TL3x071, TL3x071A, TL3x072, TL3x072A, TL3x074, TL3x074A
HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIERS
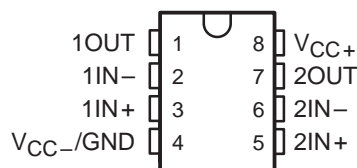
- **Wide Gain-Bandwidth Product . . . 4.5 MHz**
- **High Slew Rate . . . 13 V/μs**
- **Fast Settling Time . . . 1.1 μs to 0.1%**
- **Wide-Range Single-Supply Operation 4 V to 44 V**
- **Wide Input Common-Mode Range Includes Ground (V_{CC-})**
- **Low Total Harmonic Distortion . . . 0.02%**

- **Low Input Offset Voltage . . . 3 mV Max (A Suffix)**
- **Large Output Voltage Swing −14.7 V to 14 V (With ±15-V Supplies)**
- **Large Capacitance Drive Capability 10,000 pF**
- **Excellent Phase Margin . . . 60°**
- **Excellent Gain Margin . . . 12 dB**
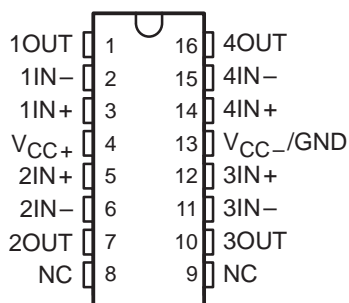- **Output Short-Circuit Protection**

D OR P PACKAGE (SINGLE, TOP VIEW)
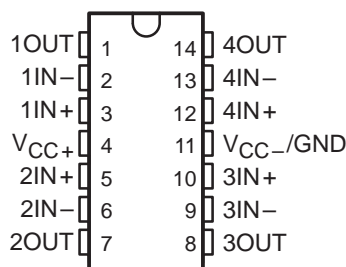
OFSET N1	1	8	NC
IN−	2	7	V_{CC+}
IN+	3	6	OUT
V_{CC-}/GND	4	5	OFSET N2
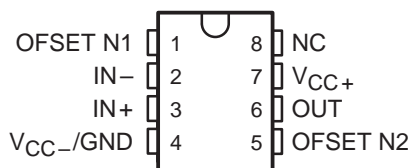
D OR P PACKAGE (DUAL, TOP VIEW)

1OUT	1	8	V_{CC+}
1IN−	2	7	2OUT
1IN+	3	6	2IN−
V_{CC-}/GND	4	5	2IN+

DW PACKAGE (QUAD, TOP VIEW)

1OUT	1	16	4OUT
1IN−	2	15	4IN−
1IN+	3	14	4IN+
V_{CC+}	4	13	V_{CC-}/GND
2IN+	5	12	3IN+
2IN−	6	11	3IN−
2OUT	7	10	3OUT
NC	8	9	NC

N PACKAGE (QUAD, TOP VIEW)

1OUT	1	14	4OUT
1IN−	2	13	4IN−
1IN+	3	12	4IN+
V_{CC+}	4	11	V_{CC-}/GND
2IN+	5	10	3IN+
2IN−	6	9	3IN−
2OUT	7	8	3OUT

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 Dual Quad	TL34071P TL34072P TL34074N	TL34071AP TL34072AP TL34074AN	TL34071D TL34072D TL34074DW	TL34071AD TL34072AD TL34074ADW
−40°C to 105°C	Single Dual Quad	TL33071P TL33072P TL33074N	TL33071AP TL33072AP TL33074AN	TL33071D TL33072D TL33074DW	TL33071AD TL33072AD TL33074ADW
−55°C to 125°C	Single Dual Quad	TL35071P TL35072P TL35074N	TL35071AP TL35072AP TL35074AN	TL35071D TL35072D TL35074DW	TL35071AD TL35072AD TL35074ADW

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

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TEXAS INSTRUMENTS

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/μs 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 avaliable 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 avaliable 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
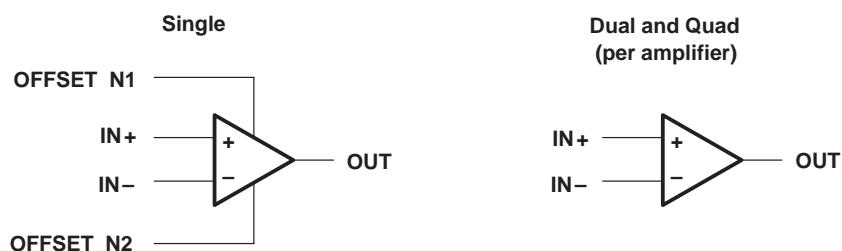
Single

OFFSET N1

IN+
IN–

OUT

OFFSET N2

Dual and Quad
(per amplifier)

