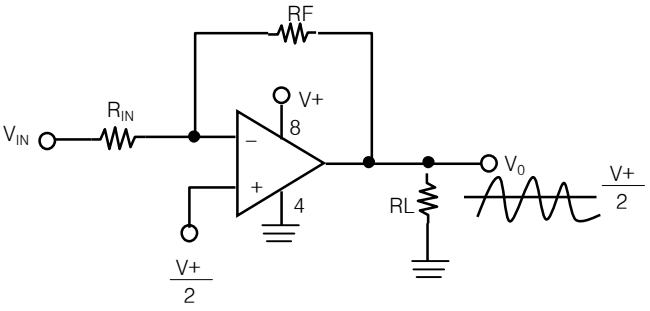
INPUT VOLTAGE RANGE



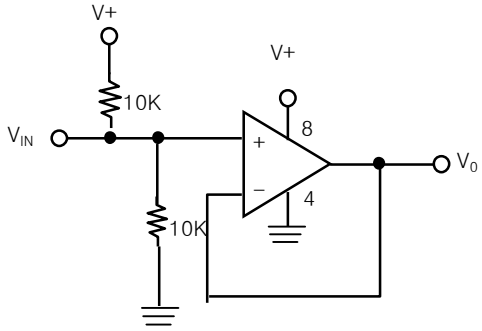
TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)



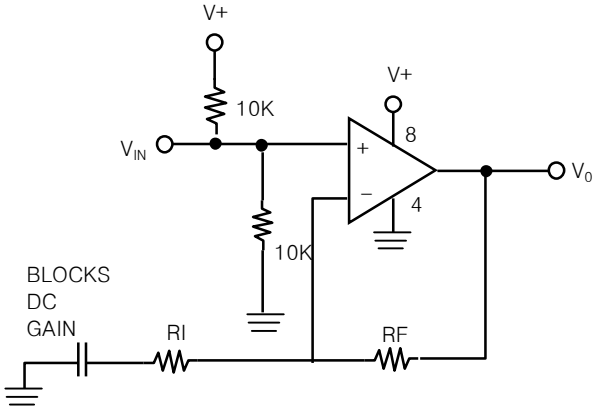
TYPICAL APPLICATIONS



SINGLE SUPPLY INVERTING AMPLIFIER



INPUT BIASING VOLTAGE POLLOWER



NON-INVERTING AMPLIFIER