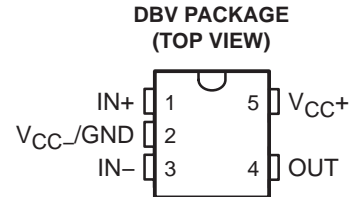


TL343

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 μ 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.

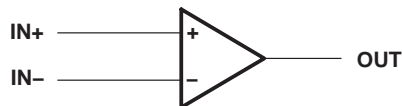
ORDERING INFORMATION

T _A	V _{IO} 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



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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**

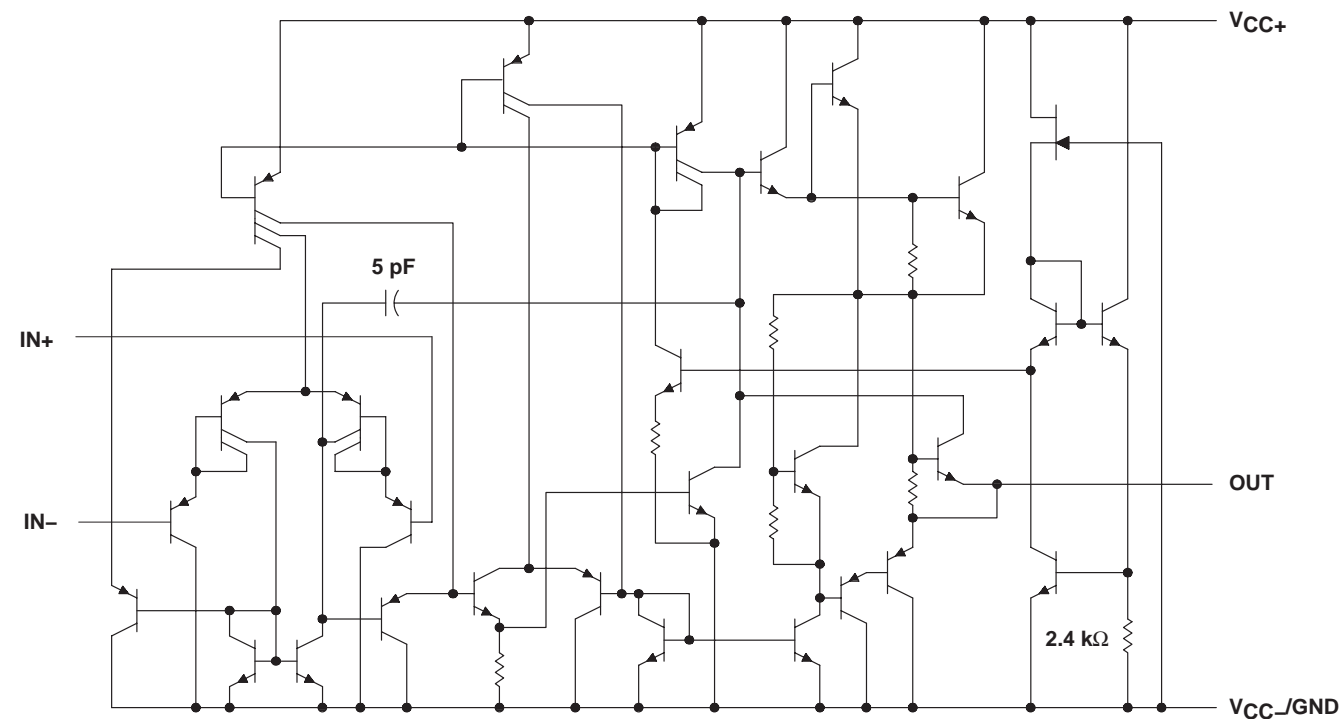
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TL343
SINGLE LOW-POWER OPERATIONAL AMPLIFIER

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 _{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)/θ_{JA}. Selecting the maximum of 150°C can affect reliability.
5. The package thermal impedance is calculated in accordance with JESD 51-7.

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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†	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		$\mu V/^{\circ}C$
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		$pA/^{\circ}C$
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	± 12	± 13.5	V
	$R_L = 2\text{ k}\Omega$	25°C	± 10	± 13	
		Full range	± 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	$V_{OPP} = 20\text{ V}$, $THD \leq 5\%$, $R_L = 2\text{ k}\Omega$	25°C	9		kHz
B_1 Unity-gain bandwidth	$V_O = 50\text{ mV}$, $R_L = 10\text{ k}\Omega$	25°C	1		MHz
ϕ_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		Ω
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	$\mu V/V$
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 $V_O = 0$.