IN+
IN–

OUT

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TEXAS
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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	$T_A \leq 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING	$T_A = 105°C$ POWER RATING	$T_A = 125°C$ 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	0	2.7	V
	$V_{CC\pm}$ = ±15 V	−15	12.7	−15	12.9	−15	12.7	
Operating free-air temperature, T_A		−40	105	0	70	−55	125	°C

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

PARAMETER		TEST CONDITIONS		T_A†	TL3x07xA MIN	TYP‡	MAX	TL3x07x MIN	TYP‡	MAX	UNIT
V_{IO}	Input offset voltage	$V_{IC} = 0$, $V_O = 0$, $R_S = 50\ \Omega$	$V_{CC} = 5$ V	25°C		0.5	3		1.5	5	mV
			$V_{CC} = \pm 15$ V	25°C		0.5	3		1.0	5	
				Full range			5			7	
αV_{IO}	Temperature coefficient of input offset voltage		$V_{CC} = \pm 15$ V	Full range		10			10		µV/°C
I_{IO}	Input offset current		$V_{CC} = \pm 15$ V	25°C		7	100		7	100	nA
				Full range			250			250	
I_{IB}	Input bias current		$V_{CC} = 5$ V	25°C		−0.8	−2		−0.8	−2	µA
				Full range			−2.3			−2.3	
			$V_{CC} = \pm 15$ V	25°C		−0.7	−1.5		−0.7	−1.5	
				Full range			−1.8			−1.8	
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	$V_{CC+} = 5$ V, $V_{CC-} = 0$, $R_L = 2\ k\Omega$		25°C	3.7	4		3.7	4		V
		$R_L = 10\ k\Omega$		25°C	13.6	14		13.6	14		
		$R_L = 2\ k\Omega$		Full range	13.4			13.4			
V_{OL}	Low-level output voltage	$V_{CC+} = 5$ V, $V_{CC-} = 0$, $R_L = 2\ k\Omega$		25°C		0.1	0.3		0.1	0.3	V
		$R_L = 10\ k\Omega$		25°C		−14.7	−14.3		−14.7	−14.3	
		$R_L = 2\ k\Omega$		Full range			−13.5			−13.5	
A_{VD}	Large-signal differential voltage amplification	$V_O = \pm 10$ V, $R_L = 2\ k\Omega$		25°C	50	100		25	100		V/mV
				Full range	25			20			
I_{OS}	Short-circuit output current	Source: $V_{ID} = 1$ V, $V_O = 0$		25°C	−10	−30		−10	−30		mA
		Sink: $V_{ID} = -1$ V, $V_O = 0$			20	30		20	30		
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR}$min, $R_S = 50\ \Omega$		25°C	80	97		70	97		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 13.5$ V to ± 16.5 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	
		$V_{CC+} = 5$ 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 $T_A = 25$°C.

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

PARAMETER		TEST CONDITIONS		TL3x07xA MIN	TL3x07xA TYP	TL3x07xA MAX	TL3x07x MIN	TL3x07x TYP	TL3x07x MAX	UNIT
SR+	Positive slew rate	$V_I = -10$ V to 10 V, $R_L = 2$ kΩ	$A_V = 1$	8	10		8	10		V/µs
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		µs
			To 0.01%		2.2			2.2		
V_n	Equivalent input noise voltage	f = 1 kHz, $R_S = 100$ Ω			32			32		nV/√Hz
I_n	Equivalent input noise current	f = 1 kHz			0.22			0.22		pA/√Hz
THD	Total harmonic distortion	$V_O = 2$ V to 20 V, $R_L = 2$ kΩ, $A_{VD} = 10$, f = 10 kHz			0.02			0.02		%
GBW	Gain-bandwidth product	f = 100 kHz		3.5	4.5		3.5	4.5		MHz
BW	Power bandwidth	$R_L = 2$ kΩ, $A_{VD} = 1$, $V_{O(PP)} = 20$ V, THD = 5.0%			200			200		kHz
ϕ_m	Phase margin	$R_L = 2$ kΩ, $C_L = 0$			60°			60°		
		$R_L = 2$ kΩ, $C_L = 300$ pF			40°			40°		
	Gain margin	$R_L = 2$ kΩ, $C_L = 0$			12			12		dB
		$R_L = 2$ kΩ, $C_L = 300$ pF			4			4		
r_i	Differential input resistance	$V_{IC} = 0$			150			150		MΩ
C_i	Input capacitance	$V_{IC} = 0$			2.5			2.5		pF
	Channel separation	f = 10 kHZ			120			120		dB
z_o	Open-loop output impedance	f = 1 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 JEDECindustry standard classifications, and peak solder temperature.

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