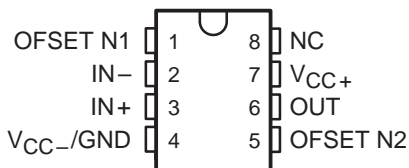


TL3x071, TL3x071A, TL3x072, TL3x072A, TL3x074, TL3x074A HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIERS

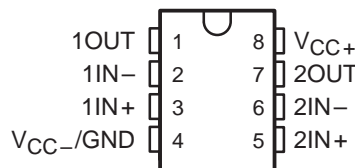
SLOS097C – MARCH 1991 – REVISED AUGUST 1996

- Wide Gain-Bandwidth Product . . . 4.5 MHz
- High Slew Rate . . . 13 V/ μ s
- Fast Settling Time . . . 1.1 μ s to 0.1%
- Wide-Range Single-Supply Operation
4 V to 44 V
- Wide Input Common-Mode Range Includes
Ground (V_{CC-})
- Low Total Harmonic Distortion . . . 0.02%
- Low Input Offset Voltage . . . 3 mV Max
(A Suffix)
- Large Output Voltage Swing
–14.7 V to 14 V (With \pm 15-V Supplies)
- Large Capacitance Drive Capability
10,000 pF
- Excellent Phase Margin . . . 60°
- Excellent Gain Margin . . . 12 dB
- Output Short-Circuit Protection

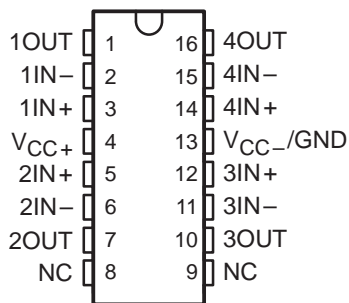
D OR P PACKAGE
(SINGLE, TOP VIEW)



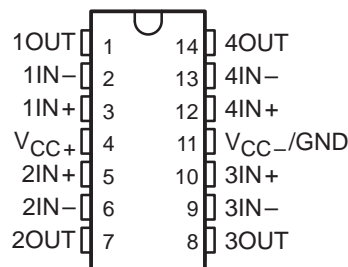
D OR P PACKAGE
(DUAL, TOP VIEW)



DW PACKAGE
(QUAD, TOP VIEW)



N PACKAGE
(QUAD, TOP VIEW)



NC – No internal connection

AVAILABLE OPTIONS

T _A	COMPLEXITY	PACKAGE			
		PLASTIC DIP		SMALL OUTLINE	
		STANDARD GRADE	PRIME GRADE	STANDARD GRADE	PRIME GRADE
0°C to 70°C	Single	TL34071P	TL34071AP	TL34071D	TL34071AD
	Dual	TL34072P	TL34072AP	TL34072D	TL34072AD
	Quad	TL34074N	TL34074AN	TL34074DW	TL34074ADW
–40°C to 105°C	Single	TL33071P	TL33071AP	TL33071D	TL33071AD
	Dual	TL33072P	TL33072AP	TL33072D	TL33072AD
	Quad	TL33074N	TL33074AN	TL33074DW	TL33074ADW
–55°C to 125°C	Single	TL35071P	TL35071AP	TL35071D	TL35071AD
	Dual	TL35072P	TL35072AP	TL35072D	TL35072AD
	Quad	TL35074N	TL35074AN	TL35074DW	TL35074ADW

D and DW packages are available taped and reeled. Add R suffix to device type (e.g., TL34071ADR).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1996, Texas Instruments Incorporated

TL3x071, TL3x071A, TL3x072, TL3x072A, TL3x074, TL3x074A HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIERS

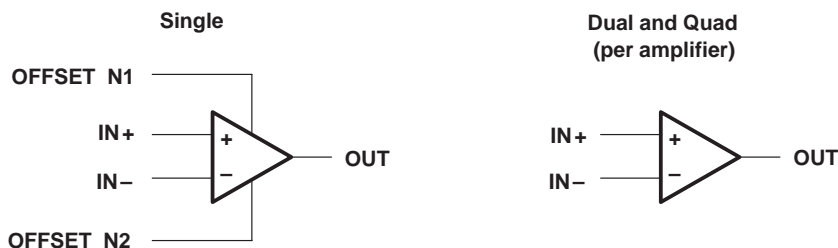
SLOS097C – MARCH 1991 – REVISED AUGUST 1996

