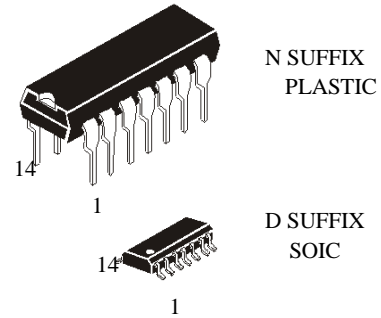


Low Power Quad Operational Amplifier

The HT324A contains four independent high gain operational amplifiers with internal frequency compensation. The op-amps operate over a wide voltage range. The device has low power supply current drain, regardless of the power supply voltage. The low power drain makes the HT324A a good choice for battery operation.

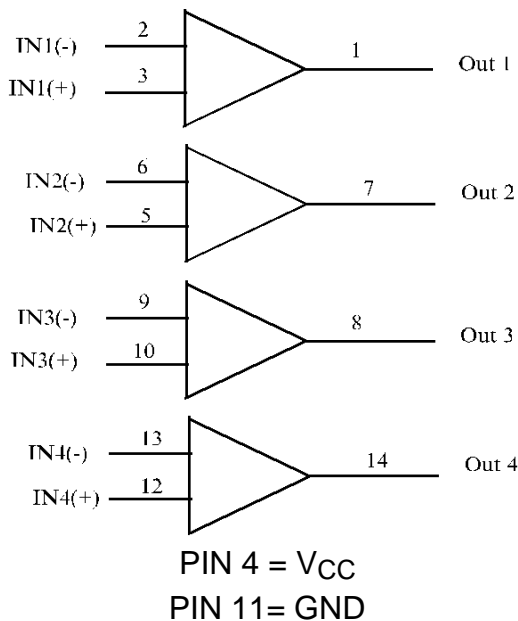
- Internally frequency compensated for unity gain
- Large DC voltage gain
- Single or split supply operation
- Input common-mode voltage range to ground
- Large output voltage swing: 0V DC to $V_{CC}-1.5V$ DC
- Power drain suitable for battery operation
- Low input offset voltage and offset current
- Differential input voltage range equal to the power supply voltage



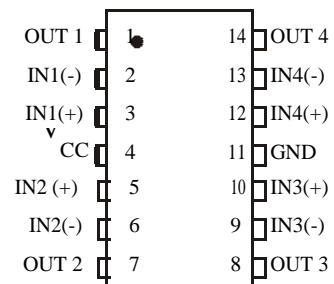
ORDERING INFORMATION

HT324AN	Plastic
HT324AR	SOIC
HT324AG	Chip

BLOCK DIAGRAM



PIN ASSIGNMENT



MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{CC}	Power Supply Voltages		
	Single Supply	32	V
	Split Supplies	±16	
V _{IDR}	Input Differential Voltage Range (1)	±32	V
V _{ICR}	Input Common Mode Voltage Range	-0.3 to 32	V
t _s	Short-Circuit duration of Output	100	ms
T _J	Junction Temperature Plastic Packages	150	°C
T _{stg}	Storage Temperature Plastic Packages	-55 to +125	°C
I _{IN}	Input Current, per pin (2)	50	mA
T _L	Lead Temperature, 1mm from Case for 10 Seconds	260	°C

* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

Notes:

1. Split Power Supplies.
2. V_{IN}<-0.3V.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V _{CC}	DC Supply Voltage	±2.5 or 5.0	±15 or 30	V
T _A	Operating Temperature, All Package Types	0	+70	°C

DC ELECTRICAL CHARACTERISTICS ($T_A=0$ to $+70^\circ\text{C}$)

