



## LM324

## LINEAR INTEGRATED CIRCUIT

### QUAD OPERATIONAL AMPLIFIERS

#### DESCRIPTION

The UTC **LM324** consists of four independent, high gain internally frequency compensated operational amplifiers which are designed specifically to operated from a single power supply over a wide voltage range. Operation from split power supplies is also possible. 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.

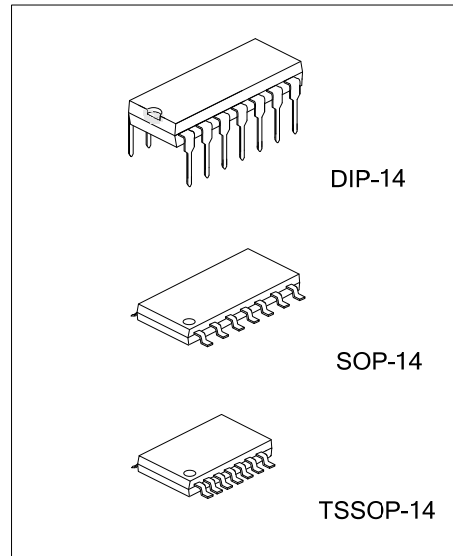
#### ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen-Free		
LM324L-D14-T	LM324G-D14-T	DIP-14	Tube
LM324L-S14-R	LM324G-S14-R	SOP-14	Tape Reel
LM324L-P14-R	LM324G-P14-R	TSSOP-14	Tape Reel

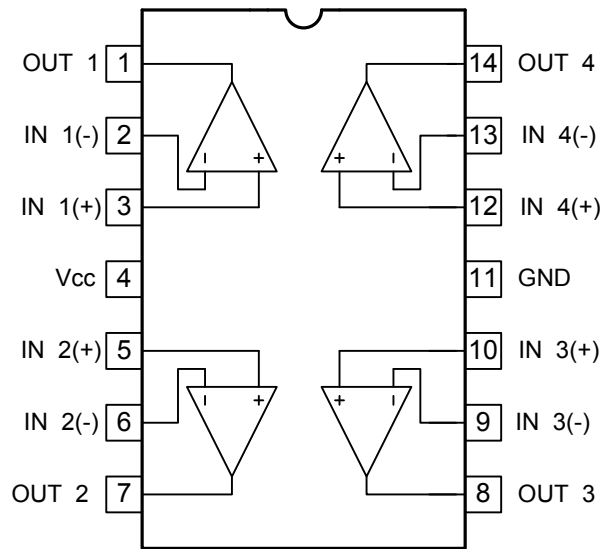
<p>LM324G-D14-T</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p>	<p>(1) T: Tube, R: Tape Reel (2) DIP: DIP-14, S14: SOP-14, P14: TSSOP-14 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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#### MARKING

