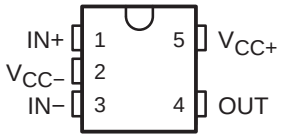
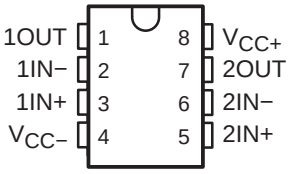
SLOS195G − FEBRUARY 1997 − REVISED NOVEMBER 2003

- **Low Supply-Voltage Operation . . . V_{CC} = ±1 V Min**
- **Wide Bandwidth . . . 7 MHz Typ at $V_{CC}\pm$ = ±2.5 V**
- **High Slew Rate . . . 3 V/μs Typ at $V_{CC}\pm$ = ±2.5 V**
- **Wide Output Voltage Swing . . . ±2.4 V Typ at $V_{CC}\pm$ = ±2.5 V, R_L = 10 kΩ**
- **Low Noise . . . 8 nV/√Hz Typ at f = 1 kHz**

TLV2361 . . . DBV PACKAGE
(TOP VIEW)



TLV2362 . . . D, DGK, P, PS, OR PW PACKAGE
(TOP VIEW)



description/ordering information

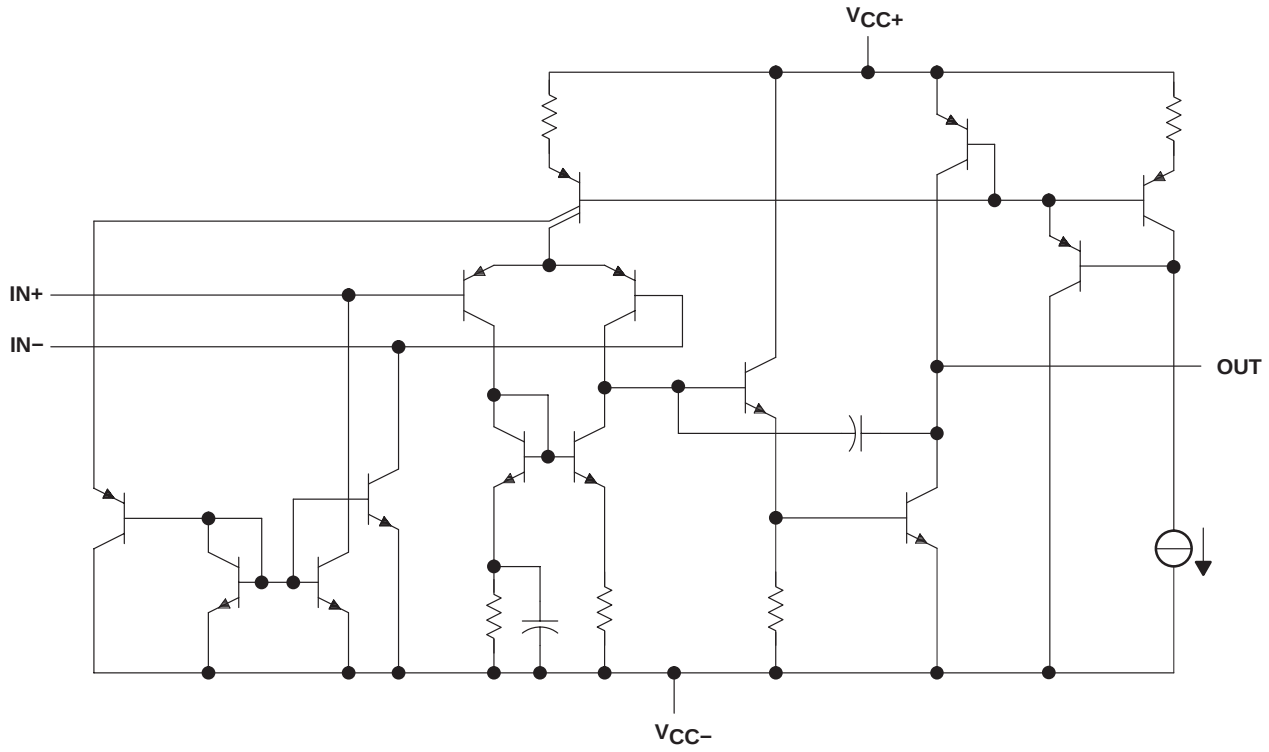
The TLV236x devices are high-performance dual operational amplifiers built using an original Texas Instruments bipolar process. These devices can be operated at a very low supply voltage (±1 V), while maintaining a wide output swing. The TLV236x devices offer a dramatically improved dynamic range of signal conditioning in low-voltage systems. The TLV236x devices also provide higher performance than other general-purpose operational amplifiers by combining higher unity-gain bandwidth and faster slew rate. With their low distortion and low-noise performance, these devices are well suited for audio applications.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−0°C to 70°C	SOT-23-5 (DBV)	Reel of 3000	TLV2361CDBVR	VAAC
		Reel of 250	TLV2361CDBVT	
−40°C to 85°C	SOT-23-5 (DBV)	Reel of 3000	TLV2361IDBVR	VAAI
		Reel of 250	TLV2361IDBVT	
	MSOP/VSSOP (DGK)	Reel of 2500	TLV2362IDGKR	YBS
	PDIP (P)	Tube of 50	TLV2362IP	TLV2362IP
	SOIC (D)	Tube of 75	TLV2362ID	2362I
		Reel of 2500	TLV2362IDR	
	SOP (PS)	Reel of 2000	TLV2362IPSR	TY2362
	TSSOP (PW)	Tube of 150	TLV2362IPW	TY2362
		Reel of 2000	TLV2362IPWR	