Symbol	Parameter	Test Conditions	Guaranteed Limit		Unit
			Min	Max	
V_{IO}	Maximum Input Offset Voltage	$V_{CC}=5.0\text{-}30\text{V}; R_S=0\Omega$ $V_O=1.4\text{V}$ $V_{ICR}=0\text{V} - (V_{CC}-1.5\text{V})^*$ $V_{ICR}=0\text{V} - (V_{CC}-2.0\text{V})$		7.0* 9.0	mV
I_{IO}	Maximum Input Offset Current	$V_{CC}=5.0\text{-}30\text{V}, V_O = 1.4\text{V}$		$\pm 50^*$ ± 150	nA
I_{IB}	Maximum Input Bias Current	$V_{CC}=5.0\text{-}30\text{V}, V_O = 1.4\text{V}$		-250^* -500	nA
V_{ICR}	Input Common Mode Voltage Range	$V_{CC}=30\text{V}$	0	$V_{CC}-1.5\text{V}$ $V_{CC}-2.0\text{V}$	V
I_{CC}	Maximum Power Supply Current	$R_L=\infty, V_{CC}=5\text{V}, V_O=2.5\text{V}$ $R_L=\infty, V_{CC}=30\text{V}, V_O=15\text{V}$		1.2 3.0	mA
A_{VOL}	Minimum Large Signal Open-Loop Voltage Gain	$V_{CC}=15\text{V}, R_L \geq 2\text{K}\Omega$	25* 15		V/mV
V_{OH}	Minimum Output High-Level Voltage Swing	$V_{CC}=5\text{V}, R_L=2\text{K}\Omega$ $V_{CC}=30\text{V}, R_L=2\text{K}\Omega$ $V_{CC}=30\text{V}, R_L=10\text{K}\Omega$	3.3 26 27		V
V_{OL}	Maximum Output Low-Level Voltage Swing	$V_{CC}=5\text{V}, R_L=10\text{K}\Omega$		20	mV
CMR	Common Mode Rejection	Ω $V_{CC}=5\text{-}30\text{V}, R_S=10\text{K}$	65*		dB
PSR	Power Supply Rejection	$V_{CC}=5\text{-}30\text{V}$	65*		dB
I_{SC}	Maximum Output Short Circuit to GND	$V_{CC}=5.0\text{V}, V_O=0\text{V}$		60*	mA
I_{O+}	Minimum Output Source Current	$V_{CC}=15\text{V}, V_{ID-}=1.0\text{V},$	20*		mA
I_{O-}	Minimum Output Sink Current	$V_{ID-}=-1.0\text{V}, V_{CC}=15\text{V}, V_O=15\text{V}$ $V_{ID-}=-1.0\text{V}, V_{CC}=15\text{V}, V_O=0.2\text{V}$	10* 5 12*		mA mA μA
V_{IDR}	Differential Input Voltage Range	All $V_{IN} \geq \text{GND}$ or V-Supply (if used)		V_{CC}^*	V

* $T_A = +25^\circ\text{C}$

NOTE: Guaranteed Limits of DC Electrical Characteristics are given for $T_A=0, +70^\circ\text{C}$ as the information for chips.

TYPICAL PERFORMANCE CHARACTERISTICS (T_A= +25°C)

