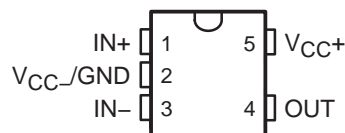


# TL343 SINGLE LOW-POWER OPERATIONAL AMPLIFIER

SLOS250G – JUNE 1999 – REVISED JANUARY 2005

- Wide Range of Supply Voltages, Single Supply 3 V to 30 V, or Dual Supplies
- Class AB Output Stage
- True Differential-Input Stage
- Low Input Bias Current
- Internal Frequency Compensation
- Short-Circuit Protection

DBV PACKAGE  
(TOP VIEW)



## description/ordering information

The TL343 is a single operational amplifier similar in performance to the  $\mu$ A741, but with several distinct advantages. It is designed to operate from a single supply over a range of voltages from 3 V to 30 V. Operation from split supplies also is possible, provided the difference between the two supplies is 3 V to 30 V. The common-mode input range includes the negative supply. Output range is from the negative supply to  $V_{CC} - 1.5$  V.

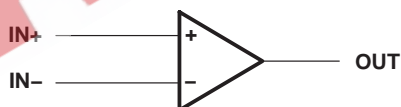
## ORDERING INFORMATION

$T_A$	$V_{IO\text{MAX}}$ AT 25°C	PACKAGE†	ORDERABLE PART NUMBER	TOP-SIDE MARKING‡
-40°C to 125°C	10 mV	SOT-23-5 (DBV)	Reel of 3000	TL343IDBVR
			Reel of 250	TL343IDBVT

† 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).

‡ The actual top-side marking has one additional character that designates the assembly/test site.

## symbol



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 **TEXAS  
INSTRUMENTS**

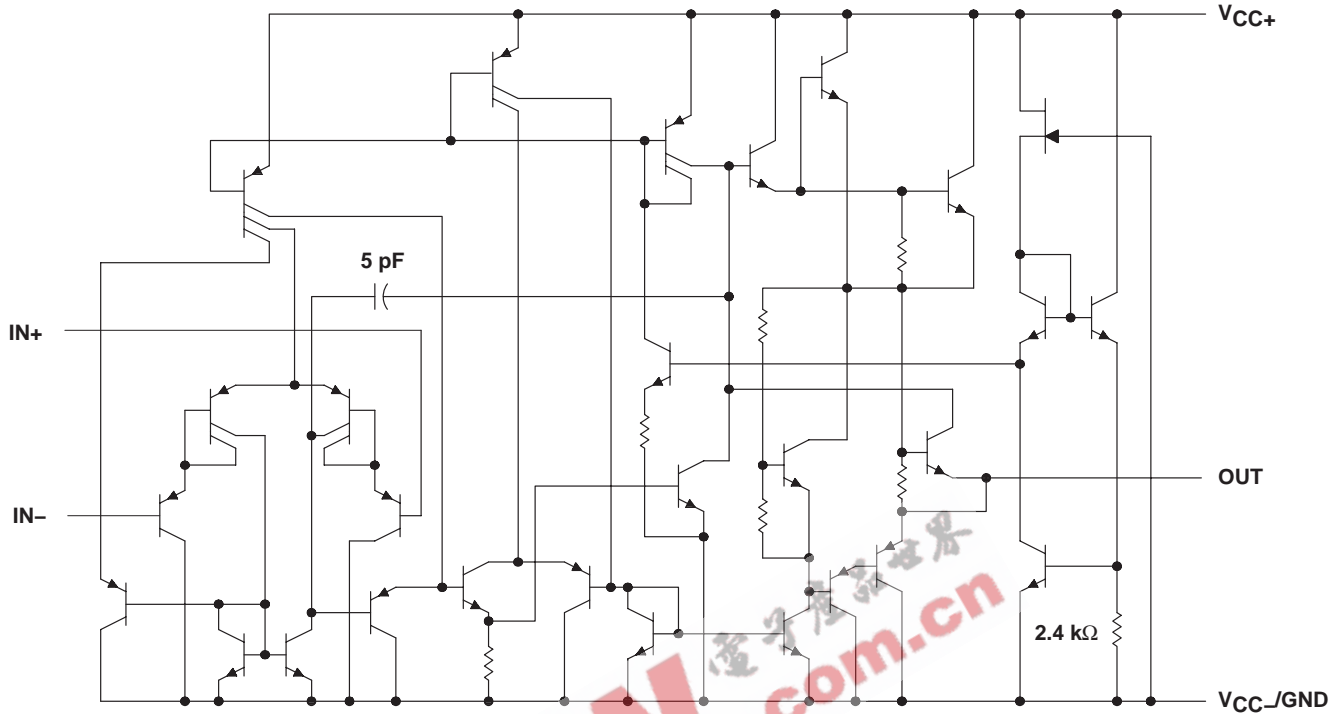
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# TL343 SINGLE LOW-POWER OPERATIONAL AMPLIFIER

