

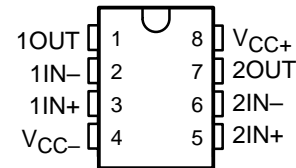
# TL4581

## DUAL LOW-NOISE HIGH-DRIVE OPERATIONAL AMPLIFIER

SLVS457A – JANUARY 2003 – REVISED MARCH 2003

- **Equivalent Input Noise Voltage**  
5 nV/ $\sqrt{\text{Hz}}$  Typ at 1 kHz
- **Unity-Gain Bandwidth . . . 10 MHz Typ**
- **High Slew Rate . . . 9 V/ $\mu\text{s}$  Typ**
- **Peak-to-Peak Output Voltage Swing**  
32 V Typ, With  $V_{CC\pm} = \pm 18 \text{ V}$  and  $R_L = 600 \Omega$
- **Wide Supply-Voltage Range . . .  $\pm 3 \text{ V}$  to  $\pm 20 \text{ V}$**
- **Common-Mode Rejection Ratio . . . 100 dB Typ**
- **High dc Voltage Gain . . . 100 V/mV Typ**
- **Applications: Audio PreAmps, Active Filters, Headphone Amps**
- **End Equipment: DVD/CD/CDRW Players; Set-Top Boxes**

D, P, OR PS PACKAGE  
(TOP VIEW)



### description/ordering information

The TL4581 is a dual operational amplifier that has been designed optimally for audio applications, such as improving tone control. It offers low noise, high-gain bandwidth, good slew, and high output current drive for driving capacitive loads. These features make the TL4581 ideally suited for audio applications, such as audio preamps and active filters. When high output current is required, the TL4581 also can be used as a headphone amplifier.

### ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP – P	Tube of 50	TL4581P	TL4581P
	SOIC – D	Tube of 75	TL4581D	T4581
		Reel of 2500	TL4581DR	
	SOP – PS	Reel of 2000	TL4581PSR	T4581

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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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**

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# TL4581

## DUAL LOW-NOISE HIGH-DRIVE OPERATIONAL AMPLIFIER

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

Supply voltage (see Note 1): $V_{CC+}$ .....	22 V
$V_{CC-}$ .....	-22 V
Input voltage, either input (see Notes 1 and 2) .....	$V_{CC\pm}$
Input current (see Note 3) .....	$\pm 10$ mA
Duration of output short circuit (see Note 4) .....	Unlimited
Operating virtual junction temperature, $T_J$ .....	150°C
Package thermal impedance, $\theta_{JA}$ (see Notes 5 and 6): D package .....	97°C/W
P package .....	85°C/W
PS package .....	95°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. The magnitude of the input voltage must never exceed the magnitude of the supply voltage.
  3. Excessive input current will flow if a differential input voltage in excess of approximately 0.6 V is applied between the inputs, unless some limiting resistance is used.
  4. The output may be shorted to ground or either power supply. Temperature and/or supply voltages must be limited to ensure the maximum dissipation rating is not exceeded.
  5. Maximum power dissipation is a function of  $T_{J(max)}$ ,  $\theta_{JA}$ , 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 affect reliability.
  6. The package thermal impedance is calculated in accordance with JESD 51-7.

### recommended operating conditions

	MIN	MAX	UNIT
$V_{CC+}$ Supply voltage	5	15	V
$V_{CC-}$ Supply voltage	-5	-15	V
$T_A$ Operating free-air temperature range	0	70	°C