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electrical characteristics, $V_{CC+} = 3\text{ V}$ and 5 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	$V_O = 1.5\text{ V}$ and 2.5 V		2	10	mV
I_{IO} Input offset current	$V_O = 1.5\text{ V}$ and 2.5 V		30	50	nA
I_{IB} Input bias current	$V_O = 1.5\text{ V}$ and 2.5 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 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 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/ μs
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	μs
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	μs
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

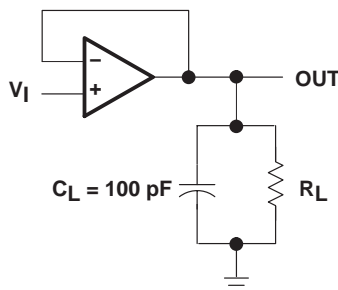


Figure 1. Unity-Gain Amplifier

TYPICAL CHARACTERISTICS†

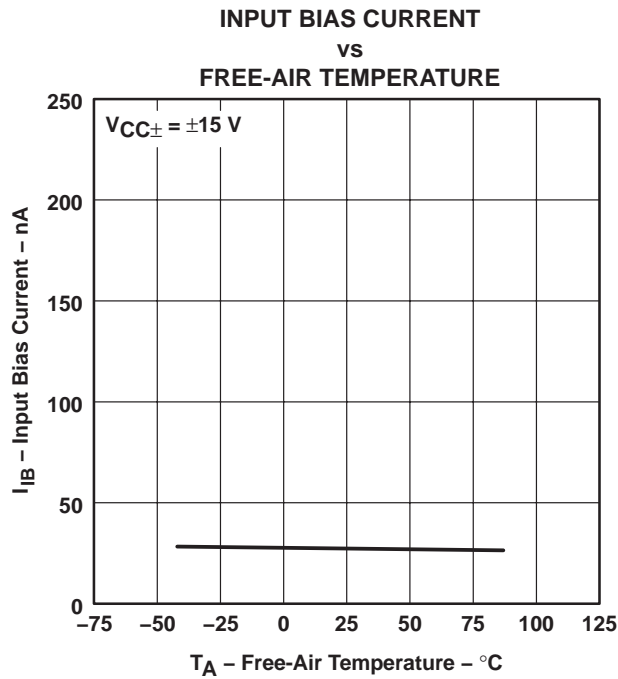


Figure 2

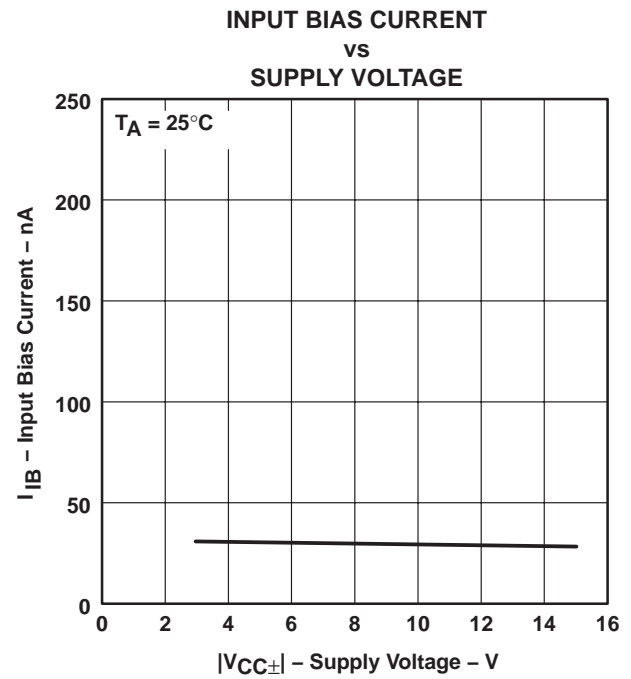


Figure 3

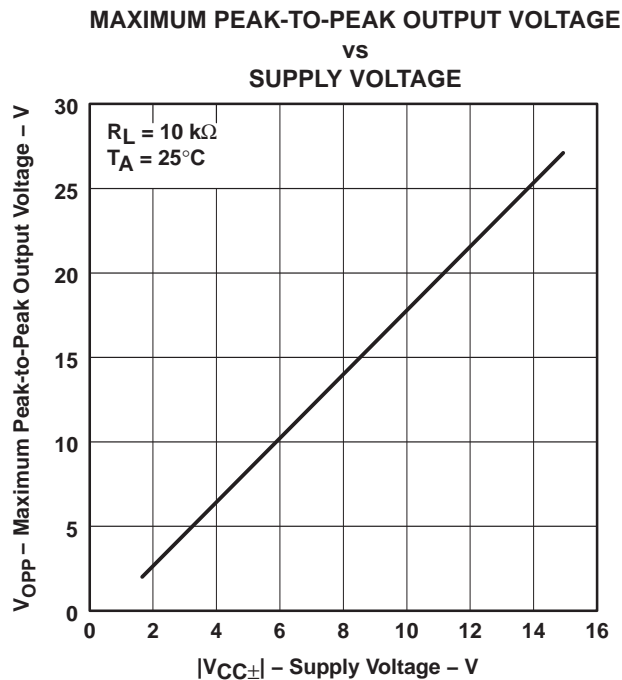


Figure 4

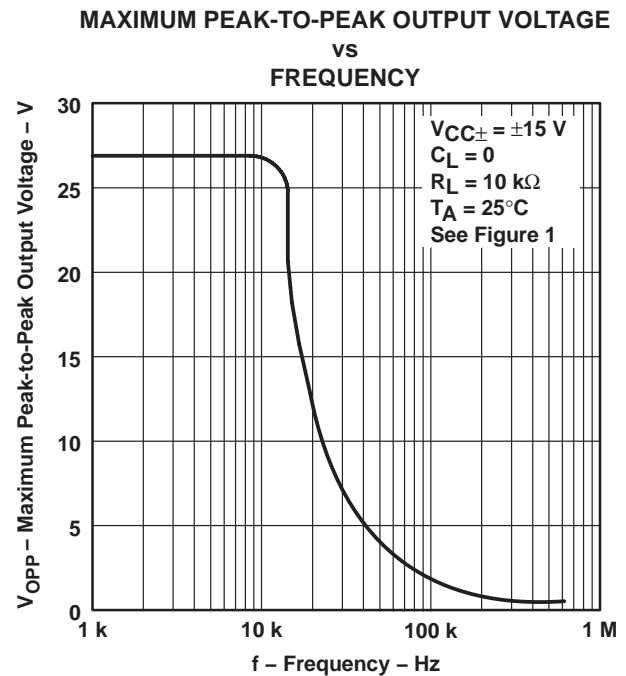


Figure 5

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