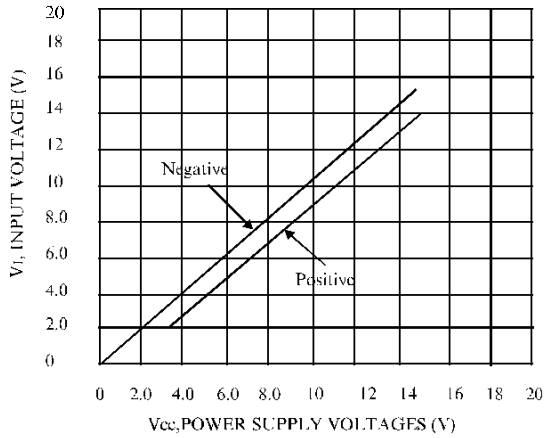


Figure 1. Input Voltage Range

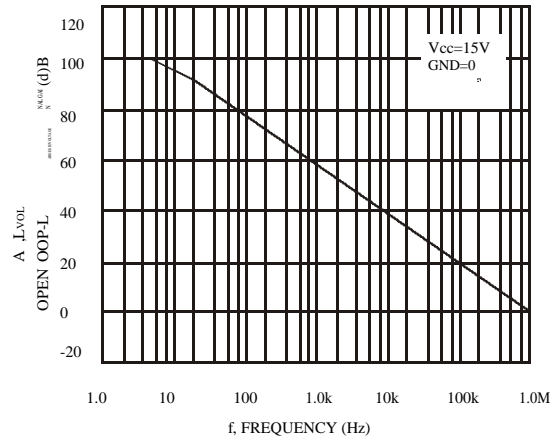


Figure 2. Open-Loop Frequency

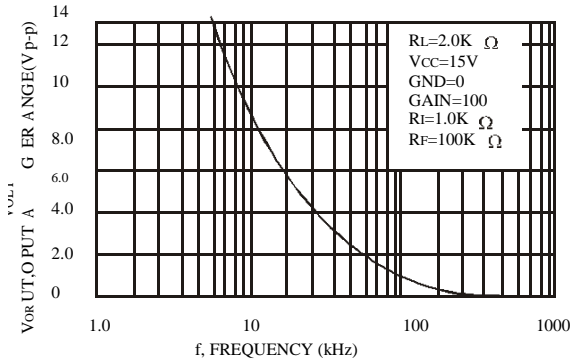


Figure 3. Large-Signal Frequency Response

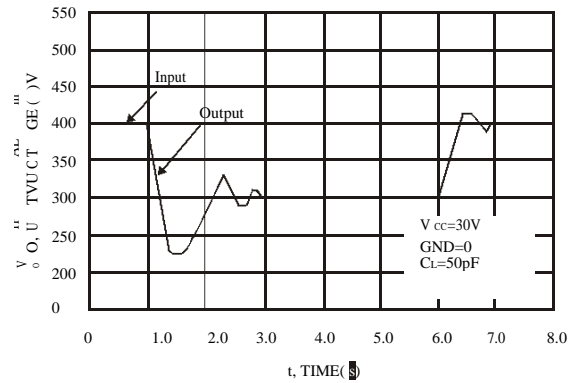


Figure 4. Small-Signal Voltage Follower Pulse Response (Noninverting)

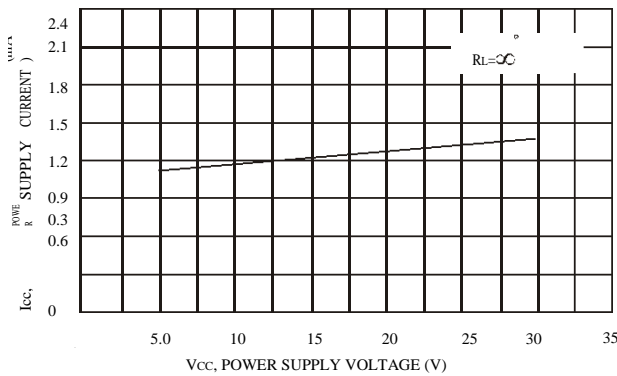


Figure 5. Power Supply Current versus Power Supply Voltage

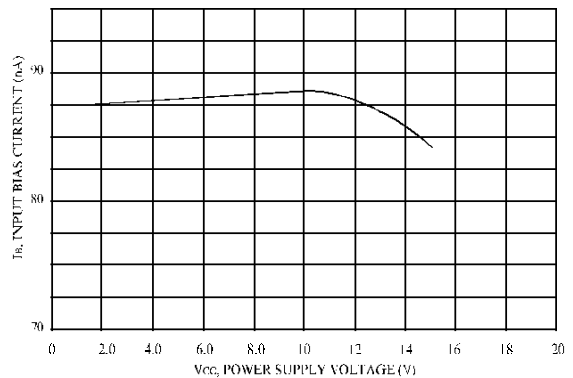
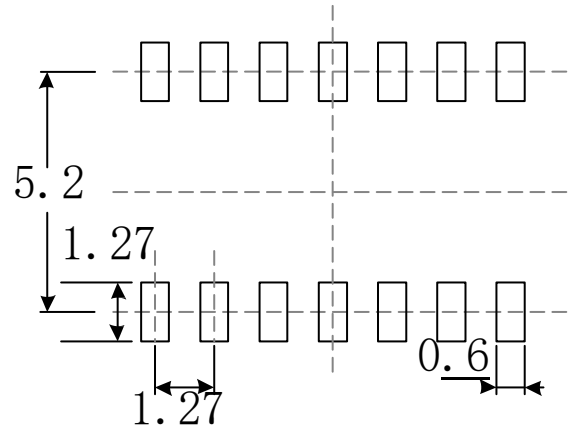
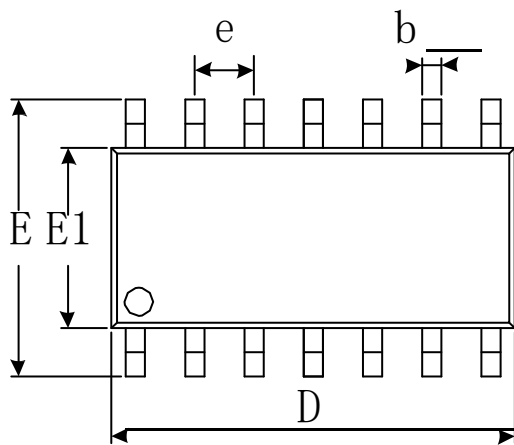
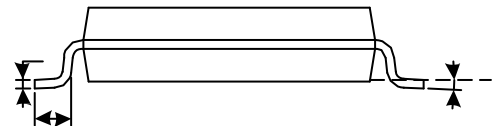
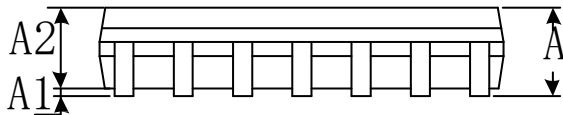