description

Quality, low cost, bipolar fabrication with innovative design concepts are employed for the TL33071/2/4, TL34071/2/4, and TL35071/2/4 series of monolithic operational amplifiers. This series of operational amplifiers offers 4.5 MHz of gain bandwidth product, 13 V/ μ s slew rate, and fast settling time without the use of JFET device technology. Although this series can be operated from split supplies, it is particularly suited for single-supply operation since the common-mode input voltage range includes ground potential (V_{CC-}). With a Darlington transistor input stage, this series exhibits high input resistance, low input offset voltage, and high gain. The all-npn output stage, characterized by no dead-band crossover distortion and large output voltage swing, provides high-capacitance drive capability, excellent phase and gain margins, low open-loop high-frequency output impedance, and symmetrical source/sink ac frequency response.

The TL34071/2/4 devices are available in standard or prime performance (A-suffix) grades and are specified over the commercial (0°C to 70°C) temperature range. The TL33071/2/4 devices are available in standard or prime performance (A-suffix) grades and are specified over industrial/vehicular (-40°C to 105°C) temperature range. The TL35071/2/4 devices are available in standard or prime performance (A-suffix) grades and are specified over the military (-55°C to 125°C) temperature range. These low-cost amplifiers are available in single, dual, and quad configurations and are pin compatible with the MC33071/2/4, MC34071/2/4, and MC35071/2/4 series of amplifiers. Packaging options include standard plastic DIP and SO packages.

symbol



TL3x071, TL3x071A, TL3x072, TL3x072A, TL3x074, TL3x074A HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIERS

SLOS097C – MARCH 1991 – REVISED AUGUST 1996

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

Supply voltage, V_{CC+} (see Note 1)	22 V
Supply voltage, V_{CC-}	–22 V
Differential input voltage, V_{ID} (see Note 2)	±44 V
Input voltage, V_I (any input)	$V_{CC\pm}$
Input current, I_I (each input)	±1 mA
Output current, I_O	±80 mA
Total current into V_{CC+}	80 mA
Total current out of V_{CC-}	80 mA
Duration of short-circuit current at (or below) 25°C (see Note 3)	unlimited
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A : TL3307x	–40°C to 105°C
TL3407x	0°C to 70°C
TL3507x	–55°C to 125°C
Storage temperature range, T_{stg}	–65°C to 150°C
Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds: D, DW, N, or P package	260°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. All voltage values, except differential voltages, are with respect to the midpoint between V_{CC+} and V_{CC-} .
 2. Differential voltages are at the noninverting input with respect to the inverting input. Excessive current flows if input is brought below $V_{CC-} - 0.3$ V.
 3. The output can be shorted to either supply. Temperature and/or supply voltages must be limited to ensure that the maximum dissipation rating is not exceeded.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$	$T_A = 105^\circ\text{C}$	$T_A = 125^\circ\text{C}$
	POWER RATING		POWER RATING	POWER RATING	POWER RATING
D	725 mW	5.8 mW/°C	464 mW	261 mW	145 mW
DW	1025 mW	8.2 mW/°C	656 mW	369 mW	205 mW
N	1150 mW	9.2 mW/°C	736 mW	414 mW	230 mW
P	1000 mW	8.0 mW/°C	640 mW	360 mW	200 mW

recommended operating conditions

	TL3307x		TL3407x		TL3507x		UNIT
	MIN	MAX	MIN	MAX	MIN	MAX	
Supply voltage, $V_{CC\pm}$	±2	±22	±2	±22	±2	±22	V
Common-mode input voltage, V_{IC}	$V_{CC} = 5$ V		0	2.7	0	2.9	V
	$V_{CC\pm} = \pm 15$ V		–15	12.7	–15	12.9	
Operating free-air temperature, T_A	–40	105	0	70	–55	125	°C



