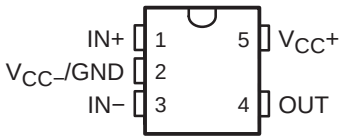
TL343
SINGLE LOW-POWER OPERATIONAL AMPLIFIER

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 μA741, 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.

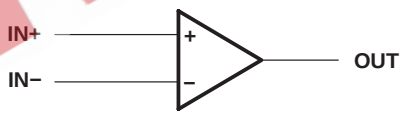
ORDERING INFORMATION

T_A	V_{IO}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	T4I_
			Reel of 250	TL343IDBVT	

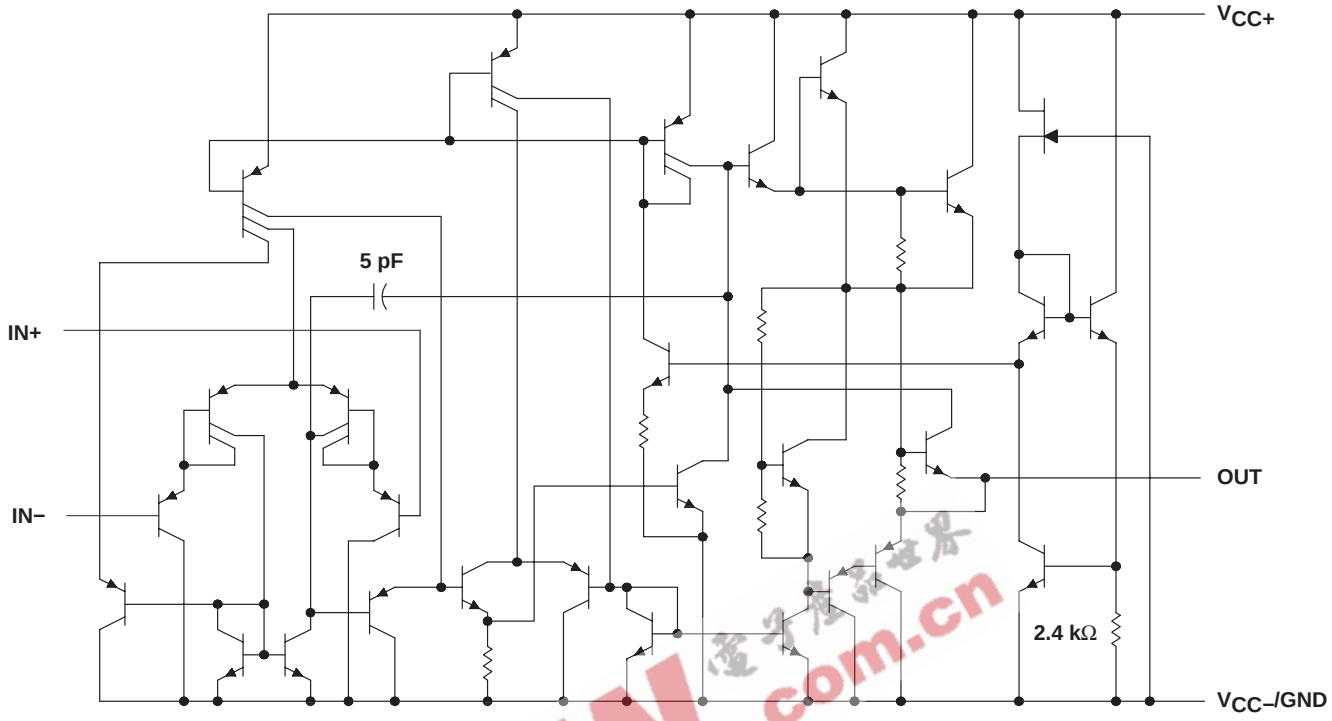
† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

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

symbol



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_{CC+}	18	V
	V_{CC-}	−18	
Supply voltage, V_{CC+} with respect to V_{CC-}		36	V
Differential input voltage (see Note 2)		±36	V
Input voltage (see Notes 1 and 3)		±18	V
Package thermal impedance, θ_{JA} (see Notes 4 and 5)		206	°C/W
Operating virtual junction temperature, T_J		150	°C
Storage temperature range, T_{stg}		−65 to 150	°C

NOTES: 1. These voltage values are with respect to the midpoint between V_{CC+} and V_{CC-}.
2. Differential voltages are at IN+ with respect to IN−.
3. Neither input must ever be more positive than V_{CC+} or more negative than V_{CC-}.
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 $P_D = (T_J(max) - T_A)/\theta_{JA}$. Selecting the maximum of 150°C can affect reliability.
5. The package thermal impedance is calculated in accordance with JESD 51-7.

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, $V_{CC\pm}$ = ±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		µV/°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		pA/°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 kΩ		25°C	±12	±13.5		V
		R_L = 2 kΩ		25°C	±10	±13		
				Full range	±10			
A_{VD}	Large-signal differential voltage amplification	V_O = ±10 V,	R_L = 2 kΩ	25°C	20	200		V/mV
				Full range	15			
B_{OM}	Maximum-output-swing bandwidth	V_{OPP} = 20 V, THD ≤ 5%,	A_{VD} = 1, R_L = 2 kΩ	25°C		9		kHz
B_1	Unity-gain bandwidth	V_O = 50 mV,	R_L = 10 kΩ	25°C		1		MHz
ϕ_m	Phase margin	C_L = 200 pF,	R_L = 2 kΩ	25°C		44		Deg
r_i	Input resistance	f = 20 Hz		25°C	0.3	1		MΩ
r_o	Output resistance	f = 20 Hz		25°C		75		Ω
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}(min)		25°C	70	90		dB
k_{SVS}	Supply-voltage sensitivity ($\Delta V_{IO}/\Delta V_{CC}$)	$V_{CC\pm}$ = ±2.5 to ±15 V		25°C		30	150	µV/V
I_{OS}	Short-circuit output current§			25°C	±10	±30	±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.

electrical characteristics, V_{CC+} = 3 V and 5 V, V_{CC-} = 0 V, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	V_O = 1.5 V and 2.5 V			2	10	mV
I_{IO}	Input offset current	V_O = 1.5 V and 2.5 V			30	50	nA
I_{IB}	Input bias current	V_O = 1.5 V and 2.5 V			−200	−500	nA
V_{OM}	Peak output voltage swing‡	R_L = 10 kΩ		3.3	3.5		V
A_{VD}	Large-signal differential voltage amplification	V_O = 1.7 V to 3.3 V,	R_L = 2 kΩ	20	200		V/mV
k_{SVS}	Supply-voltage sensitivity ($\Delta V_{IO}/\Delta V_{CC\pm}$)	$V_{CC\pm}$ = ±2.5 V to ±15 V				150	µV/V
I_{CC}	Supply current	V_O = 1.5 V and 2.5 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, $V_{CC\pm}$ = ±15 V, T_A = 25°C, A_{VD} = 1 (unless otherwise noted)

PARAMETER		TEST CONDITIONS				TYP	UNIT
SR	Slew rate at unity gain	V_I = ±10 V,	C_L = 100 pF,	R_L = 2 kΩ,	See Figure 1	1	V/µs
t_r	Rise time	ΔV_O = 50 mV,	C_L = 100 pF,	R_L = 10 kΩ,	See Figure 1	0.35	µs
t_f	Fall time	ΔV_O = 50 mV,	C_L = 100 pF,	R_L = 10 kΩ,	See Figure 1	0.35	µs
	Overshoot factor	ΔV_O = 50 mV,	C_L = 100 pF,	R_L = 10 kΩ,	See Figure 1	20%	
	Crossover distortion	$V_{I(PP)}$ = 30 mV,	V_{OPP} = 2 V,	f = 10 kHz		1%	

PARAMETER MEASUREMENT INFORMATION

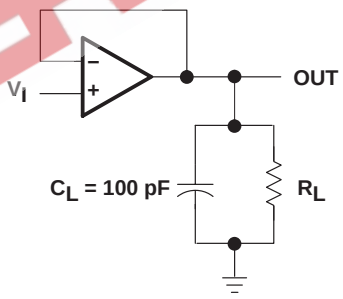


Figure 1. Unity-Gain Amplifier

TYPICAL CHARACTERISTICS†

INPUT BIAS CURRENT
vs
FREE-AIR TEMPERATURE

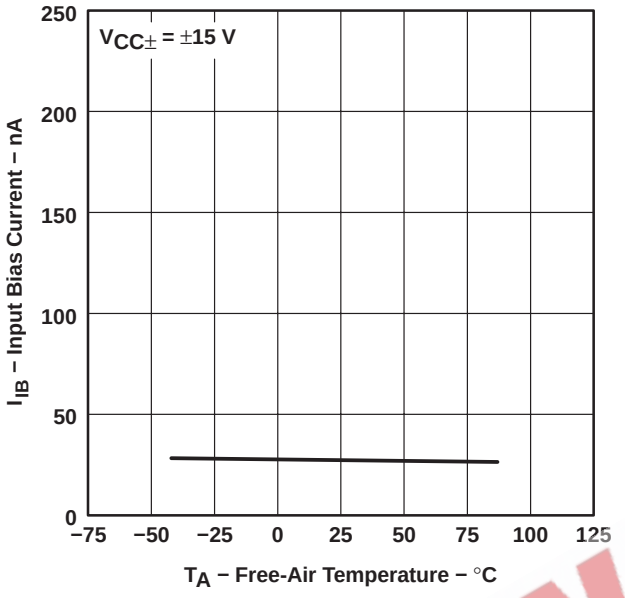


Figure 2

INPUT BIAS CURRENT
vs
SUPPLY VOLTAGE

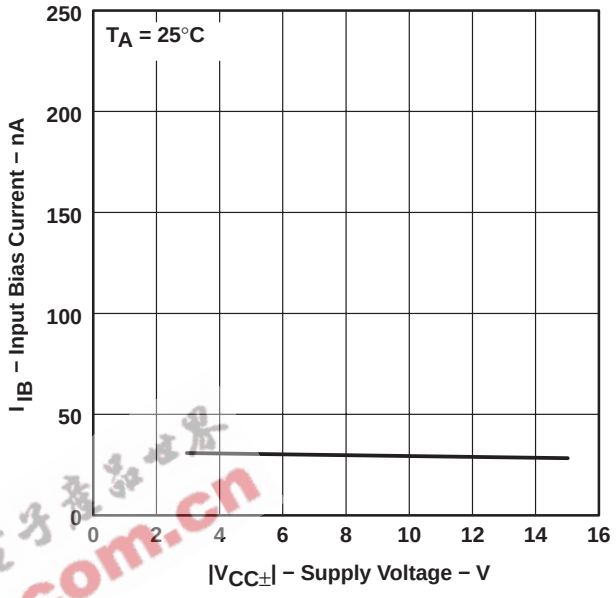


Figure 3

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE
vs
SUPPLY VOLTAGE

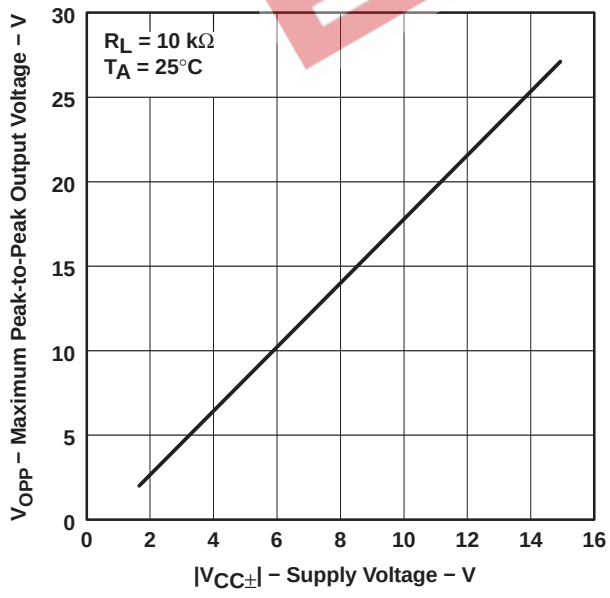


Figure 4

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE
vs
FREQUENCY

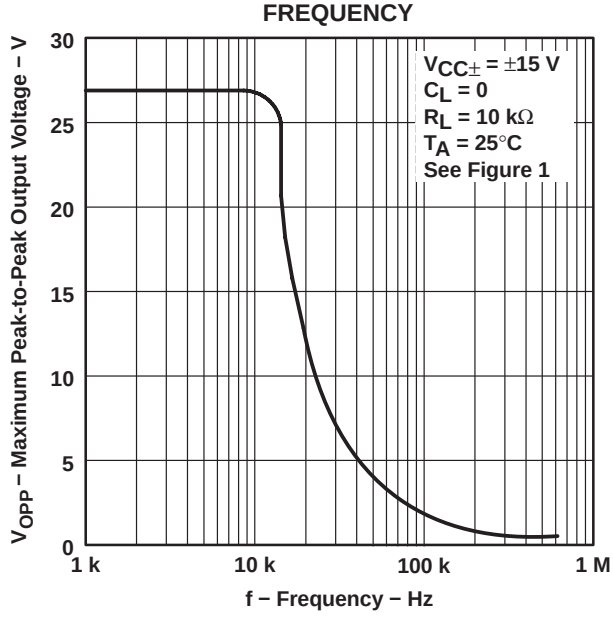


Figure 5

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

TYPICAL CHARACTERISTICS†

LARGE-SIGNAL
DIFFERENTIAL VOLTAGE AMPLIFICATION
vs
FREQUENCY