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

equivalent schematic (each amplifier)



ACTUAL DEVICE COMPONENT COUNT		
COMPONENT	TLV2361	TLV2362
Transistors	30	46
Resistors	6	11
Diodes	1	1
Capacitors	2	4
JFET	1	1

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

Supply voltage, V_{CC+} (see Note 1) . . . . . 3.5 V
Supply voltage, V_{CC-} (see Note 1) . . . . . −3.5 V
Differential input voltage, V_{ID} (see Note 2) . . . . . ±3.5 V
Input voltage, V_I (any input) (see Notes 1 and 3) . . . . . V_{CC}±
Output voltage, V_O . . . . . ±3.5 V
Output current, I_O . . . . . 20 mA
Duration of short-circuit current at (or below) 25°C (output shorted to GND) . . . . . Unlimited
Package thermal impedance, θ_{JA} (see Notes 4 and 5): D package . . . . . 97°C/W
DBV package . . . . . 206°C/W
DGK package . . . . . 172°C/W
P package . . . . . 85°C/W
PS package . . . . . 95°C/W
PW package . . . . . 149°C/W
Operating virtual junction temperature, T_J . . . . . 150°C
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. Differential voltages are at IN+ with respect to IN−.
3. All input voltage values must not exceed 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}	Supply voltage		±1	±2.5	V
T_A	Operating free-air temperature	TLV2361C	0	70	°C
		TLV2361I, TLV2362I	−40	85	

TLV2361 and TLV2362 electrical characteristics, $V_{CC}\pm$ = ±1.5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS			T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	V_O = 0,	V_{IC} = 0		25°C		1	6	mV
					Full range			7.5	
I_{IO}	Input offset current	V_O = 0,	V_{IC} = 0		25°C		5	100	nA
					Full range			150	
I_{IB}	Input bias current	V_O = 0,	V_{IC} = 0		25°C		20	150	nA
					Full range			250	
V_{IC}	Common-mode input voltage	$\|V_{IO}\| \le$ 7.5 mV			25°C	±0.5			V
					Full range	±0.5			
V_{OM+}	Maximum positive-peak output voltage	R_L = 10 kΩ			25°C	1.2	1.4		V
		$R_L \ge$ 10 kΩ			Full range	1.2			
V_{OM-}	Maximum negative-peak output voltage	R_L = 10 kΩ			25°C	−1.2	−1.4		V
		$R_L \ge$ 10 kΩ			Full range	−1.2			
I_{CC}	Supply current (per amplifier)	V_O = 0,	No load		25°C		1.4	2.25	mA
					Full range			2.75	mA
A_{VD}	Large-signal differential voltage amplification	V_O = ±1 V,	R_L = 10 kΩ	TLV2361	25°C	60	80		dB
				TLV2362			55		
CMRR	Common-mode rejection ratio	V_{IC} = ±0.5 V			25°C		75		dB
k_{SVR}	Supply-voltage rejection ratio	$V_{CC}\pm$ = ±1.5 V to ±2.5 V			25°C		80		dB