TL3x071, TL3x071A, TL3x072, TL3x072A, TL3x074, TL3x074A

HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIERS

SLOS097C – MARCH 1991 – REVISED AUGUST 1996

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

PARAMETER	TEST CONDITIONS		T_A †	TL3x07xA			TL3x07x			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IO} Input offset voltage		$V_{CC} = 5\text{ V}$	25°C	0.5	3		1.5	5	mV	
		$V_{CC} = \pm 15\text{ V}$	25°C	0.5	3		1.0	5		
			Full range			5		7		
αV_{IO} Temperature coefficient of input offset voltage	$V_{IC} = 0,$ $V_O = 0,$ $R_S = 50\ \Omega$	$V_{CC} = \pm 15\text{ V}$	Full range	10			10		$\mu\text{V}/^\circ\text{C}$	
I_{IO} Input offset current		$V_{CC} = \pm 15\text{ V}$	25°C		7	100		7	100	nA
			Full range			250		250		
I_{IB} Input bias current		$V_{CC} = 5\text{ V}$	25°C	-0.8	-2		-0.8	-2	μA	
			Full range		-2.3		-2.3			
		$V_{CC} = \pm 15\text{ V}$	25°C	-0.7	-1.5		-0.7	-1.5		
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$		25°C	-15 to 13.2			-15 to 13.2		V	
			Full range	-15 to 12.8			-15 to 12.8			
V_{OH} High-level output voltage		$V_{CC+} = 5\text{ V}, V_{CC-} = 0,$ $R_L = 2\text{ k}\Omega$	25°C	3.7	4		3.7	4	V	
		$R_L = 10\text{ k}\Omega$	25°C	13.6	14		13.6	14		
		$R_L = 2\text{ k}\Omega$	Full range	13.4			13.4			
V_{OL} Low-level output voltage		$V_{CC+} = 5\text{ V}, V_{CC-} = 0,$ $R_L = 2\text{ k}\Omega$	25°C	0.1	0.3		0.1	0.3	V	
		$R_L = 10\text{ k}\Omega$	25°C	-14.7	-14.3		-14.7	-14.3		
		$R_L = 2\text{ k}\Omega$	Full range	-13.5			-13.5			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10\text{ V}, R_L = 2\text{ k}\Omega$		25°C	50	100		25	100	V/mV	
			Full range	25			20			
I_{OS} Short-circuit output current	Source: $V_{ID} = 1\text{ V}, V_O = 0$ Sink: $V_{ID} = -1\text{ V}, V_O = 0$		25°C	-10	-30		-10	-30	mA	
				20	30		20	30		
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin},$ $R_S = 50\ \Omega$		25°C	80	97		70	97	dB	
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 13.5\text{ V}$ to $\pm 16.5\text{ V}, R_S = 100\ \Omega$		25°C	80	97		70	97	dB	
I_{CC} Supply current (per channel)	$V_O = 0,$ No Load		25°C	3.5	4.5		3.5	4.5	mA	
			Full range	4.7			4.7			
	$V_{CC+} = 5\text{ V}, V_{CC-} = 0,$ $V_O = 0,$ No Load		25°C	3.4	4.4		3.4	4.4		
			Full range	4.6			4.6			

† Full range is 0°C to 70°C for the TL3407x devices, and -40°C to 105°C for the TL3307x devices, and -55°C to 125°C for the TL3507x devices.
‡ All typical values are at $T_A = 25^\circ\text{C}$.



TL3x071, TL3x071A, TL3x072, TL3x072A, TL3x074, TL3x074A HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIERS

SLOS097C – MARCH 1991 – REVISED AUGUST 1996

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

PARAMETER		TEST CONDITIONS		TL3x07xA			TL3x07x			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_I = -10\text{ V to }10\text{ V}$, $R_L = 2\text{ k}\Omega$	$A_V = 1$	8	10		8	10	V/ μ s	
SR-	Negative slew rate		$A_V = -1$		13			13		
t_s	Settling time	$A_{VD} = -1$, 10-V step	To 0.1%		1.1			1.1	μ s	
			To 0.01%		2.2			2.2		
V_n	Equivalent input noise voltage	$f = 1\text{ kHz}$, $R_S = 100\ \Omega$		32			32	nV/ $\sqrt{\text{Hz}}$		
I_n	Equivalent input noise current	$f = 1\text{ kHz}$		0.22			0.22	pA/ $\sqrt{\text{Hz}}$		
THD	Total harmonic distortion	$V_O = 2\text{ V to }20\text{ V}$, $R_L = 2\text{ k}\Omega$, $A_{VD} = 10$, $f = 10\text{ kHz}$		0.02			0.02	%		
GBW	Gain-bandwidth product	$f = 100\text{ kHz}$	3.5	4.5		3.5	4.5	MHz		
BW	Power bandwidth	$R_L = 2\text{ k}\Omega$, $V_{O(PP)} = 20\text{ V}$, $A_{VD} = 1$, THD = 5.0%		200			200	kHz		
ϕ_m	Phase margin	$R_L = 2\text{ k}\Omega$, $C_L = 0$		60°			60°			
		$R_L = 2\text{ k}\Omega$, $C_L = 300\text{ pF}$		40°			40°			
	Gain margin	$R_L = 2\text{ k}\Omega$, $C_L = 0$		12			12	dB		
		$R_L = 2\text{ k}\Omega$, $C_L = 300\text{ pF}$		4			4			
r_i	Differential input resistance	$V_{IC} = 0$		150			150	M Ω		
C_i	Input capacitance	$V_{IC} = 0$		2.5			2.5	pF		
	Channel separation	$f = 10\text{ kHz}$		120			120	dB		
z_o	Open-loop output impedance	$f = 1\text{ MHz}$		30			30	Ω		

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TL33071AP	NRND	PDIP	P	8		Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL33071D	NRND	SOIC	D	8		Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1YEAR/ Level-1-220C-UNLIM
TL33071P	NRND	PDIP	P	8		Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL33072AD	OBSOLETE	SOIC	D	8		None	Call TI	Call TI
TL33072ADR	OBSOLETE	SOIC	D	8		None	Call TI	Call TI
TL33072AP	OBSOLETE	PDIP	P	8		None	Call TI	Call TI
TL33072DR	OBSOLETE	SOIC	D	8		None	Call TI	Call TI
TL33072P	OBSOLETE	PDIP	P	8		None	Call TI	Call TI
TL33074ADW	OBSOLETE	SOIC	DW	16		None	Call TI	Call TI
TL33074ADWR	OBSOLETE	SOIC	DW	16		None	Call TI	Call TI
TL33074AN	NRND	PDIP	N	14		None	Call TI	Call TI
TL33074DW	NRND	SOIC	DW	16		None	Call TI	Call TI
TL33074DWR	OBSOLETE	SOIC	DW	16		None	Call TI	Call TI
TL33074N	NRND	PDIP	N	14		None	Call TI	Call TI
TL34071AP	OBSOLETE	PDIP	P	8		Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL34071D	OBSOLETE	SOIC	D	8		None	Call TI	Call TI
TL34071DR	OBSOLETE	SOIC	D	8		None	Call TI	Call TI
TL34071P	OBSOLETE	PDIP	P	8		Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL34072AD	OBSOLETE	SOIC	D	8		None	Call TI	Call TI
TL34072ADR	OBSOLETE	SOIC	D	8		None	Call TI	Call TI
TL34072AP	OBSOLETE	PDIP	P	8		None	Call TI	Call TI
TL34072D	OBSOLETE	SOIC	D	8		None	Call TI	Call TI
TL34072DR	OBSOLETE	SOIC	D	8		None	Call TI	Call TI
TL34072P	OBSOLETE	PDIP	P	8		None	Call TI	Call TI
TL34074ADW	OBSOLETE	SOIC	DW	16		None	Call TI	Call TI
TL34074ADWR	OBSOLETE	SOIC	DW	16		None	Call TI	Call TI
TL34074AN	OBSOLETE	PDIP	N	14		Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL34074DW	OBSOLETE	SOIC	DW	16		None	Call TI	Call TI
TL34074DWR	OBSOLETE	SOIC	DW	16		None	Call TI	Call TI
TL34074N	OBSOLETE	PDIP	N	14		Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL35072P	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL35072PE4	ACTIVE	PDIP	P	8	50	None	Call TI	Call TI
TL35074ADW	OBSOLETE	SOIC	DW	16		None	Call TI	Call TI
TL35074ADWR	OBSOLETE	SOIC	DW	16		None	Call TI	Call TI
TL35074AN	OBSOLETE	PDIP	N	14		Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
TL35074DW	OBSOLETE	SOIC	DW	16		None	Call TI	Call TI

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TL35074DWR	OBSOLETE	SOIC	DW	16		None	Call TI	Call TI
TL35074N	OBSOLETE	PDIP	N	14		Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265