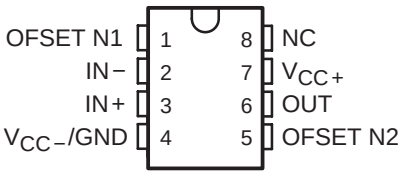
TL3x071, TL3x071A, TL3x072, TL3x072A, TL3x074, TL3x074A
HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIERS

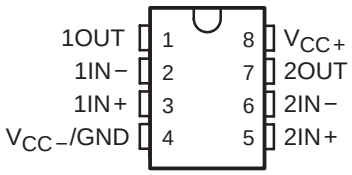
SLOS097C − MARCH 1991 − REVISED AUGUST 1996

- **Wide Gain-Bandwidth Product . . . 4.5 MHz**
- **High Slew Rate . . . 13 V/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**

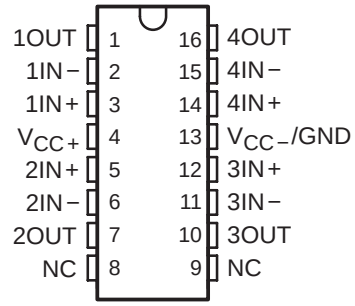
D OR P PACKAGE
(SINGLE, TOP VIEW)



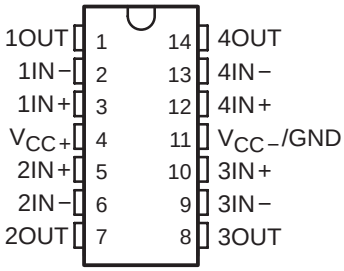
D OR P PACKAGE
(DUAL, TOP VIEW)



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).

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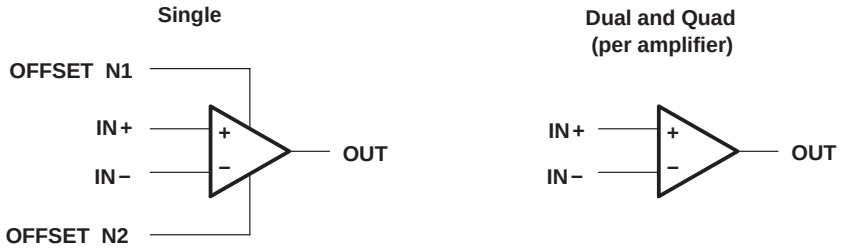
TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265
POST OFFICE BOX 1443 • HOUSTON, TEXAS 77251−1443

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



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) . . . . . $V_{CC±}$
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	$T_A \le 25°C$ 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, $V_{CC±}$		±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
	$V_{CC±}$ = ±15 V	−15	12.7	−15	12.9	−15	12.7	
Operating free-air temperature, T_A		−40	105	0	70	−55	125	°C

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

PARAMETER		TEST CONDITIONS		T_A†	TL3x07xA			TL3x07x			UNIT
					MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω	V_{CC} = 5 V	25°C		0.5	3		1.5	5	mV
			V_{CC} = ±15 V	25°C		0.5	3		1.0	5	
				Full range			5			7	
αV_{IO}	Temperature coefficient of input offset voltage		V_{CC} = ±15 V	Full range		10			10		µV/°C
I_{IO}	Input offset current		V_{CC} = ±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} = ±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 Ω		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 kΩ		25°C	3.7	4		3.7	4		V
		R_L = 10 kΩ		25°C	13.6	14		13.6	14		
		R_L = 2 kΩ		Full range	13.4			13.4			
V_{OL}	Low-level output voltage	V_{CC+} = 5 V, V_{CC-} = 0, R_L = 2 kΩ		25°C		0.1	0.3		0.1	0.3	V
		R_L = 10 kΩ		25°C		−14.7	−14.3		−14.7	−14.3	
		R_L = 2 kΩ		Full range			−13.5			−13.5	
A_{VD}	Large-signal differential voltage amplification	V_O = ±10 V, R_L = 2 kΩ		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 Ω		25°C	80	97		70	97		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±13.5 V to ±16.5 V, R_S = 100 Ω		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.

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

PARAMETER		TEST CONDITIONS		TL3x07xA			TL3x07x			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
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

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