SLOS250G – JUNE 1999 – REVISED JANUARY 2005

## schematic



NOTE A: Component values shown are nominal.

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

		MAX	UNIT
Supply voltage (see Note 1)	V <sub>CC+</sub>	18	V
	V <sub>CC-</sub>	-18	
Supply voltage, V <sub>CC+</sub> with respect to V <sub>CC-</sub>		36	V
Differential input voltage (see Note 2)		±36	V
Input voltage (see Notes 1 and 3)		±18	V
Package thermal impedance, $\theta_{JA}$ (see Notes 4 and 5)		206	°C/W
Operating virtual junction temperature, T <sub>J</sub>		150	°C
Storage temperature range, T <sub>stg</sub>		-65 to 150	°C

- NOTES:
1. These voltage values are with respect to the midpoint between V<sub>CC+</sub> and V<sub>CC-</sub>.
  2. Differential voltages are at IN+ with respect to IN-.
  3. Neither input must ever be more positive than V<sub>CC+</sub> or more negative than V<sub>CC-</sub>.
  4. Maximum power dissipation is a function of T<sub>J(max)</sub>,  $\theta_{JA}$ , and T<sub>A</sub>. The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(max) - T_A) / \theta_{JA}$ . Selecting the maximum of 150°C can affect reliability.
  5. The package thermal impedance is calculated in accordance with JESD 51-7.

# TL343 SINGLE LOW-POWER OPERATIONAL AMPLIFIER

SLOS250G – JUNE 1999 – REVISED JANUARY 2005

## recommended operating conditions

		MIN	MAX	UNIT
$V_{CC}$	Single-supply voltage	3	30	V
$V_{CC+}$	Dual-supply voltage	1.5	15	V
$V_{CC-}$		-1.5	-15	
$T_A$	Operating free-air temperature	-40	125	°C

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

PARAMETER		TEST CONDITIONS†		MIN	TYP	MAX	UNIT	
$V_{IO}$	Input offset voltage	See Note 6	25°C		2	10	mV	
			Full range			12		
$\alpha_{V_{IO}}$	Temperature coefficient of input offset voltage	See Note 6	Full range		10		$\mu\text{V}/^\circ\text{C}$	
$I_{IO}$	Input offset current	See Note 6	25°C		30	50	nA	
			Full range			200		
$\alpha_{I_{IO}}$	Temperature coefficient of input offset current	See Note 6	Full range		50		$\text{pA}/^\circ\text{C}$	
$I_{IB}$	Input bias current	See Note 6	25°C		-200	-500	nA	
			Full range			-800		
$V_{ICR}$	Common-mode input voltage range‡		25°C	$V_{CC-}$ to 13	$V_{CC-}$ to 13.5		V	
$V_{OM}$	Peak output-voltage swing	$R_L = 10\text{ k}\Omega$	25°C		$\pm 12$	$\pm 13.5$	V	
			25°C		$\pm 10$	$\pm 13$		
			Full range		$\pm 10$			
$A_{VD}$	Large-signal differential voltage amplification	$V_O = \pm 10\text{ V}$ , $R_L = 2\text{ k}\Omega$	25°C		20	200	V/mV	
			Full range		15			
$B_{OM}$	Maximum-output-swing bandwidth	$V_{OPP} = 20\text{ V}$ , $\text{THD} \leq 5\%$ , $R_L = 2\text{ k}\Omega$	25°C		9		kHz	
$B_1$	Unity-gain bandwidth	$V_O = 50\text{ mV}$ , $R_L = 10\text{ k}\Omega$	25°C		1		MHz	
$\phi_m$	Phase margin	$C_L = 200\text{ pF}$ , $R_L = 2\text{ k}\Omega$	25°C		44		Deg	
$r_i$	Input resistance	$f = 20\text{ Hz}$	25°C		0.3	1	M $\Omega$	
$r_o$	Output resistance	$f = 20\text{ Hz}$	25°C		75		$\Omega$	
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR}(\text{min})$	25°C		70	90	dB	
$k_{SVS}$	Supply-voltage sensitivity ( $\Delta V_{IO}/\Delta V_{CC}$ )	$V_{CC\pm} = \pm 2.5$ to $\pm 15\text{ V}$	25°C		30	150	$\mu\text{V}/\text{V}$	
$I_{OS}$	Short-circuit output current§		25°C		$\pm 10$	$\pm 30$	$\pm 55$	mA
$I_{CC}$	Total supply current	No load, See Note 6	25°C		0.7	2.8	mA	

† All characteristics are measured under open-loop conditions, with zero common-mode voltage, unless otherwise specified. Full range for  $T_A$  is -40°C to 125°C.

‡ The  $V_{ICR}$  limits are linked directly, volt-for-volt, to supply voltage; the positive limit is 2 V less than  $V_{CC+}$ .

§ Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.

NOTE 6:  $V_{IO}$ ,  $I_{IO}$ ,  $I_{IB}$ , and  $I_{CC}$  are defined at  $V_O = 0$ .

# TL343

## SINGLE LOW-POWER OPERATIONAL AMPLIFIER

SLOS250G – JUNE 1999 – REVISED JANUARY 2005

electrical characteristics,  $V_{CC+} = 3\text{ V}$  and  $5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	MIN	TYP	MAX	UNIT
$V_{IO}$	Input offset voltage		2	10	mV
$I_{IO}$	Input offset current		30	50	nA
$I_{IB}$	Input bias current		-200	-500	nA
$V_{OM}$	Peak output voltage swing‡	$R_L = 10\text{ k}\Omega$	3.3	3.5	V
$A_{VD}$	Large-signal differential voltage amplification	$V_O = 1.7\text{ V}$ to $3.3\text{ V}$ , $R_L = 2\text{ k}\Omega$	20	200	V/mV
$k_{SVS}$	Supply-voltage sensitivity ( $\Delta V_{IO}/\Delta V_{CC\pm}$ )	$V_{CC\pm} = \pm 2.5\text{ V}$ to $\pm 15\text{ V}$		150	$\mu\text{V/V}$
$I_{CC}$	Supply current	$V_O = 1.5\text{ V}$ and $2.5\text{ V}$ , No load	0.7	1.75	mA

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

‡ Output swings essentially to ground.

operating characteristics,  $V_{CC\pm} = \pm 15\text{ V}$ ,  $T_A = 25^\circ\text{C}$ ,  $A_{VD} = 1$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TYP	UNIT
SR	Slew rate at unity gain $V_I = \pm 10\text{ V}$ , $C_L = 100\text{ pF}$ , $R_L = 2\text{ k}\Omega$ , See Figure 1	1	V/ $\mu\text{s}$
$t_r$	Rise time $\Delta V_O = 50\text{ mV}$ , $C_L = 100\text{ pF}$ , $R_L = 10\text{ k}\Omega$ , See Figure 1	0.35	$\mu\text{s}$
$t_f$	Fall time $\Delta V_O = 50\text{ mV}$ , $C_L = 100\text{ pF}$ , $R_L = 10\text{ k}\Omega$ , See Figure 1	0.35	$\mu\text{s}$
Overshoot factor	$\Delta V_O = 50\text{ mV}$ , $C_L = 100\text{ pF}$ , $R_L = 10\text{ k}\Omega$ , See Figure 1	20%	
Crossover distortion	$V_{I(pp)} = 30\text{ mV}$ , $V_{OPP} = 2\text{ V}$ , $f = 10\text{ kHz}$	1%	

### PARAMETER MEASUREMENT INFORMATION

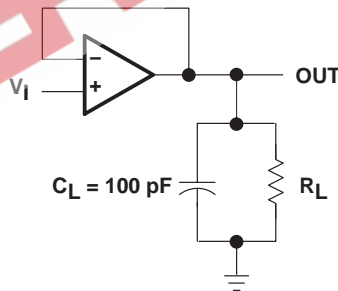


Figure 1. Unity-Gain Amplifier

# TL343 SINGLE LOW-POWER OPERATIONAL AMPLIFIER

SLOS250G – JUNE 1999 – REVISED JANUARY 2005

## TYPICAL CHARACTERISTICS†

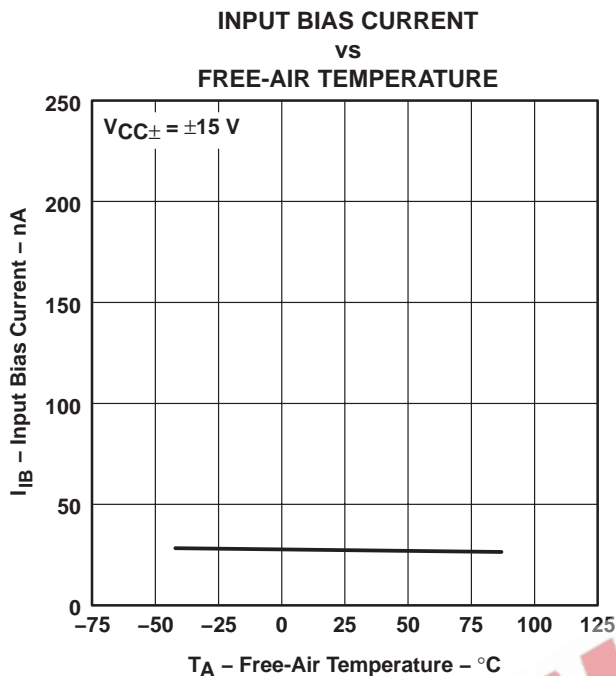


Figure 2

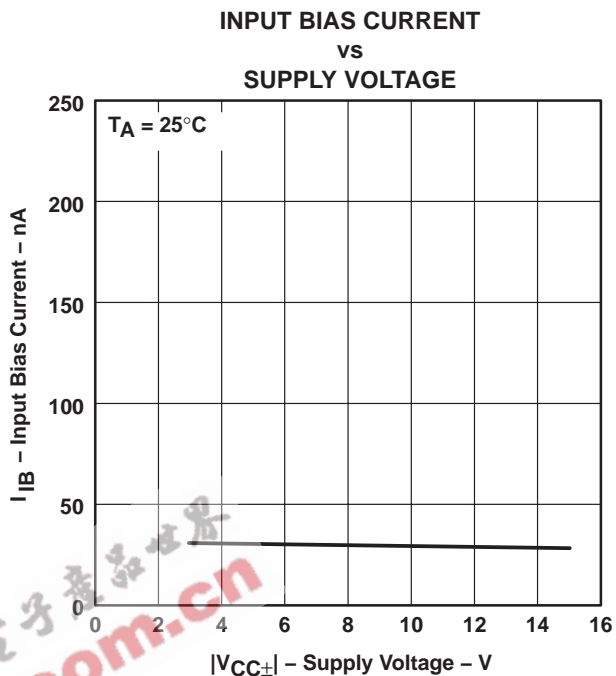


Figure 3

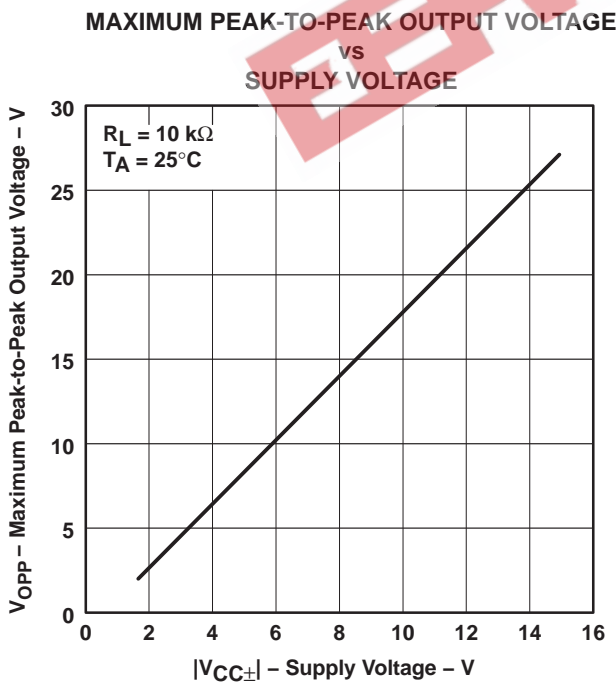


Figure 4

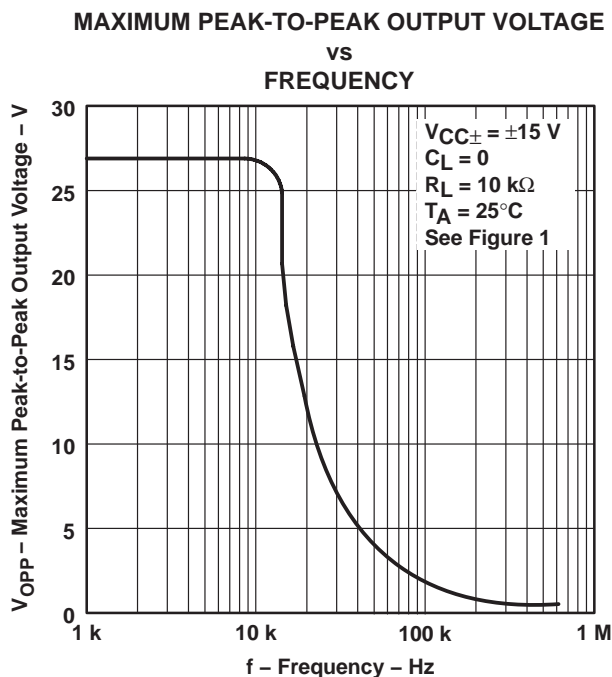


Figure 5

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

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## TYPICAL CHARACTERISTICS†

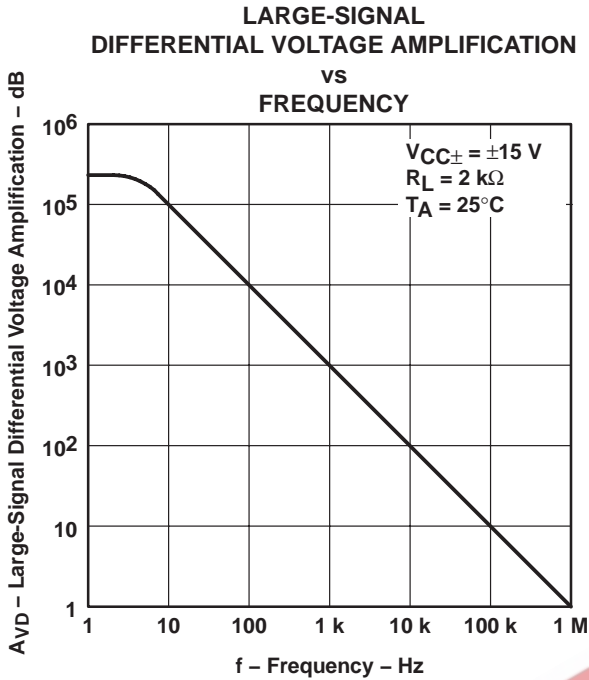


Figure 6

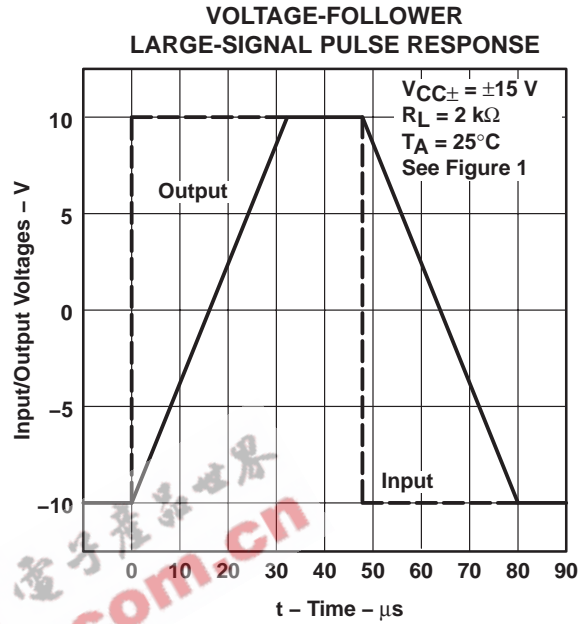


Figure 7

† Operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied.

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
TL343IDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL343IDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL343IDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TL343IDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

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**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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