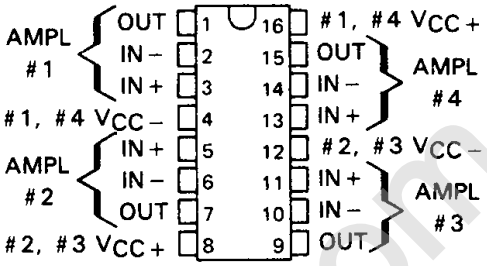
D1662, SEPTEMBER 1973—REVISED JUNE 1988

- Very Low Power Consumption
- Typical Power Dissipation with ±2-V Supplies . . . 340 μW
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- Low Input Offset Voltage
- Internal Frequency Compensation
- Latch-Up-Free Operation
- Power Applied in Pairs

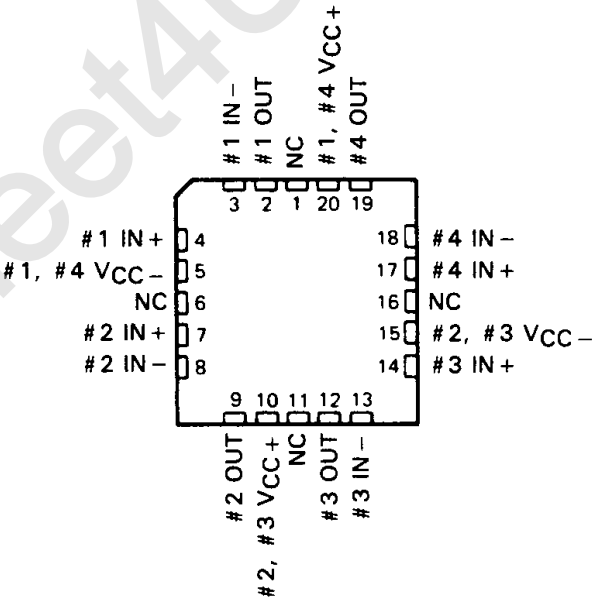
TL044M IS NOT RECOMMENDED FOR NEW DESIGNS.

TL044M . . . J OR W DUAL-IN-LINE PACKAGE
TL044C . . . J OR N PACKAGE
(TOP VIEW)



Pins 4 and 12 are internally connected together in the N package only.

TL044M . . . FK PACKAGE
(TOP VIEW)



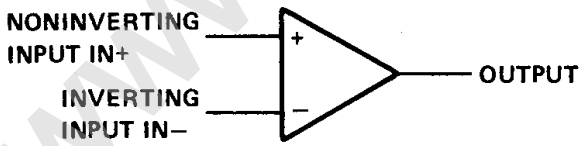
NC—No internal connection

description

The TL044 is a quad low-power operational amplifier designed to replace higher-power devices in many applications without sacrificing system performance. High input impedance, low supply currents, and low equivalent input noise voltage over a wide range of operating supply voltages result in an extremely versatile operational amplifier for use in a variety of analog applications including battery-operated circuits. Internal frequency compensation, absence of latch-up, high slew rate, and output short-circuit protection assure ease of use. Power may be applied separately to Section A (amplifiers 1 and 4) or Section B (amplifiers 2 and 3) while the other pair remains unpowered.

The TL044M is characterized for operation over the full military temperature range of −55°C to 125°C; the TL044C is characterized for operation from 0°C to 70°C.

symbol (each amplifier)



AVAILABLE OPTIONS

T_A	V_{IO} MAX AT 25°C	PACKAGE			
		CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)	FLAT PACK (W)
0°C to 70°C	5 mV	—	TL044CJ	TL044CN	—
−55°C to 125°C	5 mV	TL044MFK	TL044MJ	—	TL044MW

