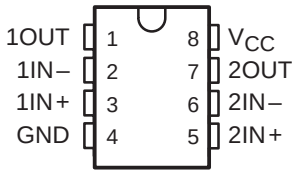
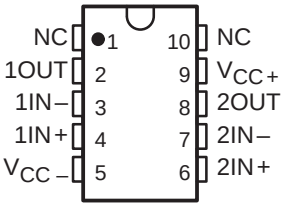
- **Very Low Power Consumption**
- **Power Dissipation With ±2-V Supplies 170 μW Typ**
- **Low Input Bias and Offset Currents**
- **Output Short-Circuit Protection**
- **Low Input Offset Voltage**
- **Internal Frequency Compensation**
- **Latch-Up-Free Operation**
- **Popular Dual Operational Amplifier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

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



TL022M . . . U PACKAGE
(TOP VIEW)

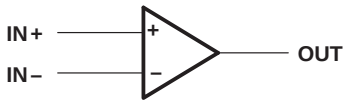


TL022M IS NOT RECOMMENDED FOR NEW DESIGNS

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.

symbol (each amplifier)



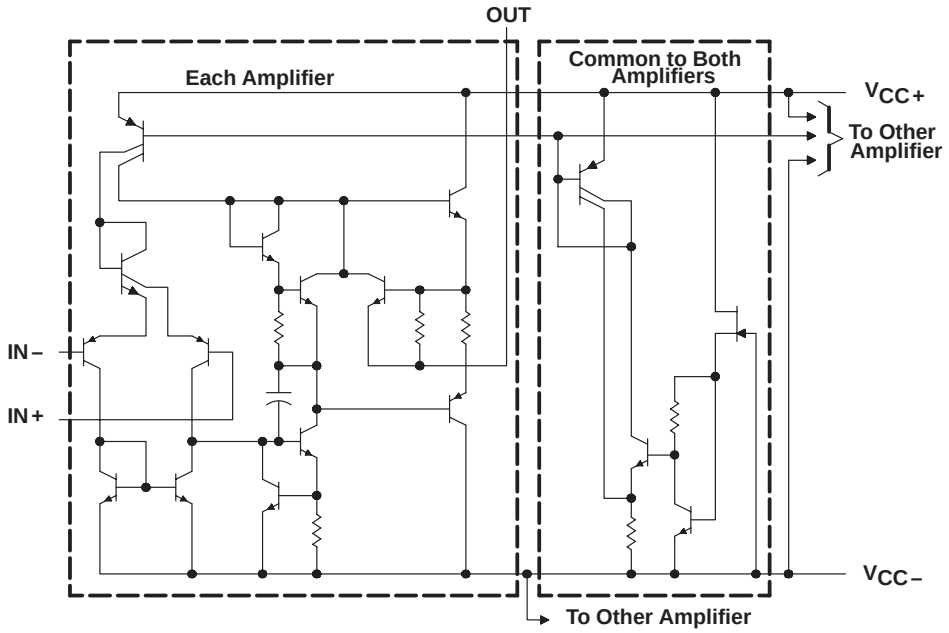
The TL022C is characterized for operation from 0°C to 70°C. The TL022M is characterized for operation over the full military temperature range of –55°C to 125°C.

AVAILABLE OPTIONS

T_A	V_{IO}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).

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	°C
Storage temperature range		–65 to 150	–65 to 150	°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	JG or U package		300	°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	D or P 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 IN+ with respect to 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	$T_A \le 25°C$ POWER RATING	DERATING FACTOR	DERATE ABOVE T_A	$T_A = 70°C$ POWER RATING	$T_A = 125°C$ POWER RATING
D	680 mW	5.8 mW/°C	33°C	464 mW	—
JG	680 mW	8.4 mW/°C	69°C	672 mW	210 mW
P	680 mW	8.0 mW/°C	65°C	640 mW	—
U	675 mW	5.4 mW/°C	25°C	432 mW	135 mW

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, $V_{CC\pm}$ = ±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 Ω	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 kΩ	25°C	20	26		20	26		V
		R_L ≥ 10 kΩ	Full range	20			20			
A_{VD}	Large-signal differehtial voltage amplification	R_L ≥ 10 kΩ, V_O = ±10 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_{ICR}min, 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, R_S = 50 Ω	25°C		30	200		30	150	μV/V
			Full range			200			150	
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 (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, $V_{CC\pm}$ = ±15 V, T_A = 25°C