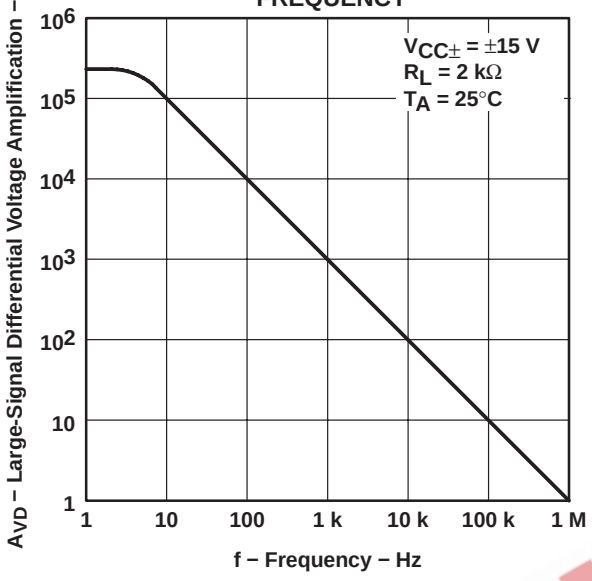


Figure 6

VOLTAGE-FOLLOWER
LARGE-SIGNAL PULSE RESPONSE

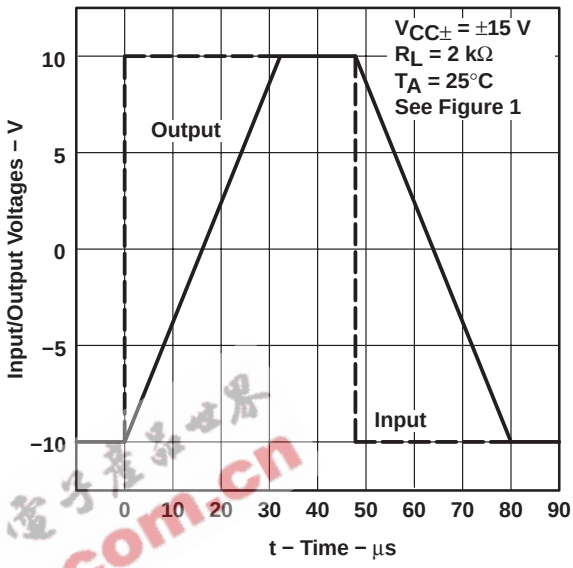


Figure 7

† 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 (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
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

(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.
OBSOLETE: TI has discontinued the production of the device.

(2) 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.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
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)

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

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