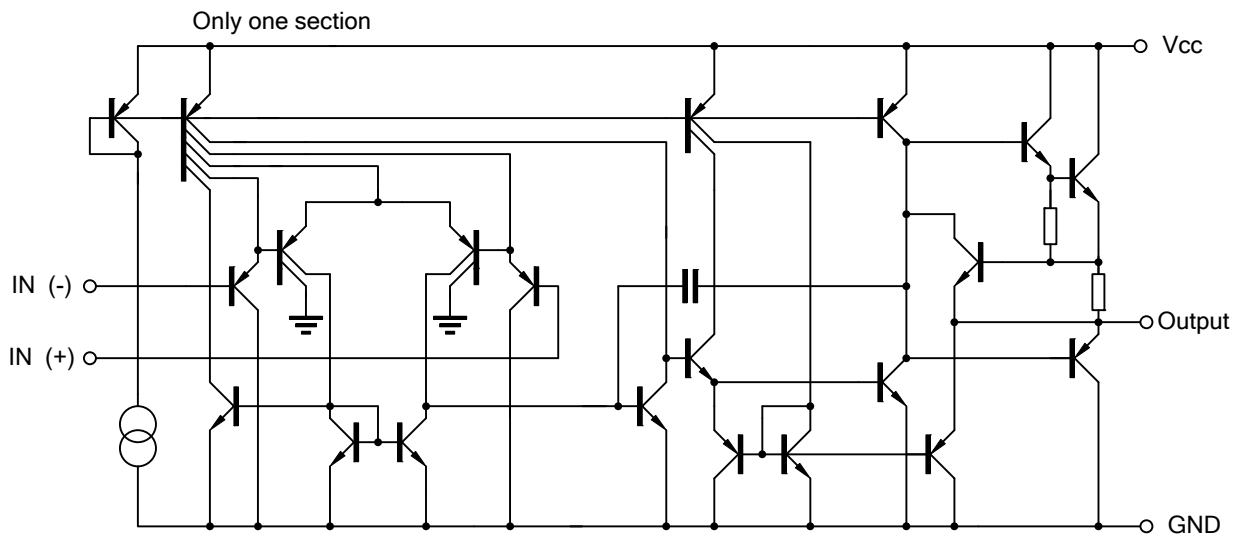
DIP-14	SOP-14 / TSSOP-14



## ■ PIN DESCRIPTION



## ■ BLOCK DIAGRAM



### ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage		$V_{CC}$	$\pm 16$ or 32	V
Differential Input Voltage		$V_{I(DIFF)}$	$\pm 32$	V
Input Voltage		$V_{IN}$	-0.3 ~ +32	V
Power Dissipation	DIP-14	$P_D$	800	mW
	SOP-14		580	mW
	TSSOP-14		460	mW
Operating Temperature		$T_{OPR}$	-40 ~ +85	°C
Storage Temperature		$T_{STG}$	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ ELECTRICAL CHARACTERISTICS

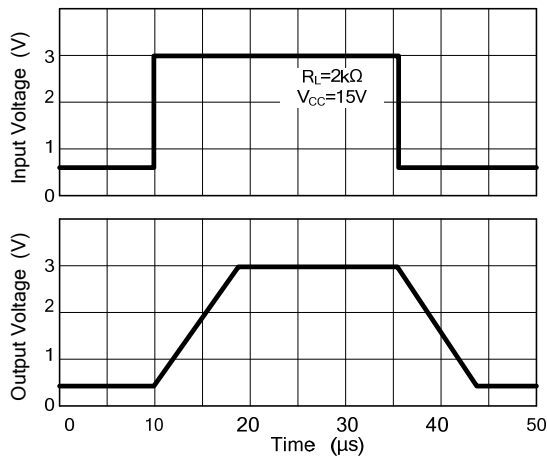
( $V_{CC}=5.0V$ , All voltage referenced to GND unless otherwise specified.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	$V_{I(OFF)}$	$V_{CM}=0V$ to $V_{CC}-1.5V$ $V_{O(P)}=1.4V$ , $R_S=0\Omega$			5.0	mV
Input Offset Current	$I_{I(OFF)}$				50	nA
Input Bias Current	$I_{I(BIAS)}$				250	nA
Input Common Mode Voltage	$V_{I(CM)}$	$V_{CC}=30V$	0	$V_{CC}-1.5$		V
Power Supply Current	$I_{CC}$	$R_L=\infty$ , $V_{CC}=30V$		1.0	3.0	mA
		$V_{CC}=5V$		0.7	1.2	mA
Large Signal Voltage Gain	$G_V$	$V_{CC}=15V$ , $R_L \geq 2K\Omega$ $V_{O(P)}=1V \sim 11V$	25	100		V/mV
Output Voltage Swing	$V_{O(H)}$	$V_{CC}=30V$ , $R_L=2K\Omega$	26			V
		$V_{CC}=30V$ , $R_L=10K\Omega$	27	28		V
	$V_{O(L)}$	$V_{CC}=5V$ , $R_L > 10K\Omega$		5	20	mV
Common Mode Rejection Ratio	CMRR		65	75		dB
Power Supply Rejection Ratio	PSRR		65	100		dB
Channel Separation	CS	$f=1KHZ \sim 20KHZ$		120		dB
Short Circuit Current to Ground	$I_{SC}$			40	60	mA
Output Current	$I_{SOURCE}$	$V_{I(+)}=1V$ , $V_{I(-)}=0V$ $V_{CC}=15V$ , $V_{O(P)}=2V$	20	40		mA
	$I_{SINK}$	$V_{I(+)}=0V$ , $V_{I(-)}=1V$ $V_{CC}=15V$ , $V_{O(P)}=2V$	10	13		mA
		$V_{I(+)}=0V$ , $V_{I(-)}=1V$ $V_{CC}=15V$ , $V_{O(P)}=200mV$	12	45		$\mu A$
Differential Input Voltage	$V_{I(DIFF)}$				$V_{CC}$	V