TLV2361 and TLV2362 operating characteristics, $V_{CC}\pm$ = ±1.5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS			TYP	UNIT
SR	Slew rate	A_V = 1,	V_I = ±0.5 V		2.5	V/μs
B_1	Unity-gain bandwidth	A_V = 40,	R_L = 10 kΩ,	C_L = 100 pF	6	MHz
V_n	Equivalent input noise voltage	R_S = 100 Ω,	R_F = 10 kΩ,	f = 1 kHz	9	nV/√Hz

TLV2361 and TLV2362 electrical characteristics, $V_{CC}\pm$ = ±2.5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS			T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	V_O = 0,	V_{IC} = 0		25°C		1	6	mV
					Full range			7.5	
I_{IO}	Input offset current	V_O = 0,	V_{IC} = 0		25°C		5	100	nA
					Full range			150	
I_{IB}	Input bias current	V_O = 0,	V_{IC} = 0		25°C		20	150	nA
					Full range			250	
V_{IC}	Common-mode input voltage	$\|V_{IO}\| \le$ 7.5 mV			25°C	±1.5			V
					Full range	±1.4			
V_{OM+}	Maximum positive-peak output voltage	R_L = 10 kΩ			25°C	2	2.4		V
		$R_L \ge$ 10 kΩ			Full range	2			
V_{OM-}	Maximum negative-peak output voltage	R_L = 10 kΩ			25°C	−2	−2.4		V
		$R_L \ge$ 10 kΩ			Full range	−2			
I_{CC}	Supply current (per amplifier)	V_O = 0,	No load		25°C		1.75	2.5	mA
					Full range			3	
A_{VD}	Large-signal differential voltage amplification	V_O = ±1 V,	R_L = 10 kΩ	TLV2361	25°C	60	80		dB
				TLV2362			60		
CMRR	Common-mode rejection ratio	V_{IC} = ±0.5 V			25°C		85		dB
k_{SVR}	Supply-voltage rejection ratio	$V_{CC}\pm$ = ±1.5 V to ±2.5 V			25°C		80		dB

TLV2361 and TLV2362 operating characteristics, $V_{CC}\pm$ = ±2.5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS			TYP	UNIT
SR	Slew rate	A_V = 1,	V_I = ±0.5 V		3	V/μs
B_1	Unity-gain bandwidth	A_V = 40,	R_L = 10 kΩ,	C_L = 100 pF	7	MHz
V_n	Equivalent input noise voltage	R_S = 100 Ω,	R_F = 10 kΩ,	f = 1 kHz	8	nV/√Hz
THD + N	Total harmonic distortion, plus noise	A_V = 1,	V_O = ±1.2 V,	R_L = 10 kΩ, f = 3 kHz	0.004	%

TYPICAL CHARACTERISTICS

Table of Graphs

GRAPH TITLE	FIGURE
Supply current vs Free-air temperature	1
Supply current vs Supply voltage	2
Maximum positive output voltage vs Output current	3
Maximum negative output voltage vs Output current	4
Maximum peak-to-peak output voltage vs Frequency	5
Equivalent input noise voltage vs Frequency	6
Total harmonic distortion vs Frequency	7
Total harmonic distortion vs Output voltage	8