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

		TL044M	TL044C	UNIT
Supply voltage V_{CC+} (see Note 1)		22	18	V
Supply voltage V_{CC-} (see Note 1)		−22	−18	V
Differential input voltage (see Note 2)		±30	±30	V
Input voltage (any input, see Notes 1 and 3)		±15	±15	V
Duration of output short-circuit (see Note 4)		unlimited	unlimited	
Continuous total dissipation		See Dissipation Rating Table		
Operating free-air temperature range		−55 to 125	0 to 70	°C
Storage temperature range		−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 or W package	300	300	°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	N package		260	°C

NOTES: 1. All voltage values, unless otherwise noted, 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 input terminal.
3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.
4. The output may be shorted to ground or either power supply. For the TL044M only, the unlimited duration of the short-circuit applies at (or below) 125°C case temperature or 85°C free-air temperature.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25°C$ POWER RATING	DERATING FACTOR	DERATE ABOVE T_A	$T_A = 70°C$ POWER RATING	$T_A = 125°C$ POWER RATING
FK	680 mW	11.0 mW/°C	88°C	680 mW	275 mW
J (TL044M)	680 mW	11.0 mW/°C	88°C	680 mW	275 mW
J (TL044C)	680 mW	8.2 mW/°C	67°C	656 mW	—
N	680 mW	N/A	N/A	680 mW	—
W	680 mW	8.0 mW/°C	65°C	640 mW	200 mW

electrical characteristics at specified free-air temperature, V_{CC+} = 15 V, V_{CC-} = −15 V

PARAMETER		TEST CONDITIONS†		TL044M			TL044C			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_O = 0, R_S = 50 Ω	25°C		1	5		1	5	mV
			Full range			6			7.5	
I_{IO}	Input offset current	V_O = 0	25°C		5	40		15	80	nA
			Full range			100			200	
I_{IB}	Input bias current	V_O = 0	25°C		50	100		100	250	nA
			Full range			250			400	
V_{ICR}	Common-mode input voltage range		25°C	±12	±13		±12	±13		V
			Full range	±12			±12			
V_{OPP}	Maximum peak-to-peak output voltage swing	R_L = 10 kΩ	25°C	20	26		20	26		V
		R_L ≥ 10 kΩ	Full range	20			20			
A_{VD}	Large-signal differential voltage amplification	R_L ≥ 10 kΩ, V_O = ±10 V	25°C	72	86		60	80		dB
			Full range	66			60			
B_1	Unity-gain bandwidth		25°C		0.5			0.5		MHz
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR} min, V_O = 0, R_S = 50 Ω	25°C	60	72		60	72		dB
			Full range	60			60			
k_{SVS}	Supply voltage sensitivity ($\Delta V_{IO}/\Delta V_{CC}$)	V_{CC} = ±9 V to ±15 V, V_O = 0, R_S = 50 Ω	25°C		30	150		30	200	μV/V
			Full range			150			200	
V_n	Equivalent input noise voltage	A_{VD} = 20 dB, B = 1 Hz, f = 1 kHz	25°C		50			50		nV/√Hz
I_{OS}	Short-circuit output current		25°C		±6			±6		mA
I_{CC}	Supply current (four amplifiers)	No load, V_O = 0 V	25°C		250	400		250	500	μA
			Full range			400			500	
P_D	Total dissipation (four amplifiers)	No load, V_O = 0 V	25°C		7.5	12		7.5	15	mW
			Full range			12			15	

†All characteristics are measured under open-loop conditions with zero common-mode input voltage, unless otherwise specified. Full range for TL044M is −55°C to 125°C and for TL044C is 0°C to 70°C.

operating characteristics, V_{CC+} = 15 V, V_{CC-} = −15 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		TL044M			TL044C			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
t_r	Rise time	V_I = 20 mV, C_L = 100 pF,	R_L = 10 kΩ, See Figure 1		0.3			0.3		μs
	Overshoot factor				5%			5%		
SR	Slew rate at unity gain	V_I = 10 V, C_L = 100 pF,	R_L = 10 kΩ, See Figure 1		0.5			0.5		V/μs