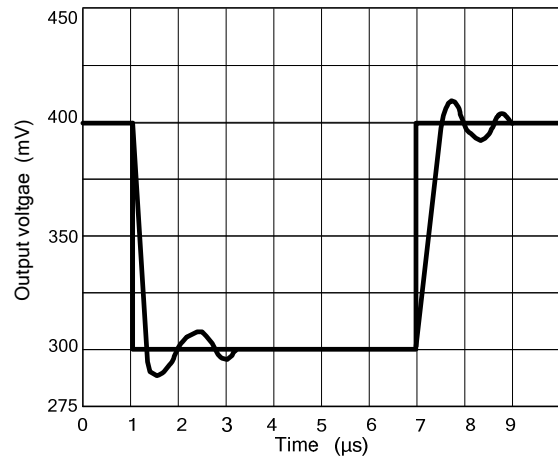


## TYPICAL CHARACTERISTICS(cont.)

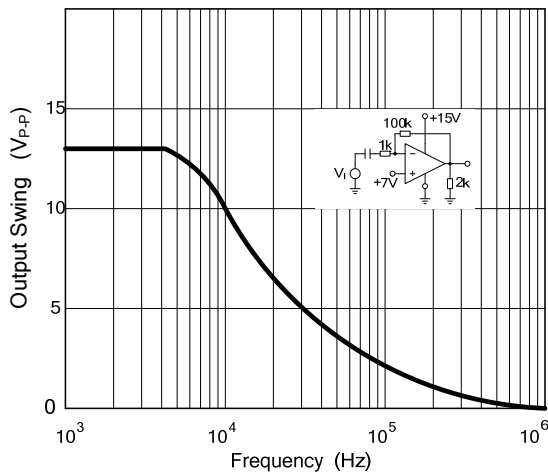
Voltage Follower Pulse Response



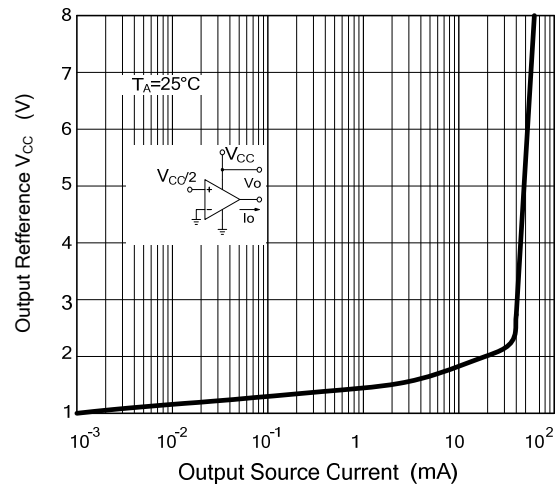
Voltage Follower pulse response (small signal)



Large Signal Frequency Response



Output Characteristics Current Sourcing



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