

LINEAR INTEGRATED CIRCUITS

TYPES TL044M, TL044C QUAD LOW-POWER OPERATIONAL AMPLIFIERS

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FORMERLY SN52L044, SN72L044

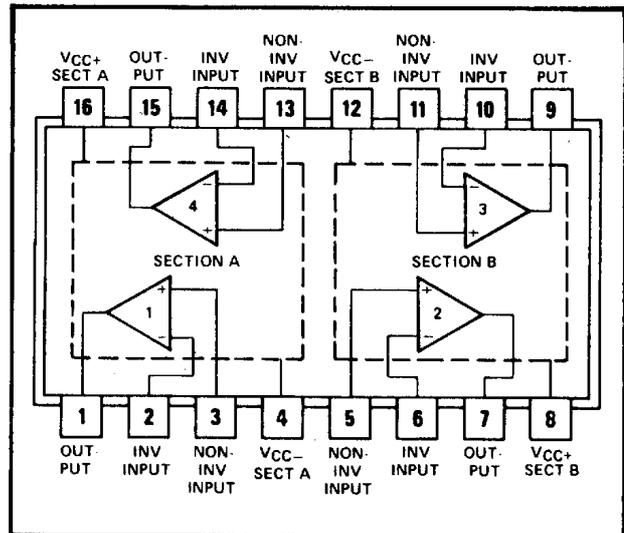
- Very Low Power Consumption
- Typical Power Dissipation with ± 2 -V Supplies . . . 340 μ W
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- Low Input Offset Voltage
- Internal Frequency Compensation
- Latch-Up-Free Operation
- Power Applied in Pairs

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 .

J OR N
DUAL-IN-LINE PACKAGE (TOP VIEW)



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

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 at (or below) 25°C free-air temperature range (see Note 5)	Each amplifier	500	mW
	Total package	680	
Operating free-air temperature range	-55 to 125	0 to 70	$^{\circ}\text{C}$
Storage temperature range	-65 to 150	-65 to 150	$^{\circ}\text{C}$
Lead temperature $1/16$ inch from case for 60 seconds	J Package	300	$^{\circ}\text{C}$
Lead temperature $1/16$ inch from case for 10 seconds	N Package	260	$^{\circ}\text{C}$

- NOTES: 1. All voltage values, unless otherwise noted, are with respect to the zero-reference level (ground) of the supply voltage where the zero-reference level is the midpoint between V_{CC+} and V_{CC-} . If the zero-reference level of the system is not the midpoint of the supply voltages, all voltage values must be changed accordingly.
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 volts, 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 75°C free-air temperature.
5. For operation above 25°C free-air temperature, refer to Dissipation Derating Curves, Section 2.

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

PARAMETER	TEST CONDITIONS†	TL044M			TL044C			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$R_S < 10\text{ k}\Omega$	25°C	1	5	1	5	mV	
		Full range		6		7.5		
I_{IO} Input offset current		25°C	5	40	15	80	nA	
		Full range		100		200		
I_{IB} Input bias current		25°C	50	100	100	250	nA	
		Full range		250		400		
V_I Input voltage range		25°C	±12	±13	±12	±13	V	
		Full range	±12		±12			
V_{OPP} Maximum peak-to-peak output voltage swing	$R_L = 10\text{ k}\Omega$	25°C	20	26	20	26	V	
	$R_L \geq 10\text{ k}\Omega$	Full range	20		20			
A_{VD} Large-signal differential voltage amplification	$R_L \geq 10\text{ k}\Omega$, $V_O = \pm 10\text{ V}$	25°C	72	86	60	80	dB	
		Full range	72		60			
B_1 Unity-gain bandwidth		25°C	0.8		0.8	MHz		
CMRR Common-mode rejection ratio	$R_S < 10\text{ k}\Omega$	25°C	60	72	60	72	dB	
		Full range	60		60			
$\Delta V_{IO}/\Delta V_{CC}$ Supply voltage sensitivity	$R_S < 10\text{ k}\Omega$	25°C	30	150	30	200	$\mu\text{V/V}$	
		Full range		150		200		
V_n Equivalent input noise voltage	$A_{VD} = 20\text{ dB}$, $B = 1\text{ Hz}$, $f = 1\text{ kHz}$	25°C	50		50	$\text{nV}/\sqrt{\text{Hz}}$		
I_{OS} Short-circuit output current		25°C	±6		±6	mA		
I_{CC} Supply current (Four amplifiers)	No load, No signal	25°C	250	400	250	500	μA	
		Full range		400		500		
P_D Total dissipation (Four amplifiers)	No load, No signal	25°C	7.5	12	7.5	15	mW	
		Full range		12		15		

†All characteristics are specified under open-loop operation, unless otherwise noted. Full range for TL044M is -55°C to 125°C and for TL044C is 0°C to 70°C .

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

PARAMETER	TEST CONDITIONS	TL044M			TL044C			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
t_r Rise time	$V_I = 20\text{ mV}$, $R_L = 10\text{ k}\Omega$,	0.3			0.3			μs
	$C_L = 100\text{ pF}$, See Figure 1	5%			5%			
SR Slew rate at unity gain	$V_I = 10\text{ V}$, $R_L = 10\text{ k}\Omega$, $C_L = 100\text{ pF}$, See Figure 1	0.5			0.5			$\text{V}/\mu\text{s}$

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PARAMETER MEASUREMENT INFORMATION

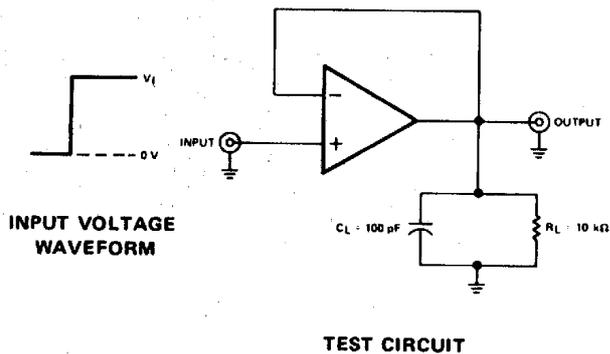


FIGURE 1—RISE TIME, OVERSHOOT FACTOR, AND SLEW RATE

TYPICAL CHARACTERISTICS

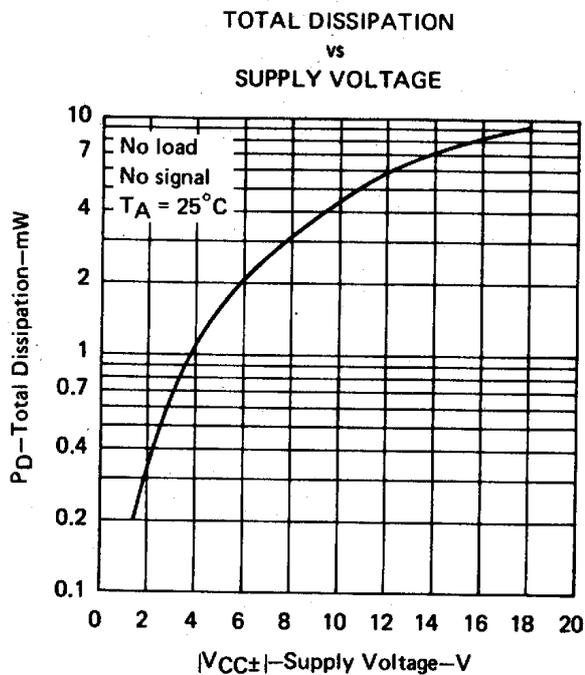


FIGURE 2

schematic (each section)

