

LM124, LM124A, LM224, LM224A, LM324, LM324A, LM2902, LM2902V, LM224K, LM224KA, LM324K, LM324KA, LM2902K, LM2902KV, LM2902KAV QUADRUPLE OPERATIONAL AMPLIFIERS

SLOS066R – SEPTEMBER 1975 – REVISED JANUARY 2005

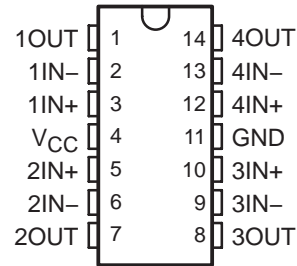
- **2-kV ESD Protection for:**
 - LM224K, LM224KA
 - LM324K, LM324KA
 - LM2902K, LM2902KV, LM2902KAV
- **Wide Supply Ranges**
 - Single Supply . . . 3 V to 32 V
(26 V for LM2902)
 - Dual Supplies . . . ± 1.5 V to ± 16 V
(± 13 V for LM2902)
- **Low Supply-Current Drain Independent of Supply Voltage . . . 0.8 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
A Versions . . . 2 mV Typ
 - Input Offset Current . . . 2 nA Typ
 - Input Bias Current . . . 20 nA Typ
A Versions . . . 15 nA Typ
- **Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage . . . 32 V (26 V for LM2902)**
- **Open-Loop Differential Voltage Amplification . . . 100 V/mV Typ**
- **Internal Frequency Compensation**

description/ordering information

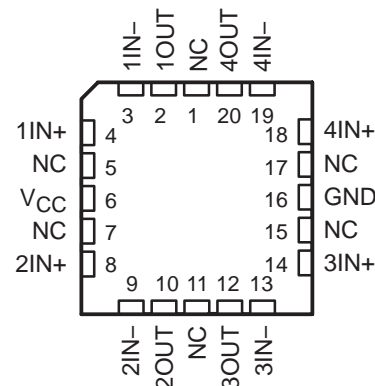
These devices consist of four independent high-gain frequency-compensated operational amplifiers that are designed specifically to operate from a single supply over a wide range of voltages. Operation from split supplies also is possible if the difference between the two supplies is 3 V to 32 V (3 V to 26 V for the LM2902), 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. For example, the LM124 can be operated directly from the standard 5-V supply that is used in digital systems and provides the required interface electronics, without requiring additional ± 15 -V supplies.

LM124 . . . D, J, OR W PACKAGE
LM124A . . . J PACKAGE
LM224, LM224A, LM224K, LM224KA . . . D OR N PACKAGE
LM324, LM324K . . . D, N, NS, OR PW PACKAGE
LM324A . . . D, DB, N, NS, OR PW PACKAGE
LM324KA . . . D, N, NS, OR PW PACKAGE
LM2902 . . . D, N, NS, OR PW PACKAGE
LM2902K . . . D, DB, N, NS, OR PW PACKAGE
LM2902KV, LM2902KAV . . . D OR PW PACKAGE
(TOP VIEW)



LM124, LM124A . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

**LM124, LM124A, LM224, LM224A, LM324, LM324A, LM2902, LM2902V,
LM224K, LM224KA, LM324K, LM324KA, LM2902K, LM2902KV, LM2902KAV
QUADRUPLE OPERATIONAL AMPLIFIERS**

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description/ordering information (continued)

ORDERING INFORMATION

TA	V _{IO} max AT 25°C	MAX TESTED V _{CC}	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING	
0°C to 70°C	7 mV	30 V	PDIP (N)	Tube of 25	LM324N	LM324N	
					LM324KN	LM324KN	
			SOIC (D)	Tube of 50	LM324D	LM324	
					LM324DR		
				Reel of 2500	LM324KD		LM324K
					LM324KDR		
			SOP (NS)	Reel of 2000	LM324NSR	LM324	
				Tube of 50	LM324KNS		LM324K
				Reel of 2000	LM324KNSR		
			TSSOP (PW)	Tube of 90	LM324PW	L324	
				Reel of 2000	LM324PWR		
				Tube of 90	LM324KPW	L324K	
	Reel of 2000	LM324KPWR					
	3 mV	30 V	PDIP (N)	Tube of 25	LM324AN	LM324AN	
				LM324KAN	LM324KAN		
			SOIC (D)	Tube of 50	LM324AD	LM324A	
				Reel of 2500	LM324ADR		
				Tube of 50	LM324KAD		LM324KA
				Reel of 2500	LM324KADR		
			SOP (NS)	Reel of 2000	LM324ANSR	LM324A	
				Tube of 50	LM324KANS		LM324KA
				Reel of 2000	LM324KANSR		
			SSOP (DB)	Reel of 2000	LM324ADBR	LM324A	
			TSSOP (PW)	Tube of 90	LM324APW	L324A	
Reel of 2000				LM324APWR			
Tube of 90	LM324KAPW	L324KA					
Reel of 2000	LM324KAPWR						
-25°C to 85°C	5 mV	30 V	PDIP (N)	Tube of 25	LM224N	LM224N	
					LM224KN	LM224KN	
			SOIC (D)	Tube of 50	LM224D	LM224	
					LM224DR		
				Reel of 2500	LM224KD		LM224K
					LM224KDR		
	3 mV	30 V	PDIP (N)	Tube of 25	LM224AN	LM224AN	
				LM224KAN	LM224KAN		
			SOIC (D)	Tube of 50	LM224AD	LM224A	
				Reel of 2500	LM224ADR		
				Tube of 50	LM224KAD		LM224KA
				Reel of 2500	LM224KADR		

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
LM2902KAVQDR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
LM2902KAVQPWR	ACTIVE	TSSOP	PW	14	2000	TBD	CU NIPDAU	Level-1-250C-UNLIM
LM2902KD	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM2902KDB	ACTIVE	SSOP	DB	14	80	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM2902KDBE4	ACTIVE	SSOP	DB	14	80	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM2902KDBR	ACTIVE	SSOP	DB	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM2902KDBRE4	ACTIVE	SSOP	DB	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM2902KDR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM2902KN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
LM2902KNSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM2902KPW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM2902KPWE4	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM2902KPWR	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM2902KPWRE4	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM2902KVQDR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
LM2902KVQPWR	ACTIVE	TSSOP	PW	14	2000	TBD	CU NIPDAU	Level-1-250C-UNLIM
LM2902N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
LM2902NSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM2902PW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM2902PWLE	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI
LM2902PWR	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM2902QN	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
LM324AD	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324ADBLE	OBSOLETE	SSOP	DB	14		TBD	Call TI	Call TI
LM324ADBR	ACTIVE	SSOP	DB	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324ADBRE4	ACTIVE	SSOP	DB	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324ADR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
LM324ANSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324APW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM324APWE4	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM324APWLE	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI
LM324APWR	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM324APWRE4	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM324D	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324DR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324DRE4	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324KAD	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324KADR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324KAN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
LM324KANS	PREVIEW	SO	NS	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324KANSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324KAPW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM324KAPWR	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM324KD	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324KDR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324KN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
LM324KNS	PREVIEW	SO	NS	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324KNSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM324KPW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM324KPWE4	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM324KPWR	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM324KPWRE4	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM324N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC