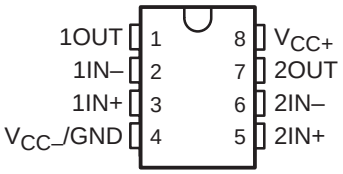
TL3472
HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIER

SLOS200E – OCTOBER 1997 – REVISED FEBRUARY 2000

- **Wide Gain-Bandwidth Product . . . 4 MHz**
- **High Slew Rate . . . 13 V/μs**
- **Fast Settling Time . . . 1.1 μs to 0.1%**
- **Wide-Range Single-Supply Operation . . . 4 V to 36 V**
- **Wide Input Common-Mode Range Includes Ground (V_{CC-})**
- **Low Total Harmonic Distortion . . . 0.02%**
- **Large-Capacitance Drive Capability . . . 10,000 pF**
- **Output Short-Circuit Protection**

D OR P PACKAGE
(TOP VIEW)



description

Quality, low-cost, bipolar fabrication with innovative design concepts are employed for the TL3472 operational amplifier. This device offers 4 MHz of gain-bandwidth product, 13-V/μs slew rate, and fast settling time, without the use of JFET device technology. Although the TL3472 can be operated from split supplies, it is particularly suited for single-supply operation because the common-mode input voltage range includes ground potential (V_{CC-}). With a Darlington transistor input stage, this device 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. This low-cost amplifier is an alternative to the MC33072 and the MC34072 operational amplifiers.

The TL3472C is characterized for operation from 0°C to 70°C. The TL3472I is characterized for operation from –40°C to 105°C.

AVAILABLE OPTIONS

T_A	PACKAGED DEVICES	
	SMALL OUTLINE (D)	PLASTIC DUAL-IN-LINE (P)
0°C to 70°C	TL3472CD	TL3472CP
–40°C to 105°C	TL3472ID	TL3472IP

D package is available taped and reeled. Add the suffix R to device type (e.g., TL3472CDR).

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

Supply voltage (see Note 1): V_{CC+} . . . . . 18 V
$V_{CC–}$ . . . . . –18 V
Differential input voltage, V_{ID} (see Note 2) . . . . . ±36 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
Package thermal impedance, θ_{JA} (see Notes 4 and 5): D package . . . . . 97°C/W
P package . . . . . 85°C/W
Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds . . . . . 260°C
Storage temperature range, T_{stg} . . . . . –65°C to 150°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 input current can flow when the input is less than $V_{CC–}$ – 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.
4. Maximum power dissipation is a function of $T_J(max)$, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) – T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can impact reliability.
5. The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions

			MIN	MAX	UNIT
$V_{CC±}$	Supply voltage		4	36	V
V_{IC}	Common-mode input voltage	V_{CC} = 5 V	0	2.8	V
		$V_{CC±}$ = ±15 V	–15	12.8	
T_A	Operating free-air temperature	TL3472C	0	70	°C
		TL3472I	–40	105	

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

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP†	MAX	UNIT
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω	V_{CC} = 5 V	25°C		1.5	10	mV
			V_{CC} = ±15 V	25°C		1.0	10	
				Full range‡			12	
$\alpha_{V_{IO}}$	Temperature coefficient of input offset voltage		V_{CC} = ±15 V	Full range‡		10		µV/°C
I_{IO}	Input offset current		V_{CC} = ±15 V	25°C		6	75	nA
				Full range‡			300	
I_{IB}	Input bias current		V_{CC} = ±15 V	25°C		100	500	µA
				Full range‡			700	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C		–15 to 12.8		V
				Full range‡		–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		V
		R_L = 10 kΩ		25°C	13.6	14		
		R_L = 2 kΩ		Full range‡	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	V
		R_L = 10 kΩ		25°C		–14.7	–14.3	
		R_L = 2 kΩ		Full range‡			–13.5	
A_{VD}	Large-signal differential voltage amplification	V_O = ±10 V,	R_L = 2 kΩ	25°C	25	100		V/mV
				Full range‡	20			
I_{OS}	Short-circuit output current	Source: V_{ID} = 1 V,	V_O = 0	25°C	–10	–34		mA
		Sink: V_{ID} = –1 V,	V_O = 0		20	27		
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}(min),	R_S = 50 Ω	25°C	65	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	70	97		dB
I_{CC}	Supply current (per channel)	V_O = 0,	No load	25°C		3.5	4.5	mA
				Full range‡		4.5	5.5	
		V_{CC+} = 5 V, V_O = 2.5 V, V_{CC-} = 0, No load		25°C		3.5	4.5	

† All typical values are at T_A = 25°C.
‡ Full range is 0°C to 70°C for the TL3472C device and –40°C to 105°C for the TL3472I device.

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

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
SR+	Positive slew rate	V_I = –10 V to 10 V, R_L = 2 kΩ, C_L = 300 pF	A_V = 1	8	10		V/µs
SR–	Negative slew rate		A_V = –1		13		V/µs
t_s	Settling time	A_{VD} = –1, 10-V step	To 0.1%		1.1		µs
			To 0.01%		2.2		
V_n	Equivalent input noise voltage	f = 1 kHz,	R_S = 100 Ω		49		nV/√Hz
I_n	Equivalent input noise current	f = 1 kHz			0.22		pA/√Hz
THD	Total harmonic distortion	$V_{O(PP)}$ = 2 V to 20 V, R_L = 2 kΩ, A_{VD} = 10, f = 10 kHz			0.02		%
GBW	Gain-bandwidth product	f =100 kHz		3	4		MHz
BW	Power bandwidth	$V_{O(PP)}$ = 20 V, R_L = 2 kΩ, A_{VD} = 1, THD = 5.0%			160		kHz
ϕ_m	Phase margin	R_L = 2 kΩ	C_L = 0		70		deg
			C_L = 300 pF		50		
	Gain margin	R_L = 2 kΩ	C_L = 0		12		dB
			C_L = 300 pF		4		
r_i	Differential input resistance	V_{IC} = 0			150		MΩ
C_i	Input capacitance	V_{IC} = 0			2.5		pF
	Channel separation	f = 10 kHz			101		dB
z_o	Open-loop output impedance	f = 1 MHz,	A_V = 1		20		Ω

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