

# LM324x2 OCTAL OPERATIONAL AMPLIFIER

SLOS133A – APRIL 1994 – REVISED AUGUST 1996

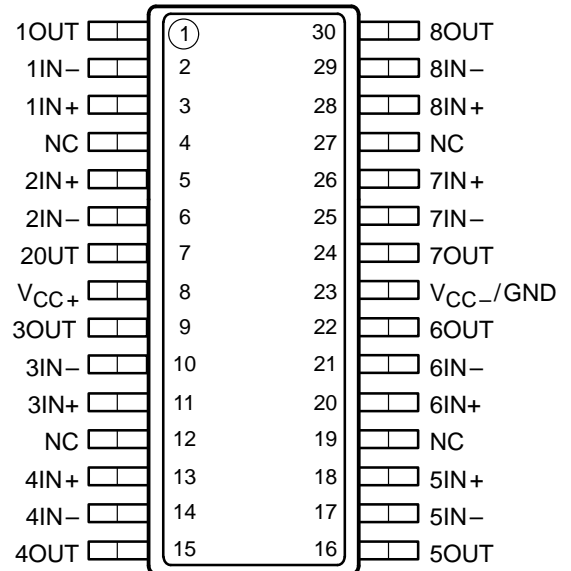
- **Wide Range of Supply Voltages:**  
Single Supply . . . 3 V to 30 V  
or Dual Supplies
- **Low Supply-Current Drain Independent of Supply Voltage** . . . 1.4 mA Typ
- **Common-Mode Input Voltage Range**  
Includes Ground Allowing Direct Sensing  
Near Ground
- **Low Input Bias and Offset Parameters:**  
Input Offset Voltage . . . 3 mV Typ  
Input Offset Current . . . 2 nA Typ  
Input Bias Current . . . –20 nA Typ
- **Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage** . . . 32 V
- **Open-Loop Differential Voltage Amplification** . . . 100 V/mV Typ
- **Internal Frequency Compensation**

## description

The LM324x2 device consists of eight independent, high-gain frequency-compensated operational amplifiers that are designed specifically to operate from a single supply over a wide range of voltages. Operation from split supplies is also possible when the difference between the two supplies is 3 V to 30 V and  $V_{CC}$  is at least 1.5 V more positive than the input common-mode voltage. The low supply-current drain is independent of the magnitude of the supply voltage.

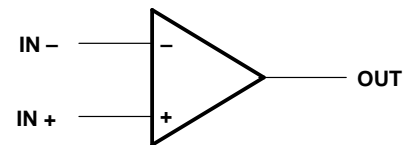
Applications include transducer amplifiers, dc amplification blocks, and all the conventional operational-amplifier circuits that now can be more easily implemented in single-supply-voltage systems.

**DB PACKAGE  
(TOP VIEW)**



NC – No internal connection

## symbol (each amplifier)



## AVAILABLE OPTION

T <sub>A</sub>	V <sub>IO</sub> max AT 25°C	PACKAGE
		SMALL OUTLINE (DB)†
0°C to 70°C	7 mV	LM324x2DBLE

† The DB package is only available left-end taped and reeled.



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

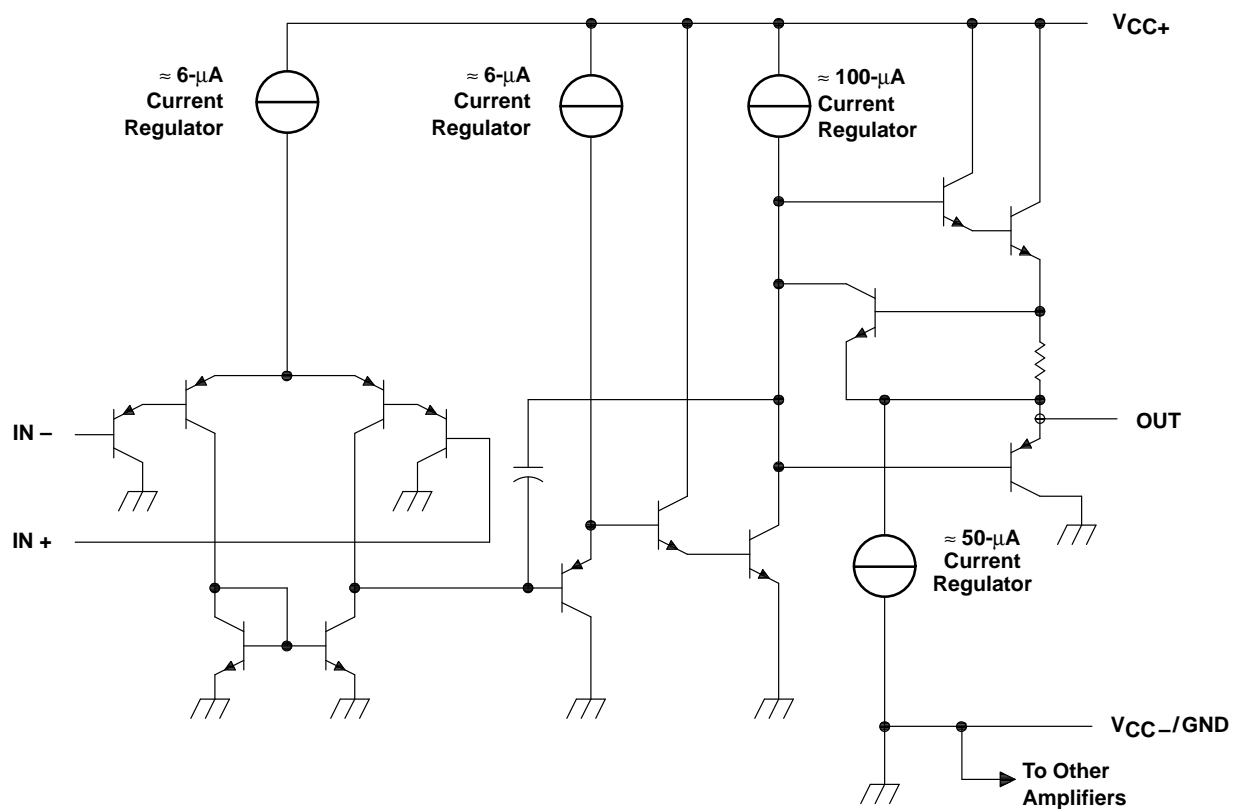
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## schematic (each amplifier)



