

TL022C, TL022M DUAL LOW-POWER OPERATIONAL AMPLIFIERS

SLOS076 – SEPTEMBER 1973 – REVISED SEPTEMBER 1990

- Very Low Power Consumption
- Power Dissipation With ± 2 -V Supplies
170 μ 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

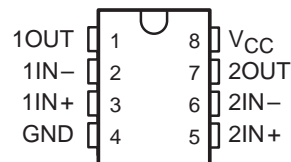
**TL022M IS NOT RECOMMENDED FOR
NEW DESIGNS**

description

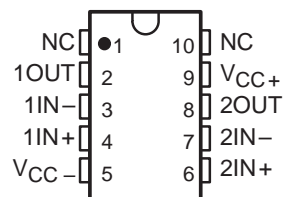
The TL022 is a dual low-power operational amplifier designed to replace higher power devices in many applications without sacrificing system performance. High input impedance, low supply currents, and low equivalent input noise voltage over a wide range of operating supply voltages result in an extremely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

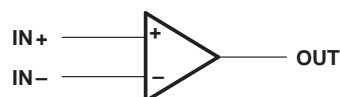
TL022M . . . JG PACKAGE
TL022C . . . D OR P PACKAGE
(TOP VIEW)



TL022M . . . U PACKAGE
(TOP VIEW)



symbol (each amplifier)



AVAILABLE OPTIONS

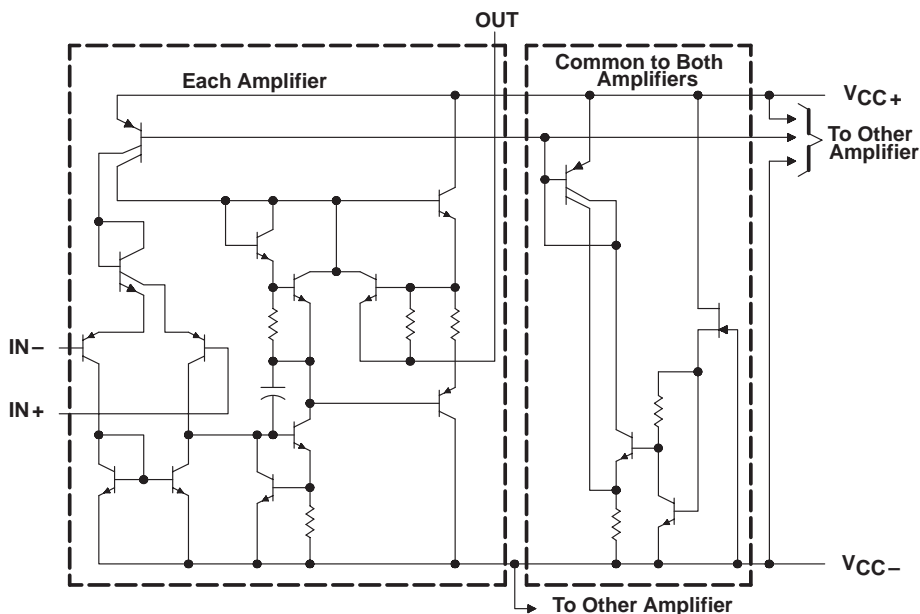
T _A	V _{I0} max AT 25°C	PACKAGE			
		SMALL OUTLINE (D)	CERAMIC DIP (JG)	PLASTIC DIP (P)	CERAMIC FLAT PACK (U)
0°C to 70°C	5 mV	TL022CD	—	TL022CP	—
-55°C to 125°C	5 mV	—	TL022MJG	—	TL022MU

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

TL022C, TL022M DUAL LOW-POWER OPERATIONAL AMPLIFIERS

SLOS076 – SEPTEMBER 1973 – REVISED SEPTEMBER 1990

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)	± 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	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
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	D or P package		260

- 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°C case temperature or 75°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°C	464 mW	—
JG	680 mW	8.4 mW/ $^{\circ}\text{C}$	69°C	672 mW	210 mW
P	680 mW	8.0 mW/ $^{\circ}\text{C}$	65°C	640 mW	—
U	675 mW	5.4 mW/ $^{\circ}\text{C}$	25°C	432 mW	135 mW



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

TL022C, TL022M DUAL LOW-POWER OPERATIONAL AMPLIFIERS

SLOS076 – SEPTEMBER 1973 – REVISED SEPTEMBER 1990

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	±12	±13	±12	±13	V	
		Full range	±12			±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	±6		±6		mA	
I_{CC} Supply current (both amplifiers)	$V_O = 0$, No load	25°C	130	250	130	250	μA	
		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			μs
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/ μs



TL022C, TL022M DUAL LOW-POWER OPERATIONAL AMPLIFIERS

SLOS076 – SEPTEMBER 1973 – REVISED SEPTEMBER 1990

PARAMETER MEASUREMENT INFORMATION

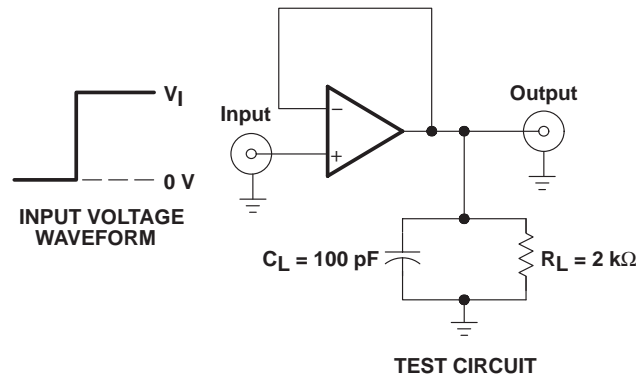


Figure 1. Rise Time, Overshoot Factor, and Slew Rate

TYPICAL CHARACTERISTICS

TOTAL POWER DISSIPATION vs SUPPLY RATE

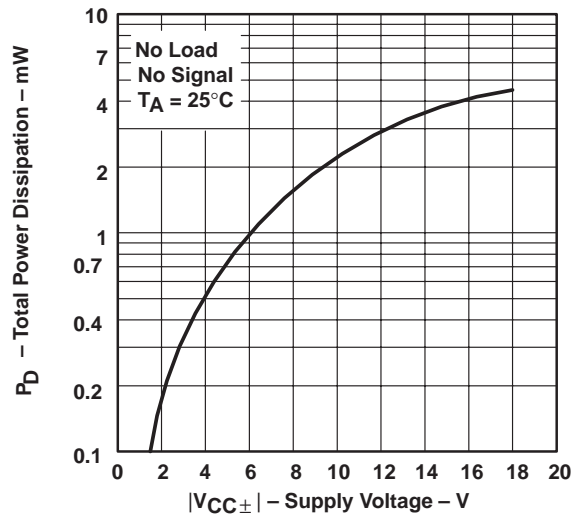


Figure 2

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.