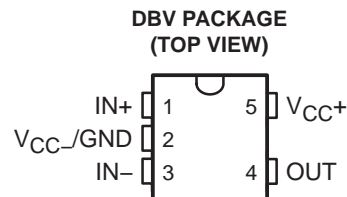


# TL343 SINGLE LOW-POWER OPERATIONAL AMPLIFIER

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



## 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.

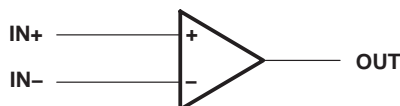
## ORDERING INFORMATION

$T_A$	$V_{IO\text{MAX}}$ 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
				T4I_

† 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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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**

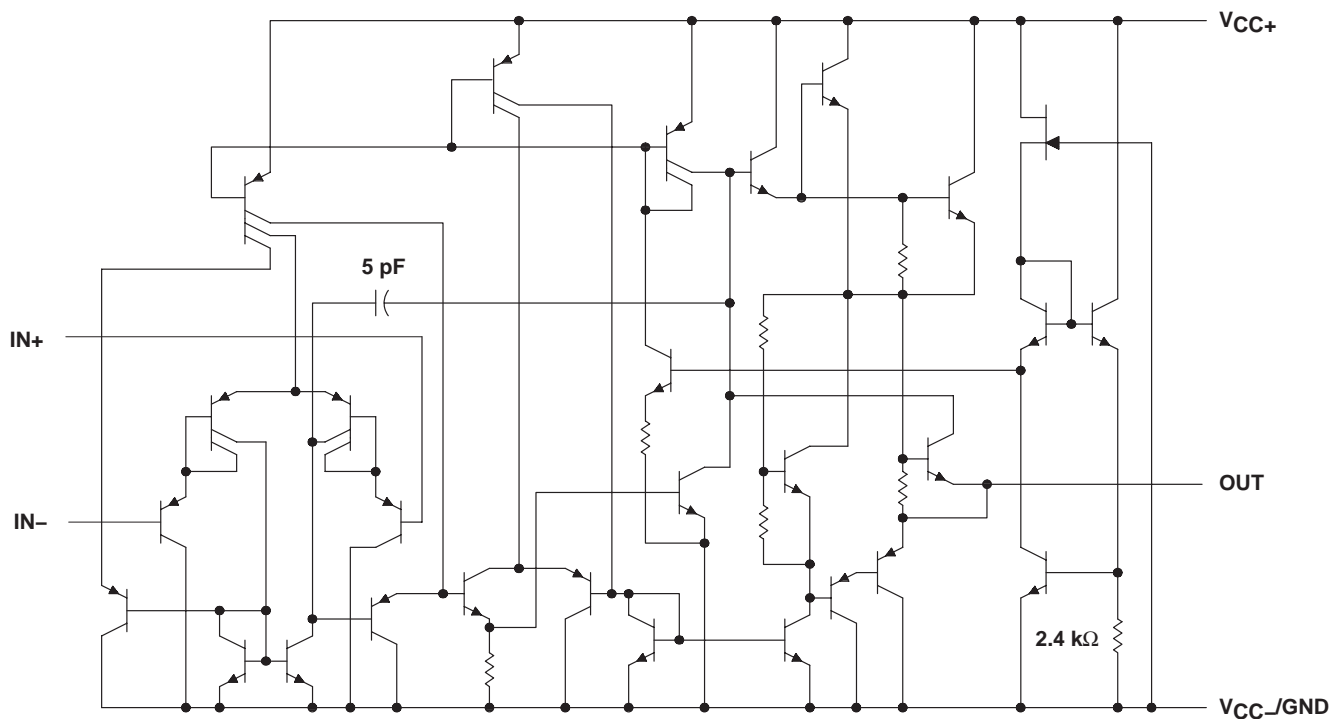
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# TL343 SINGLE LOW-POWER OPERATIONAL AMPLIFIER

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 <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

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### 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 CONDITION <sup>†</sup>		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 <sup>‡</sup>		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	$\text{M}\Omega$	
$r_o$	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 <sup>§</sup>		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	

<sup>†</sup> All characteristics are measured under open-loop conditions, with zero common-mode voltage, unless otherwise specified. Full range for  $T_A$  is  $-40^\circ\text{C}$  to  $125^\circ\text{C}$ .

