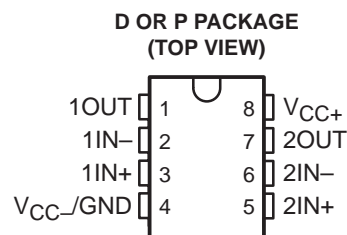


TL3472

HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIER

SLOS200E – OCTOBER 1997 – REVISED FEBRUARY 2000

- **Wide Gain-Bandwidth Product . . . 4 MHz**
- **High Slew Rate . . . 13 V/ μ s**
- **Fast Settling Time . . . 1.1 μ s 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**



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/ μ s 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).



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 © 2000, Texas Instruments Incorporated

TL3472

HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIER

SLOS200E – OCTOBER 1997 – REVISED FEBRUARY 2000

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)	$V_{CC\pm}$
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
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 $T_J(\text{max})$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can impact reliability.
 5. The package thermal impedance is calculated in accordance with JEDEC 51.

recommended operating conditions

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

TL3472

HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIER

SLOS200E – OCTOBER 1997 – REVISED FEBRUARY 2000

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

PARAMETER	TEST CONDITIONS	T_A	MIN	TYP†	MAX	UNIT
V_{IO} Input offset voltage	$V_{IC} = 0$, $V_O = 0$, $R_S = 50 \Omega$	$V_{CC} = 5$ V	25°C	1.5	10	mV
		$V_{CC} = \pm 15$ V	25°C	1.0	10	
			Full range‡			
$\alpha_{V_{IO}}$ Temperature coefficient of input offset voltage	$V_{IC} = 0$, $V_O = 0$, $R_S = 50 \Omega$	$V_{CC} = \pm 15$ V	Full range‡	10		$\mu V/^\circ C$
I_{IO} Input offset current		$V_{CC} = \pm 15$ V	25°C	6	75	nA
			Full range‡		300	
I_{IB} Input bias current	$V_{CC} = \pm 15$ V	25°C	100	500	μA	
		Full range‡		700		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C		-15 to 12.8		V
		Full range‡		-15 to 12.8		
V_{OH} High-level output voltage	$V_{CC+} = 5$ V, $V_{CC-} = 0$, $R_L = 2$ k Ω	25°C	3.7	4	V	
		25°C	13.6	14		
		Full range‡	13.4			
V_{OL} Low-level output voltage	$V_{CC+} = 5$ V, $V_{CC-} = 0$, $R_L = 2$ k Ω	25°C	0.1	0.3	V	
		25°C	-14.7	-14.3		
		Full range‡	-13.5			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10$ V, $R_L = 2$ k Ω	25°C	25	100	V/mV	
		Full range‡	20			
I_{OS} Short-circuit output current	Source: $V_{ID} = 1$ V, $V_O = 0$ Sink: $V_{ID} = -1$ V, $V_O = 0$	25°C	-10	-34	mA	
			20	27		
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICR}(\min)$, $R_S = 50 \Omega$	25°C	65	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	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		
		25°C	3.5	4.5		

† All typical values are at $T_A = 25^\circ C$.

‡ Full range is $0^\circ C$ to $70^\circ C$ for the TL3472C device and $-40^\circ C$ to $105^\circ C$ for the TL3472I device.

TL3472

HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIER

SLOS200E – OCTOBER 1997 – REVISED FEBRUARY 2000

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

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

EEPW.com.cn

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

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

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.