

LM148, LM248, LM348
QUADRUPLE OPERATIONAL AMPLIFIERS

T-79-05-40

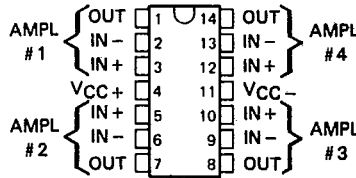
D2551, OCTOBER 1979—REVISED MAY 1988

NOTICE

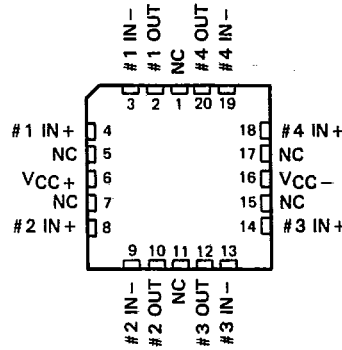
SEE ORDER OF DATA FOR ERRATA INFORMATION

- uA741 Operating Characteristics
- Low Supply Current Drain . . . 0.6 mA Typ (per amplifier)
- Low Input Offset Voltage
- Low Input Offset Current
- Class AB Output Stage
- Input/Output Overload Protection
- Designed to be Interchangeable with National LM148, LM248, and LM348.

LM148 . . . J PACKAGE
LM248, LM348 . . . D, J, OR N PACKAGE
(TOP VIEW)



LM148 . . . FK PACKAGE
(TOP VIEW)



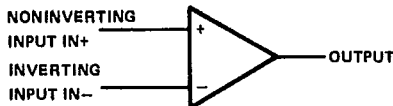
NC—No internal connection

description

The LM148, LM248, and LM348 are quadruple, independent, high-gain, internally compensated operational amplifiers designed to have operating characteristics similar to the uA741. These amplifiers exhibit low supply current drain, and input bias and offset currents that are much less than those of the uA741.

The LM148 is characterized for operation over the full military temperature range of -55°C to 125°C, the LM248 is characterized for operation from -25°C to 85°C, and the LM348 is characterized for operation from 0°C to 70°C.

symbol (each amplifier)



AVAILABLE OPTIONS

T _A	V _{IO} MAX AT 25°C	PACKAGE			
		SMALL OUTLINE (D)	CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)
0°C to 70°C	6 mV	LM348D	—	LM348J	LM348N
-25°C to 85°C	6 mV	LM248D	—	LM248J	LM248N
-55°C to 125°C	5 mV	—	LM148FK	LM148J	—

The D package is available taped and reeled. Add the suffix R to the device type when ordering. (e.g., LM348DR)

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

	LM148	LM248	LM348	UNIT
Supply voltage V_{CC+} (see Note 1)	22	18	18	V
Supply voltage V_{CC-} (see Note 1)	-22	-18	-18	V
Differential input voltage (see Note 2)	44	36	36	V
Input voltage (either input, see Notes 1 and 3)	± 22	± 18	± 18	V
Duration of output short-circuit (see Note 4)	unlimited	unlimited	unlimited	
Continuous total power dissipation	See Dissipation Rating Table			
Operating free-air temperature range	-55 to 125	-25 to 85	0 to 70	°C
Storage temperature range	-65 to 160	-65 to 150	-65 to 150	°C
Case temperature for 60 seconds	FK package			
	260			°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	J package			
	300	300	300	°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	D or N package			
		260	260	°C

- NOTES: 1. All voltage values, except differential voltages, are with respect to the midpoint between V_{CC+} and V_{CC-} .
 2. Differential voltages are at the noninverting input terminal with respect to the inverting terminal.
 3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or the value specified in the table, whichever is less.
 4. The output may be shorted to ground or either power supply. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR	DERATE ABOVE T_A	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
D	900 mW	7.6 mW/°C	32°C	608 mW	494 mW	N/A
FK	900 mW	11.0 mW/°C	68°C	880 mW	715 mW	275 mW
J (LM148)	900 mW	11.0 mW/°C	68°C	880 mW	715 mW	275 mW
J (LM248, LM348)	900 mW	8.2 mW/°C	40°C	656 mW	533 mW	N/A
N	900 mW	9.2 mW/°C	52°C	736 mW	598 mW	N/A

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electrical characteristics, $V_{CC} \pm = \pm 15 V$

PARAMETER	TEST CONDITIONS†	LM148			LM248			LM348			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage $V_O = 0$		25°C	1	5	6	1	6	1	6	mV
			Full range		6	7.5		7.5		7.5	
I_{IO}	Input offset current $V_O = 0$		25°C	4	25	50	4	50	4	50	nA
			Full range		75	125		100		100	
I_{IB}	Input bias current $V_O = 0$		25°C	30	100	200	30	200	30	200	nA
			Full range		325	500		400		400	
V_{ICR}	Common-mode input voltage range		Full range	± 12			± 12		± 12		V
			25°C	± 12	± 13		± 12	± 13	± 12	± 13	
			Full range	± 12			± 12		± 12		V
V_{OM}	Maximum peak output voltage swing		25°C	± 10	± 12		± 10	± 12	± 10	± 12	V
			Full range	± 10			± 10		± 10		
			25°C	50	160	25	15	15	25	160	V/mV
			Full range	25			0.8	2.5	0.8	2.5	MΩ
r_i	Input resistance		25°C	0.8	2.5		0.8	2.5	0.8	2.5	MΩ
B_1	Unity-gain bandwidth		25°C	1			1		1		MHz
ϕ_M	Phase margin		25°C	60°			60°		60°		°
CMRR	Common-mode rejection ratio		25°C	70	90		70	90	70	90	dB
			Full range	70			70		70		
kSVR	Supply voltage rejection ratio ($\Delta V_{CC} \pm / \Delta V_{IO}$)		25°C	77	96		77	96	77	96	dB
			Full range	77			77		77		
I_{OS}	Short-circuit output current		25°C	± 25			± 25		± 25		mA
I_{CC}	Supply current (four amplifiers)	No load $V_O = V_{OM}^{\dagger}$	25°C	2.4	3.6		2.4	4.5	2.4	4.5	mA
V_{O1}/V_{O2}	Crosstalk attenuation	$f = 1 \text{ Hz to } 20 \text{ kHz}$	25°C	120			120		120		dB

† All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. Full range for T_A is -55°C to 125°C for LM148, -25°C to 85°C for LM248, and 0°C to 70°C for LM348.

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operating characteristics, $V_{CC\pm} = \pm 15 \text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SR Slew rate at unity gain	$R_L = 2 \text{ k}\Omega$, $C_L = 100 \text{ pF}$, See Figure 1		0.6		$\text{V}/\mu\text{s}$

PARAMETER MEASUREMENT INFORMATION

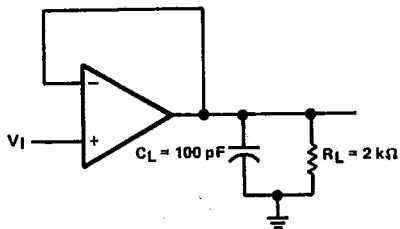
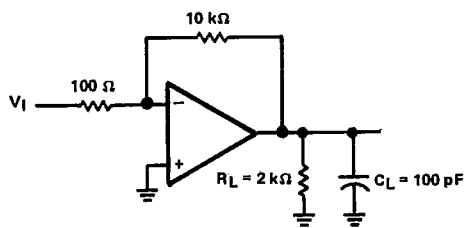


FIGURE 1. UNITY-GAIN AMPLIFIER



$A_{VD} = -100$

FIGURE 2. INVERTING AMPLIFIER