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

<sup>§</sup> 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

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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 CONDITION†	MIN	TYP	MAX	UNIT
$V_{IO}$ Input offset voltage	$V_O = 1.5\text{ V}$ and $2.5\text{ V}$		2	10	mV
$I_{IO}$ Input offset current	$V_O = 1.5\text{ V}$ and $2.5\text{ V}$		30	50	nA
$I_{IB}$ Input bias current	$V_O = 1.5\text{ V}$ and $2.5\text{ V}$		-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	$\mu\text{V}/\text{V}$
$I_{CC}$ 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	$\text{V}/\mu\text{s}$
$t_r$ 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

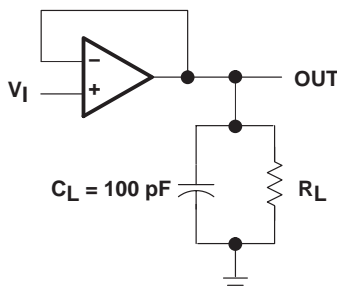


Figure 1. Unity-Gain Amplifier

TYPICAL CHARACTERISTICS†

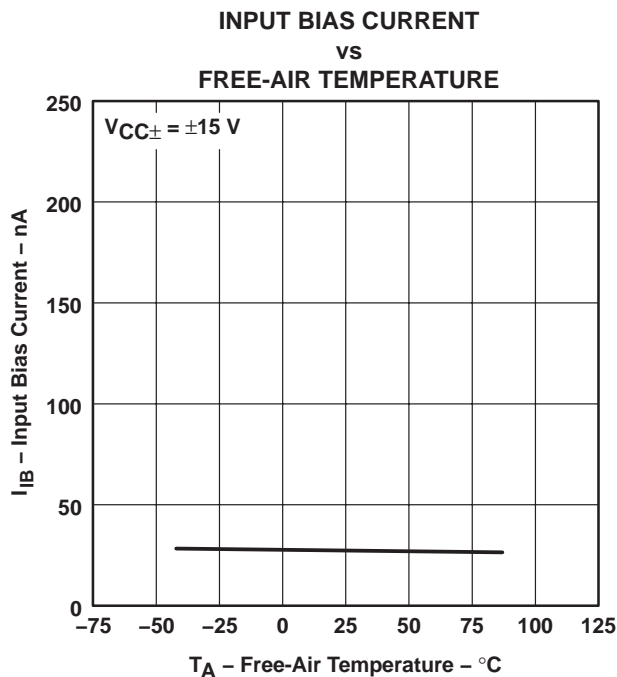


Figure 2

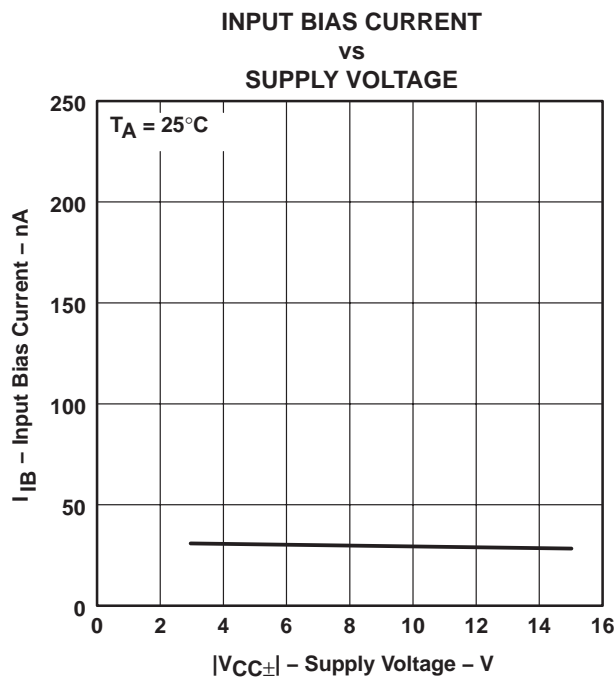


Figure 3

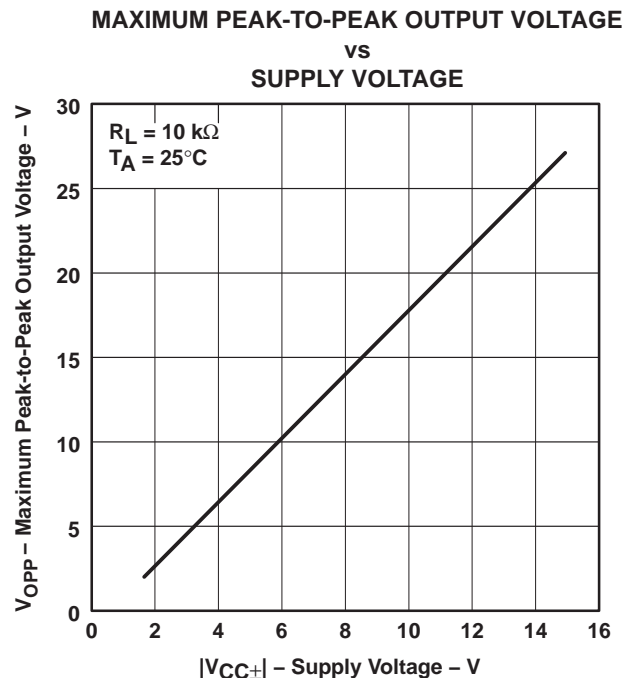


Figure 4

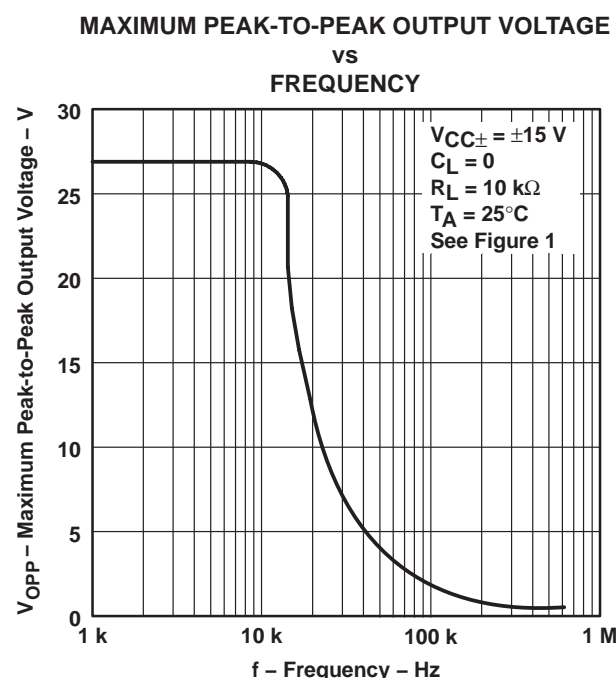


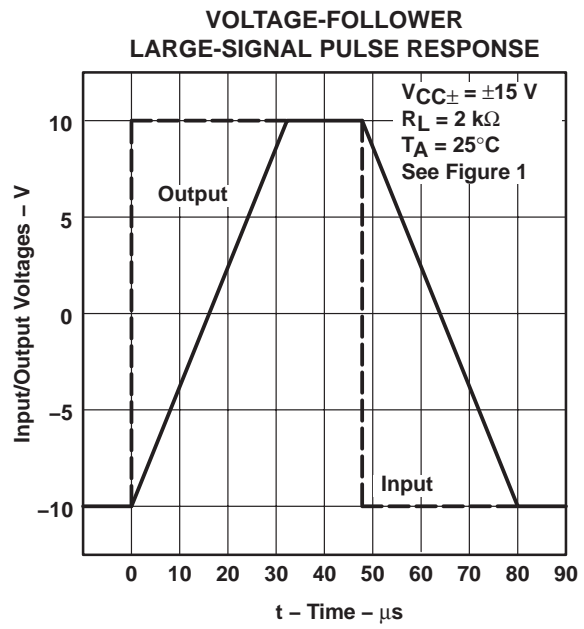
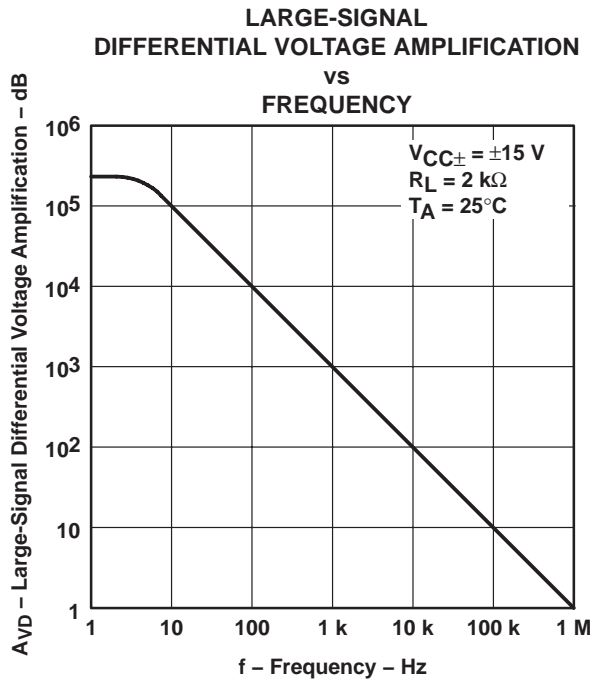
Figure 5

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

# TL343 SINGLE LOW-POWER OPERATIONAL AMPLIFIER

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## TYPICAL CHARACTERISTICS†



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

**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">TL343IDBVR</a>	Active	Production	SOT-23 (DBV)   5	3000   LARGE T&R	Yes	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 125	(T41J, T4IG, T4IJ, T4IL, T4IS)
TL343IDBVR.A	Active	Production	SOT-23 (DBV)   5	3000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(T41J, T4IG, T4IJ, T4IL, T4IS)
<a href="#">TL343IDBVT</a>	Obsolete	Production	SOT-23 (DBV)   5	-	-	Call TI	Call TI	-40 to 125	(T4IG, T4IJ, T4IL, T4IU)

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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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
TL343IDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL343IDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3



**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL3431DBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL3431DBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0



# EXAMPLE BOARD LAYOUT

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

4214839/K 08/2024

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

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:15X

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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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