

Quad Operational Amplifier



Rev.1. Jan. 2010.



VSP MIKRON

LM324nd

DESCRIPTION

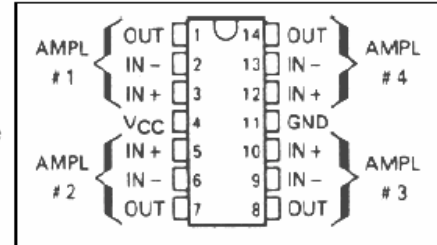
The LM324 consists of four independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits.

FEATURES

- Wide range of supply voltages
- Low supply current drain independent of supply voltage
- Low input biasing current
- Low input offset voltage and offset current
- Input common-mode voltage range includes ground
- Differential input voltage range equal to the power supply voltage
- DC voltage gain 100 V/ mV Typ
- Internally frequency compensation

PACKAGE INFORMATION



ELECTRICAL CHARACTERISTICS

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

PARAMETER	TEST CONDITIONS*	LM324			UNIT
		MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{CC} = 5V$ to MAX, $V_{IC} = V_{ICR}$ min, $V_O = 1.4V$	25 °□ Full range	3	7 9	mV
αV_{IO} Average temperature coefficient of input offset voltage		Full range	7		$\mu V/^\circ C$
I_{IO} Input offset current	$V_O = 1.4V$	25 ° □ Full range	2	50 150	nA
αI_{IO} Average temperature coefficient of input offset current		Full range	10		$pA/^\circ C$
I_{IB} Input bias current	$V_O = 1.4V$	25 °□ Full range	-20	-250 -500	nA
V_{ICR} Common-mode input voltage range	$V_{CC} = 5V$ to MAX	25 °□ Full range	0 to $V_{CC} - 1.5$		V
V_{OH} High-level output voltage	$R_L = 2\text{ k}\Omega$ $V_{CC} = \text{MAX}, R_L = 2\text{ k}\Omega$ $V_{CC} = \text{MAX}, R_L = 10\text{ k}\Omega$	25 °□ Full range Full range	$V_{CC} - 1.5$ 26 27		V
V_{OL} Low-level output voltage	$R_L = 10\text{ k}\Omega$	Full range		5 20	mV
A_{VD} Large-signal differential voltage amplification	$V_{CC} = 15\text{ V},$ $V_O = 1V$ to 11 V, $R_L \geq 2\text{ k}\Omega$	25 °□ Full range	25 15	100	V/mV
CMRR Common-mode rejection ratio	$V_{CC} = 5V$ to MAX, $V_{IC} = V_{ICR}$ 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_{O1}/V_{O2} Crosstalk attenuation	$f = 1\text{ kHz}$ to 20 kHz	25 °□		120	dB
I_O Output current	$V_{CC} = 15\text{ V},$ $V_{IP} = 1V, V_O = 0$ $V_{CC} = 15\text{ V},$ $V_{ID} = -1V, V_O = 15V$ $V_{ID} = -1V, V_O = 200\text{ mV}$	25 °□ Full range 25 °□ Full range 25 °C	-20 -10 10 5 12	-30 20	mA μA
I_{OS} Short-circuit output current	V_{CC} at 5 V, GND at -5V, $V_O = 0$	25 °□		± 40 ± 60	mA
I_{CC} Supply current (four amplifiers)	$V_O = 2.5\text{ V},$ No load $V_{CC} = \text{MAX}, V_O = 0.5V_{CC},$ No load	Full range Full range		1.5 1.1 2.4 3	mA

* 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 °□ to 70 °□

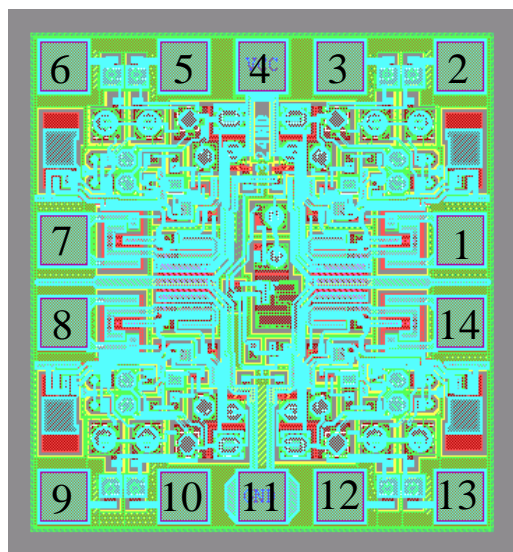
Quad Operational Amplifier



VSP MIKRON

LM324nd

Pad Location



Wafer Thickness: $460 \pm 30 \mu\text{m}$ (or $350 \pm 30 \mu\text{m}$, $280 \pm 30 \mu\text{m}$)

Top metal: AlSi

Backside metal: - (or Ti-Ni (V)-Ag)

Wafer size: 100 mm

Chip size: 0,98 x 1,0 mm

PAD LOCATION COORDINATES

Pad N	Pad Name	Pad size ($\mu\text{m} \times \mu\text{m}$)	Coordinates, μm		Pad N	Pad Name	Pad size ($\mu\text{m} \times \mu\text{m}$)	Coordinates, μm	
			X	Y				X	Y
1	1 OUT	88 x 88	870	575	8	3 OUT	88 x 88	110	425
2	1 IN -	88 x 88	870	890	9	3 IN -	88 x 88	110	110
3	1 IN +	88 x 88	640	890	10	3 IN +	88 x 88	340	110
4	V _{CC}	88 x 88	490	890	11	GND	88 x 88	490	110
5	2 IN -	88 x 88	340	890	12	4 IN -	88 x 88	640	110
6	2 IN +	88 x 88	110	890	13	4 IN +	88 x 88	870	110
7	2 OUT	88 x 88	110	575	14	4 OUT	88 x 88	870	425