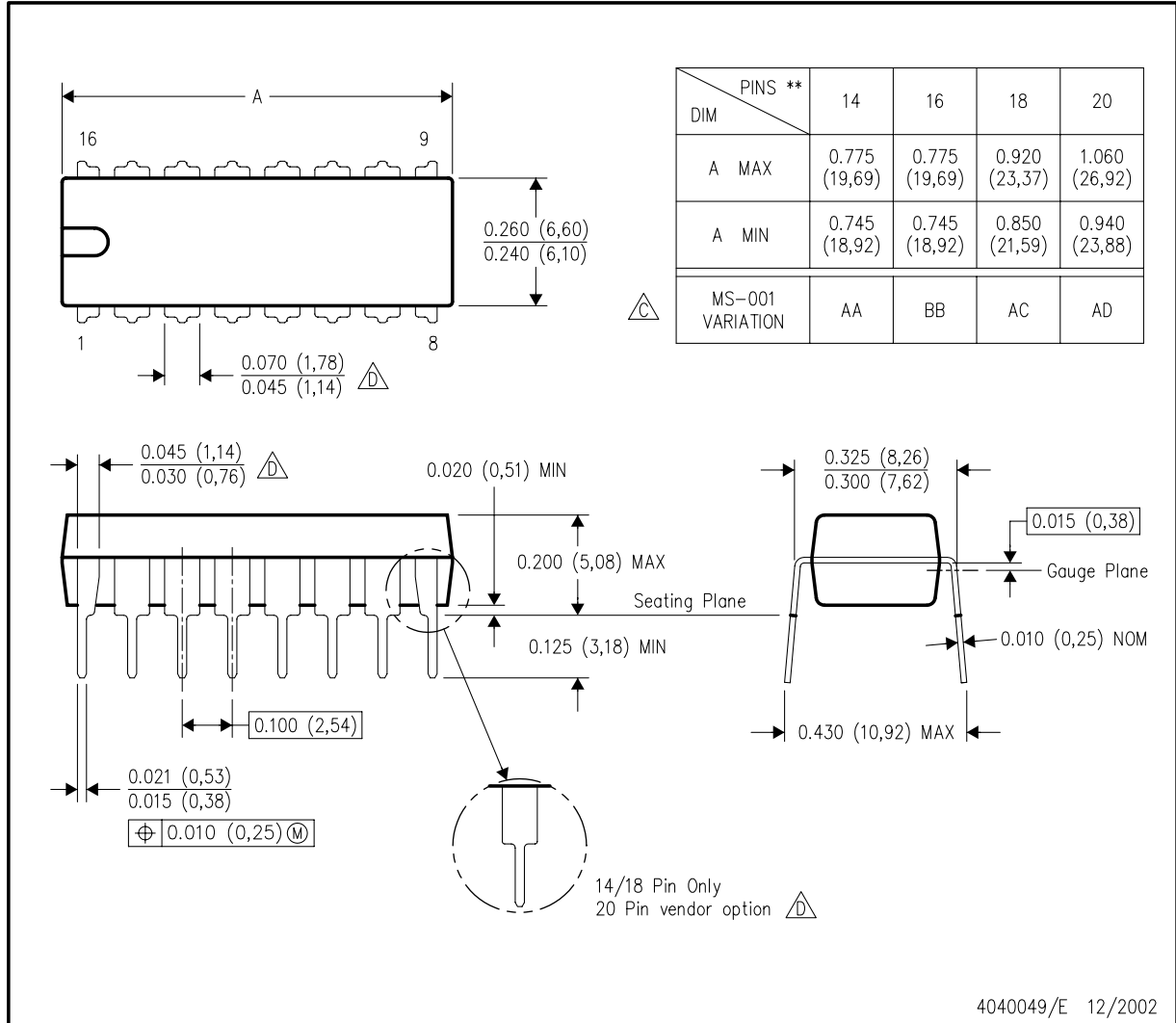
Figure 6. Input Bias Current versus Power Supply Voltage



SOP-14

RECOMMENDED LAND PATTERN (Unit: mm)


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.310	0.510	0.012	0.020
c	0.100	0.250	0.004	0.010
D	8.450	8.850	0.333	0.348
e	1.270(BSC)		0.050(BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

DIP-14

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 -  The 20 pin end lead shoulder width is a vendor option, either half or full width.

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