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TYPICAL CHARACTERISTICS†

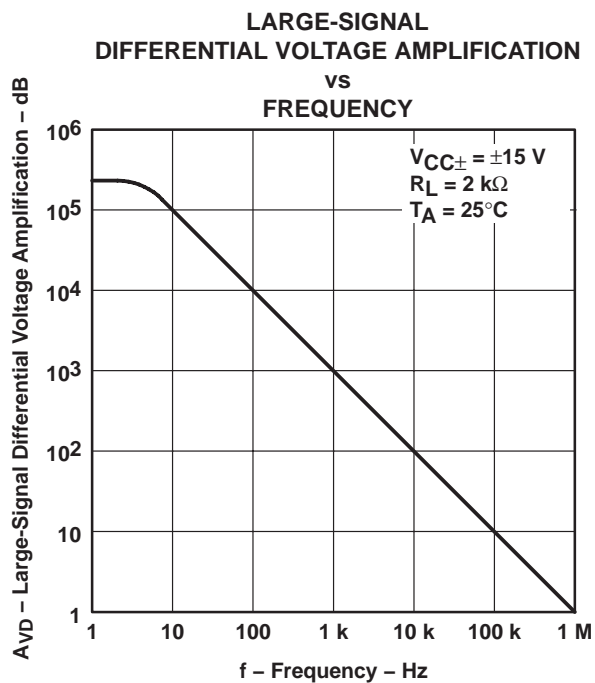


Figure 6

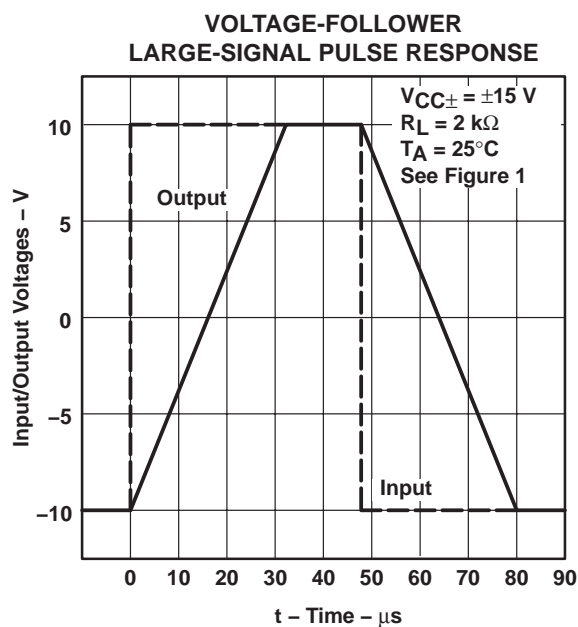


Figure 7

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

PACKAGING INFORMATION

Orderable 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)
TL343IDBVR	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)
TL343IDBVT	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



*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

DBV0005A**PACKAGE OUTLINE****SOT-23 - 1.45 mm max height**

SMALL OUTLINE TRANSISTOR

**NOTES:**

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC MO-178.
4. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25 mm per side.
5. Support pin may differ or may not be present.

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

4214839/K 08/2024

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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