### COMPONENT COUNT (total device)

Epi-FET	2
Transistors	190
Diodes	8
Resistors	22
Capacitors	8

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†**

Supply voltage, $V_{CC}$ (see Note 1)	32 V
Differential input voltage, $V_{ID}$ (see Note 2)	$\pm 32$ V
Input voltage range, $V_I$ (any input)	–0.3 V to 32 V
Duration of output short circuit to ground (see Note 3)	unlimited
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, $T_A$	0°C to 70°C
Storage temperature range	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these conditions beyond those indicated is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. All voltage values, except differential voltages and  $V_{CC}$  specified for the measurement of  $I_{OS}$ , are with respect to GND.  
 2. Differential voltages are at  $IN+$  with respect to  $IN-$ .  
 3. Short circuits from outputs to  $V_{CC}$  can cause excessive heating and eventual destruction.

**DISSIPATION RATING TABLE**

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING
DB	1024 mW	8.2 mW/°C	655 mW

# LM324x2

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**electrical characteristics at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)**

PARAMETER		TEST CONDITIONS†	T <sub>A</sub> ‡	MIN	TYP§	MAX	UNIT
V <sub>IO</sub>	Input offset voltage	V <sub>CC</sub> = 5 V to MAX, V <sub>O</sub> = 1.4 V V <sub>IC</sub> = V <sub>ICRmin</sub> ,	25°C	3		7	mV
			Full range			9	
I <sub>IO</sub>	Input offset current	V <sub>O</sub> = 1.4 V	25°C	2		50	nA
			Full range			150	
I <sub>IB</sub>	Input bias current	V <sub>O</sub> = 1.4 V	25°C	–20		–250	nA
			Full range			–500	
V <sub>ICR</sub>	Common-mode input voltage range	V <sub>CC</sub> = 5 V to MAX	25°C	0 to V <sub>CC</sub> –1.5			V
			Full range	0 to V <sub>CC</sub> –2			
V <sub>OH</sub>	High-level output voltage	R <sub>L</sub> = 2 kΩ	25°C	V <sub>CC</sub> –1.5			V
		V <sub>CC</sub> = MAX, R <sub>L</sub> = 2 kΩ	Full range	26			
		V <sub>CC</sub> = MAX, R <sub>L</sub> ≥ 10 kΩ	Full range	27	28		
V <sub>OL</sub>	Low-level output voltage	R <sub>L</sub> ≤ 10 kΩ	Full range	5		20	mV
A <sub>VD</sub>	Large-signal differential voltage amplification	V <sub>CC</sub> = 15 V, V <sub>O</sub> = 1 V to 11 V, R <sub>L</sub> = ≥ 2 kΩ	25°C	25	100		V/mV
			Full range	15			
CMRR	Common-mode rejection ratio	V <sub>IC</sub> = V <sub>ICRmin</sub>	25°C	65	80		dB
k <sub>SVR</sub>	Supply-voltage rejection ratio (ΔV <sub>CC</sub> /ΔV <sub>IO</sub> )		25°C	65	100		dB
V <sub>O1</sub> /V <sub>O2</sub>	Crosstalk attenuation	f = 1 kHz to 20 kHz	25°C	120			dB
I <sub>O</sub>	Output current	V <sub>CC</sub> = 15 V, V <sub>O</sub> = 0	25°C	–20	–30	–60	mA
			Full range	–10			
		V <sub>CC</sub> = 15 V, V <sub>O</sub> = 15 V	25°C	10	20		
			Full range	5			
		V <sub>ID</sub> = –1 V, V <sub>O</sub> = 200 mV	25°C	12	30		μA
I <sub>OS</sub>	Short-circuit output current	V <sub>O</sub> = 0, GND = –5 V	25°C	±40	±60		mA
I <sub>CC</sub>	Supply current (eight amplifiers)	V <sub>O</sub> = 2.5 V, No load	Full range	1.4	2.4		mA
		V <sub>CC</sub> = MAX, V <sub>O</sub> = 0.5 V <sub>CC</sub> , No load	Full range	2.2	6		

† All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. MAX  $V_{CC}$  for testing purposes is 30 V.

‡ Full range is 0°C to 70°C.

§ All typical values are at  $T_A = 25^\circ\text{C}$ .



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