# TL4581

## DUAL LOW-NOISE HIGH-DRIVE OPERATIONAL AMPLIFIER

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### electrical characteristics, $V_{CC\pm} = +15\text{ V}$ , $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		MIN	TYP	MAX	UNIT
$V_{IO}$	Input offset voltage	$V_O = 0$	$T_A = 25^\circ\text{C}$	0.5	4		mV
			$T_A = 0^\circ\text{C to } 70^\circ\text{C}$			5	
$I_{IO}$	Input offset current	$T_A = 25^\circ\text{C}$		10	150		nA
		$T_A = 0^\circ\text{C to } 70^\circ\text{C}$				200	
$I_{IB}$	Input bias current	$T_A = 25^\circ\text{C}$		200	800		nA
		$T_A = 0^\circ\text{C to } 70^\circ\text{C}$				1000	
$V_{ICR}$	Common-mode input-voltage range			$\pm 12$	$\pm 13$		V
$V_{OPP}$	Maximum peak-to-peak output-voltage swing	$R_L \geq 600\ \Omega$	$V_{CC\pm} = \pm 15\text{ V}$	24	26		V
			$V_{CC\pm} = \pm 18\text{ V}$	30	32		
$A_{VD}$	Large-signal differential-voltage amplification	$R_L \geq 600\ \Omega$ , $V_O = \pm 10\text{ V}$	$T_A = 25^\circ\text{C}$	15	50		V/mV
			$T_A = 0^\circ\text{C to } 70^\circ\text{C}$	10			
		$R_L \geq 2\text{ k}\Omega$ , $V_O = \pm 10\text{ V}$	$T_A = 25^\circ\text{C}$	25	100		
			$T_A = 0^\circ\text{C to } 70^\circ\text{C}$	15			
$A_{vd}$	Small-signal differential-voltage amplification	$f = 10\text{ kHz}$		2.2		V/mV	
$B_{OM}$	Maximum-output-swing bandwidth	$R_L = 600\ \Omega$	$V_O = \pm 10\text{ V}$	140			kHz
			$V_{CC\pm} = \pm 18\text{ V}$ , $V_O = \pm 14\text{ V}$	100			
$B_1$	Unity-gain bandwidth	$R_L = 600\ \Omega$ ,	$C_L = 100\text{ pF}$	10			MHz
$r_i$	Input resistance			30	300		k $\Omega$
$z_o$	Output impedance	$A_{VD} = 30\text{ dB}$ , $R_L = 600\ \Omega$ , $f = 10\text{ kHz}$		0.3			$\Omega$
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR}\text{ min}$		70	100		dB
$k_{SVR}$	Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ )	$V_{CC\pm} = \pm 9\text{ V to } \pm 15\text{ V}$ , $V_O = 0$		80	100		dB
$I_{OS}$	Output short-circuit current			10	38	60	mA
$I_{CC}$	Total supply current	$V_O = 0$ ,	No load	8	16		mA
	Crosstalk attenuation ( $V_{O1}/V_{O2}$ )	$V_{O1} = 10\text{ V}$ peak,	$f = 1\text{ kHz}$	110			dB

† All characteristics are measured under open-loop conditions with zero common-mode input voltage, unless otherwise specified.

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

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain				9		V/ $\mu\text{s}$
	Overshoot factor	$V_I = 100\text{ mV}$ , $R_L = 600\ \Omega$ ,	$A_{VD} = 1$ , $C_L = 100\text{ pF}$		10		%
$V_n$	Equivalent input noise voltage	$f = 30\text{ Hz}$			8		nV/ $\sqrt{\text{Hz}}$
		$f = 1\text{ kHz}$			5		
$I_n$	Equivalent input noise current	$f = 30\text{ Hz}$			2.7		pA/ $\sqrt{\text{Hz}}$
		$f = 1\text{ kHz}$			0.7		



**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TL4581D	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	T4581	<a href="#">Samples</a>
TL4581DG4	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	T4581	<a href="#">Samples</a>
TL4581DR	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	T4581	<a href="#">Samples</a>

(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.

**OBSELETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

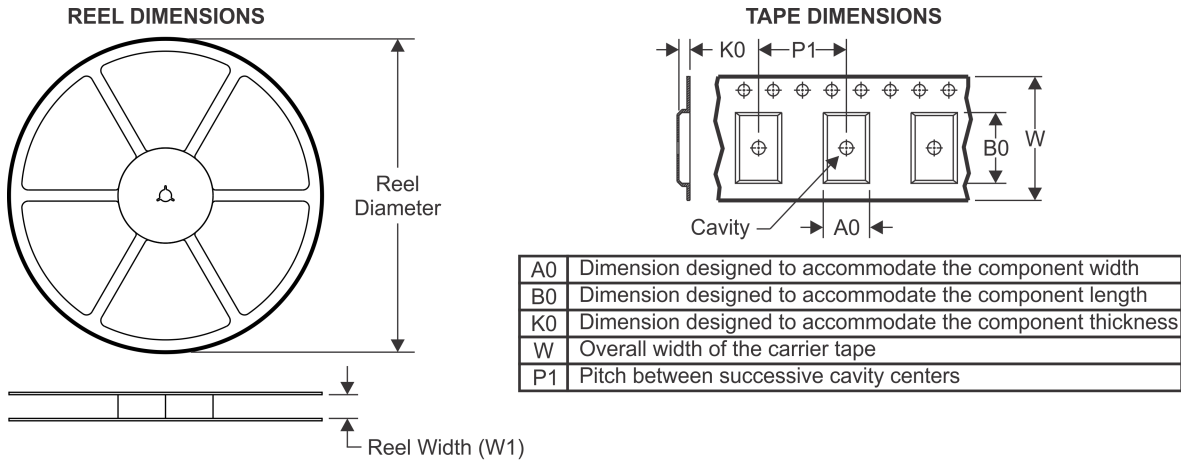
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TL4581DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL4581DR	SOIC	D	8	2500	340.5	338.1	20.6



D0008A

# PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed  $.006$  [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.



# EXAMPLE BOARD LAYOUT

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:8X



SOLDER MASK DETAILS

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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON .005 INCH [0.125 MM] THICK STENCIL  
SCALE:8X

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NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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