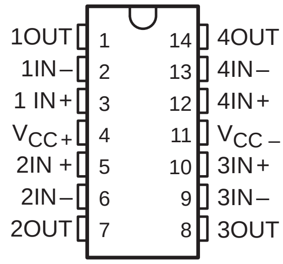
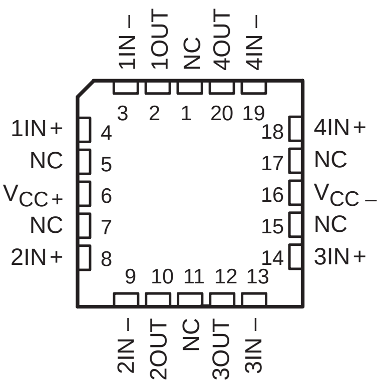
- **μA741 Operating Characteristics**
- **Low Supply Current Drain . . . 0.6 mA Typ (per amplifier)**
- **Low Input Offset Voltage**
- **Low Input Offset Current**
- **Class AB Output Stage**
- **Input/Output Overload Protection**
- **Designed to Be Interchangeable With National LM148, LM248, and LM348**

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



LM148 . . . FK PACKAGE
(TOP VIEW)



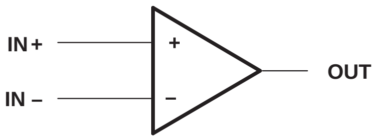
NC – No internal connection

description

The LM148, LM248, and LM348 are quadruple, independent, high-gain, internally compensated operational amplifiers designed to have operating characteristics similar to the μA741. These amplifiers exhibit low supply current drain, and input bias and offset currents that are much less than those of the μA741.

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)	TSSOP (PW)
0°C to 70°C	6 mV	LM348D	—	—	LM348N	LM348PW
–25°C to 85°C	6 mV	LM248D	—	—	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 (e.g., LM348DR).

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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, V_{ID} (see Note 2)		44	36	36	V
Input voltage, V_I (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, T_A		–55 to 125	–25 to 85	0 to 70	°C
Storage temperature range		–65 to 150	–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			°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	D, N, or PW 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 IN+ with respect to IN–.
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	$T_A \le 25°C$ POWER RATING	DERATING FACTOR	DERATE ABOVE T_A	$T_A = 70°C$ POWER RATING	$T_A = 85°C$ POWER RATING	$T_A = 125°C$ POWER RATING
D	900 mW	7.6 mW/°C	32°C	611 mW	497 mW	N/A
FK	900 mW	11.0 mW/°C	68°C	878 mW	713 mW	273 mW
J	900 mW	11.0 mW/°C	68°C	878 mW	713 mW	273 mW
N	900 mW	9.2 mW/°C	52°C	734 mW	596 mW	N/A
PW	700 mW	5.6 mW/°C	N/A	448 mW	N/A	N/A

recommended operating conditions

	MIN	MAX	UNIT
Supply voltage, V_{CC+}	4	18	V
Supply voltage, V_{CC-}	–4	–18	V

electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm15$ V (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		LM148 MIN	LM148 TYP	LM148 MAX	LM248 MIN	LM248 TYP	LM248 MAX	LM348 MIN	LM348 TYP	LM348 MAX	UNIT
V_{IO}	Input offset voltage	$V_O = 0$	25°C		1	5		1	6		1	6	mV
			Full range			6			7.5			7.5	
I_{IO}	Input offset current	$V_O = 0$	25°C		4	25		4	50		4	50	nA
			Full range			75			125			100	
I_{IB}	Input bias current	$V_O = 0$	25°C		30	100		30	200		30	200	nA
			Full range			325			500			400	
V_{ICR}	Common-mode input voltage range		Full range	±12			±12			±12			V
V_{OM}	Maximum peak output voltage swing	$R_L = 10\ k\Omega$	25°C	±12	±13		±12	±13		±12	±13		V
		$R_L \geq 10\ k\Omega$	Full range	±12			±12			±12			
		$R_L = 2\ k\Omega$	25°C	±10	±12		±10	±12		±10	±12		
		$R_L \geq 2\ k\Omega$	Full range	±10			±10			±10			
A_{VD}	Large-signal differential voltage amplification	$V_O = \pm10$ V, $R_L = \geq 2\ k\Omega$	25°C	50	160		25	160		25	160		V/mV
			Full range	25			15			15			
r_i	Input resistance‡		25°C	0.8	2.5		0.8	2.5		0.8	2.5		MΩ
B_1	Unity-gain bandwidth	$A_{VD} = 1$	25°C		1			1			1		MHz
ϕ_m	Phase margin	$A_{VD} = 1$	25°C		60°			60°			60°		
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR}min$, $V_O = 0$	25°C	70	90		70	90		70	90		dB
			Full range	70			70			70			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 9$ V to ± 15 V, $V_O = 0$	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, $V_O = 0$	25°C					2.4	4.5		2.4	4.5	mA
		No load, $V_O = V_{OM}$			2.4	3.6							
V_{O1}/V_{O2}	Crosstalk attenuation	f = 1 Hz to 20 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.
‡ This parameter is not production tested.

operating characteristics, $V_{CC\pm} = \pm15$ V, $T_A = 25°C$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	$R_L = 2\ k\Omega$, $C_L = 100$ pF, See Figure 1		0.5		V/µs

PARAMETER MEASUREMENT INFORMATION

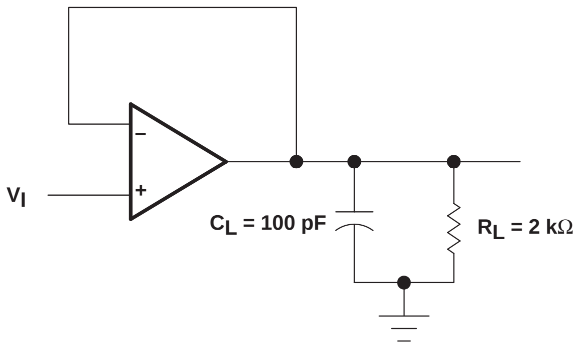


Figure 1. Unity-Gain Amplifier

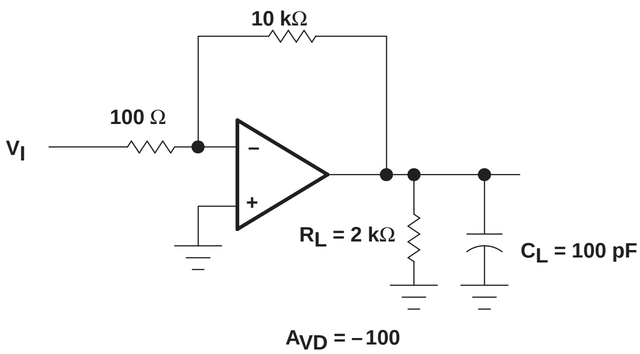


Figure 2. Inverting Amplifier

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