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

PARAMETER MEASUREMENT INFORMATION

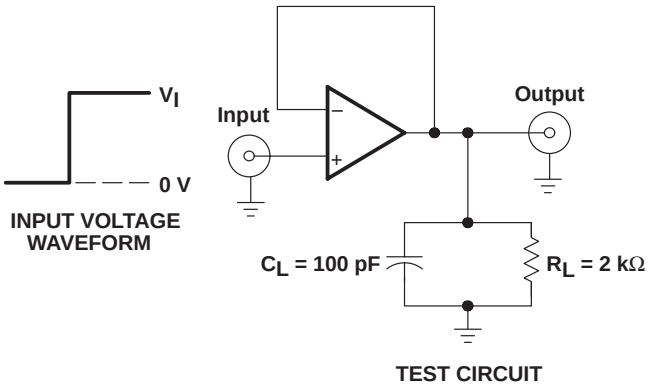


Figure 1. Rise Time, Overshoot Factor, and Slew Rate

TYPICAL CHARACTERISTICS

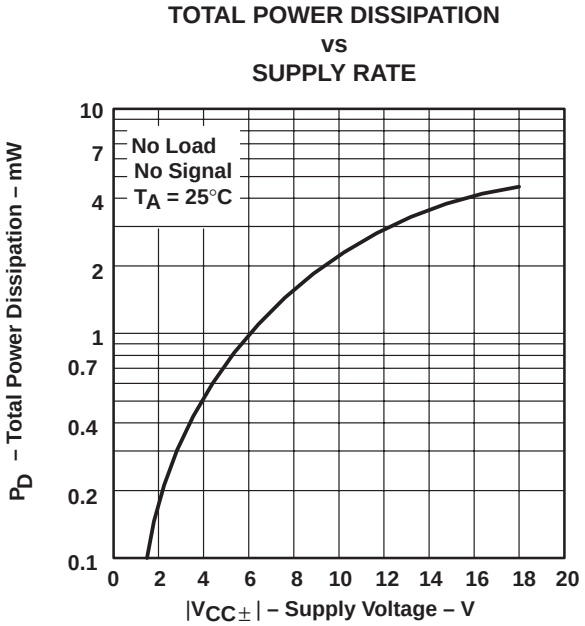


Figure 2

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TL022, Dual Low-Power General-Purpose Operational Amplifier

DEVICE STATUS: **ACTIVE**

PARAMETER NAME	TL022
Number of Channels	2
Available Channels	D
Shutdown	No
Vs (max) (V)	30
Vs (min) (V)	10
IQ per channel (max) (mA)	0.125
GBW (typ) (MHz)	0.5
Slew Rate (typ) (V/us)	0.5
VIO (25 deg C) (max) (mV)	5
IIB (max) (pA)	250000
CMRR (min) (dB)	60
Vn at 1kHz (typ) (nV/rtHz)	50
Single Supply	No

FEATURES

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

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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.

TECHNICAL DOCUMENTS

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To view the following documents, Acrobat Reader 4.0 is required.
To download a document to your hard drive, right-click on the link and choose 'Save'.

DATASHEET

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Full datasheet in Acrobat PDF: tl022.pdf (87 KB) (Updated: 09/01/1990)

APPLICATION NOTES

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View Application Notes for Operational Amplifiers (Less than equal to 100MHz)

- AB-172: Current Feedback Amplifiers: Review, Stability Analysis,and Applications (SBOA081 - Updated: 11/20/2000)
- Analysis of the Sallen-Key Architecture (Rev. B) (SLOA024B - Updated: 09/13/2002)

RELATED DOCUMENTS

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- Enhanced Plastic Portfolio Brochure (SGZB004, 385 KB - Updated: 08/19/2002)
- Military Analog Selection Guide (SGLB002, 318 KB - Updated: 11/09/2000)
- Military Semiconductors Selection Guide 2002 (Rev. B) (SGYC003B, 1648 KB - Updated: 04/22/2002)

USER MANUALS

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- Universal Op Amp Single, Dual, Quad (SOIC) Evaluation Module With Shutdown (Rev. A) (SLOU061A, 457 KB - Updated: 03/20/2001)
- Universal Operational Amplifier EVM (Rev. A) (SLVU006A, 387 KB - Updated: 03/22/1999)
- Universal Operational Amplifier Evaluation Module Selection Guide (Rev. B) (SLOU060B, 20 KB - Updated: 03/20/2001)
- Universal Operational Amplifier Single, Dual, Quad (MSOP/TSSOP) (SLOU055, 1196 KB - Updated: 10/22/1999)
- Universal Operational Amplifier Single, Dual, Quad (PDIP) (Rev. A) (SLOU062A, 513 KB - Updated: 03/20/2001)

SAMPLES

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ORDERABLE DEVICE	PACKAGE INDUSTRY (TI)	PINS	TEMP (°C)	STATUS	PRODUCT CONTENT	SAMPLES
TL022CP	PDIP (P)	8		ACTIVE	View Product Content	Request Samples

PRICING/AVAILABILITY/PKG

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DEVICE INFORMATION							TI INVENTORY STATUS AS OF 3:00 PM GMT, 26 Sep 2002			REPORTED DISTRIBUTOR INVENTORY AS OF 3:00 PM GMT, 26 Sep 2002		
ORDERABLE DEVICE	STATUS	PACKAGE TYPE|PINS	TEMP (°C)	PRODUCT CONTENT	BUDGETARY PRICING QTY | $US	STD PACK QTY	IN STOCK	IN PROGRESS QTY|DATE	LEAD TIME	DISTRIBUTOR COMPANY|REGION	IN STOCK	PURCHASE
TL022CD	ACTIVE	SOP (D) | 8		View Contents	1KU | 0.95	75	N/A*	>10k | 03 Oct	5 WKS			
								>10k | 10 Oct				
TL022CDR	ACTIVE	SOP (D) | 8		View Contents	1KU | 0.98	2500	N/A*	>10k | 03 Oct	5 WKS			
								>10k | 10 Oct				
TL022CP	ACTIVE	PDIP (P) | 8		View Contents	1KU | 0.95	50	N/A*	>10k | 01 Oct	5 WKS			
								6300 | 03 Oct				

								>10k | 08 Oct						
TL022CPSR	ACTIVE	SOP (PS) | 8	0 TO 70	View Contents	1KU | 0.95	2000	N/A*	763 | 23 Sep	5 WKS					
								8590 | 07 Oct						
								>10k | 14 Oct						
								>10k | 21 Oct						

DEVELOPMENT TOOLS Back to Top

Tool Part Number	Tool Title	Tool Type
UNIV-OPAMP-GUIDE	Universal EVM Selection Guide	Development Boards/EVMs

RELATED SOFTWARE Back to Top

- FilterPro Filter Design Programs for the UAF42 and Other Op Amps (SBFC001, 105 KB, ZIP - Updated: 10/25/2000)
- FilterPro MFB and Sallen-Key Design Program (Rev. A) (SLVC003A, 4314 KB, ZIP - Updated: 02/27/2002)

Table Data Updated on: 9/26/2002