

# TL022C, TL022M DUAL LOW-POWER OPERATIONAL AMPLIFIERS

SLOS076 – SEPTEMBER 1973 – REVISED SEPTEMBER 1990

- Very Low Power Consumption
- Power Dissipation With  $\pm 2$ -V Supplies  
170  $\mu$ W Typ
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- Low Input Offset Voltage
- Internal Frequency Compensation
- Latch-Up-Free Operation
- Popular Dual Operational Amplifier Pinout

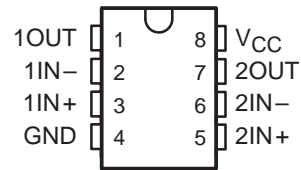
**TL022M IS NOT RECOMMENDED FOR  
NEW DESIGNS**

## description

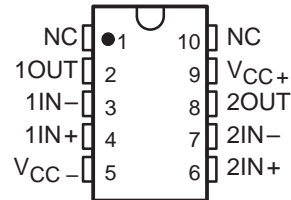
The TL022 is a dual low-power operational amplifier designed to replace higher power devices in many applications without sacrificing system performance. High input impedance, low supply currents, and low equivalent input noise voltage over a wide range of operating supply voltages result in an extremely 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.

The TL022C is characterized for operation from 0°C to 70°C. The TL022M is characterized for operation over the full military temperature range of -55°C to 125°C.

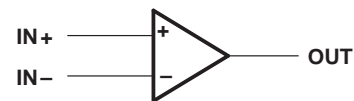
TL022M . . . JG PACKAGE  
TL022C . . . D OR P PACKAGE  
(TOP VIEW)



TL022M . . . U PACKAGE  
(TOP VIEW)



## symbol (each amplifier)



## AVAILABLE OPTIONS

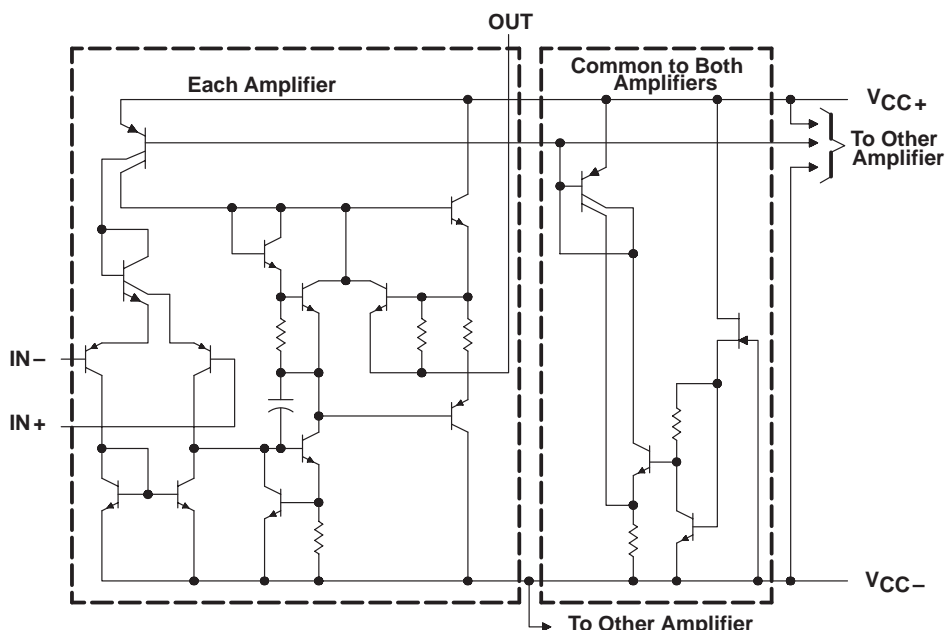
T <sub>A</sub>	V <sub>IO</sub> max AT 25°C	PACKAGE			
		SMALL OUTLINE (D)	CERAMIC DIP (JG)	PLASTIC DIP (P)	CERAMIC FLAT PACK (U)
0°C to 70°C	5 mV	TL022CD	—	TL022CP	—
-55°C to 125°C	5 mV	—	TL022MJG	—	TL022MU

The D package is available taped and reeled. Add the suffix R to the device type (i.e. TL022CDR).

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## schematic



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

	TL022C	TL022M	UNIT
Supply voltage, $V_{CC+}$ (see Note 1)	18	22	V
Supply voltage, $V_{CC-}$ (see Note 1)	-18	-22	V
Differential input voltage (see Note 2)	$\pm 30$	$\pm 30$	V
Input voltage (any input, see Notes 1 and 3)	$\pm 15$	$\pm 15$	V
Duration of output short circuit (see Note 4)	unlimited	unlimited	
Continuous total dissipation	See Dissipation Rating Table		
Operating free-air temperature range	0 to 70	-55 to 125	$^{\circ}\text{C}$
Storage temperature range	-65 to 150	-65 to 150	$^{\circ}\text{C}$
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	JG or U package	300	$^{\circ}\text{C}$
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	D or P package	260	$^{\circ}\text{C}$

- 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  $\text{IN}+$  with respect to  $\text{IN}-$ .  
 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 TL022M only, the unlimited duration of the short circuit applies at (or below) 125 $^{\circ}\text{C}$  case temperature or 75 $^{\circ}\text{C}$  free-air temperature.

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	$T_A = 125^{\circ}\text{C}$ POWER RATING
D	680 mW	5.8 mW/ $^{\circ}\text{C}$	33 $^{\circ}\text{C}$	464 mW	—
JG	680 mW	8.4 mW/ $^{\circ}\text{C}$	69 $^{\circ}\text{C}$	672 mW	210 mW
P	680 mW	8.0 mW/ $^{\circ}\text{C}$	65 $^{\circ}\text{C}$	640 mW	—
U	675 mW	5.4 mW/ $^{\circ}\text{C}$	25 $^{\circ}\text{C}$	432 mW	135 mW



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## recommended operating conditions

	MIN	MAX	UNIT
Supply voltage, $V_{CC+}$	5	15	V
Supply voltage, $V_{CC-}$	-5	-15	V

## electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	TL022C			TL022M			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_O = 0$ , $R_S = 50 \Omega$	25°C	1	5	1	5	mV	
		Full range		7.5		6		
$I_{IO}$ Input offset current	$V_O = 0$	25°C	15	80	5	40	nA	
		Full range		200		100		
$I_{IB}$ Input bias current	$V_O = 0$	25°C	100	250	50	100	nA	
		Full range		400		250		
$V_{ICR}$ Common-mode input voltage range		25°C	$\pm 12$	$\pm 13$	$\pm 12$	$\pm 13$	V	
		Full range	$\pm 12$		$\pm 12$			
$V_{O(PP)}$ 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	60	80	72	86	dB	
		Full range	60		66			
$B_1$ Unity-gain bandwidth		25°C	0.5		0.5		MHz	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$ , $R_S = 50 \Omega$	25°C	60	72	60	72	dB	
		Full range	60		60			
$k_{SVS}$ Supply voltage sensitivity ( $\Delta V_{IO}/\Delta V_{CC}$ )	$V_{CC} = \pm 9 \text{ V to } \pm 15 \text{ V}$ , $R_S = 50 \Omega$	25°C	30	200	30	150	$\mu\text{V/V}$	
		Full range		200		150		
$V_n$ Equivalent input noise voltage	$A_{VD} = 20 \text{ dB}$ , $B = 1 \text{ Hz}$ , $f = 1 \text{ kHz}$	25°C	50		50		nV/Hz	
$I_{OS}$ Short-circuit output current		25°C	$\pm 6$		$\pm 6$		mA	
$I_{CC}$ Supply current (both amplifiers)	$V_O = 0$ , No load	25°C	130	250	130	250	$\mu\text{A}$	
		Full range		250		250		
$P_D$ Total dissipation (both amplifiers)	$V_O = 0$ , No load	25°C	3.9	7.5	3.9	6	mW	
		Full range		7.5		6		

† All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. Full range for TL022C is 0°C to 70°C and for TL022M is -55°C to 125°C.

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_r$ Rise time	$V_I = 20 \text{ mV}$ , $R_L = 10 \text{ k}\Omega$ , $C_L = 100 \text{ pF}$ , See Figure 1		0.3		$\mu\text{s}$
Overshoot factor			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		V/ $\mu\text{s}$



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## PARAMETER MEASUREMENT INFORMATION

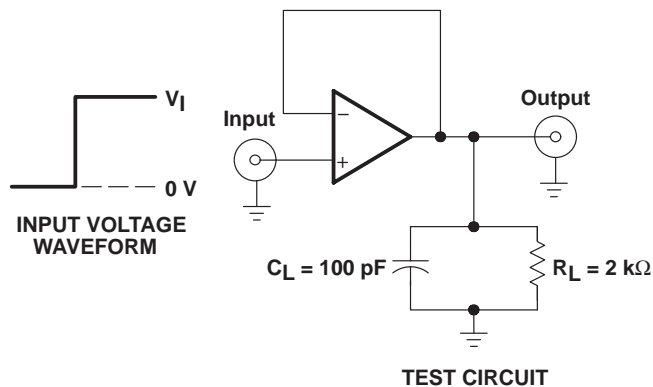


Figure 1. Rise Time, Overshoot Factor, and Slew Rate

## TYPICAL CHARACTERISTICS

TOTAL POWER DISSIPATION  
vs  
SUPPLY RATE

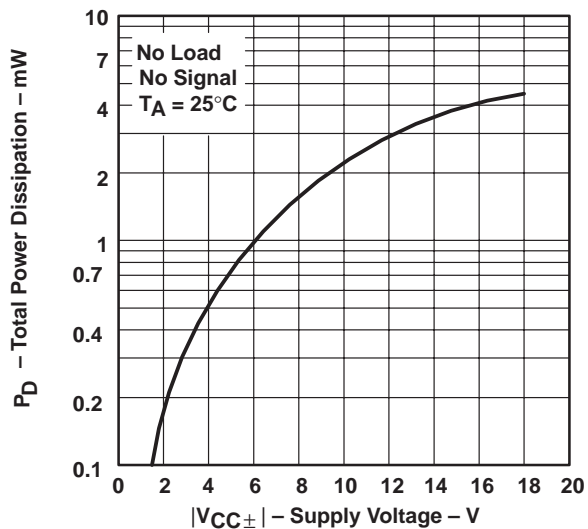


Figure 2

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