TYPICAL CHARACTERISTICS

SUPPLY CURRENT vs FREE-AIR TEMPERATURE

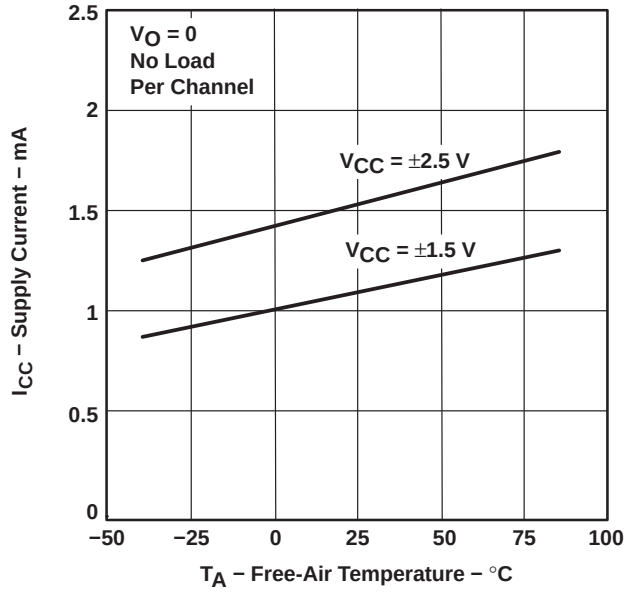


Figure 1

SUPPLY CURRENT vs SUPPLY VOLTAGE

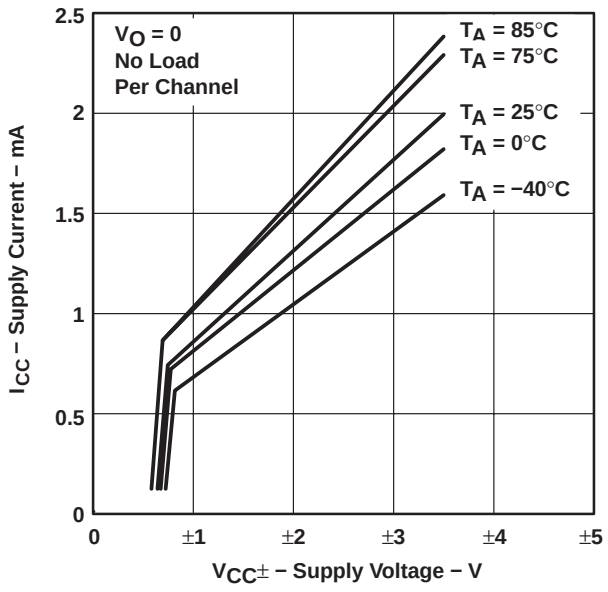


Figure 2

MAXIMUM POSITIVE OUTPUT VOLTAGE vs OUTPUT CURRENT

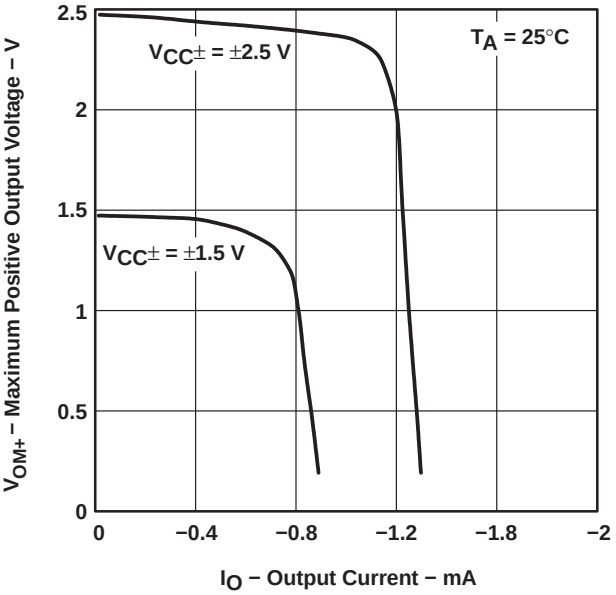


Figure 3

MAXIMUM NEGATIVE OUTPUT VOLTAGE vs OUTPUT CURRENT

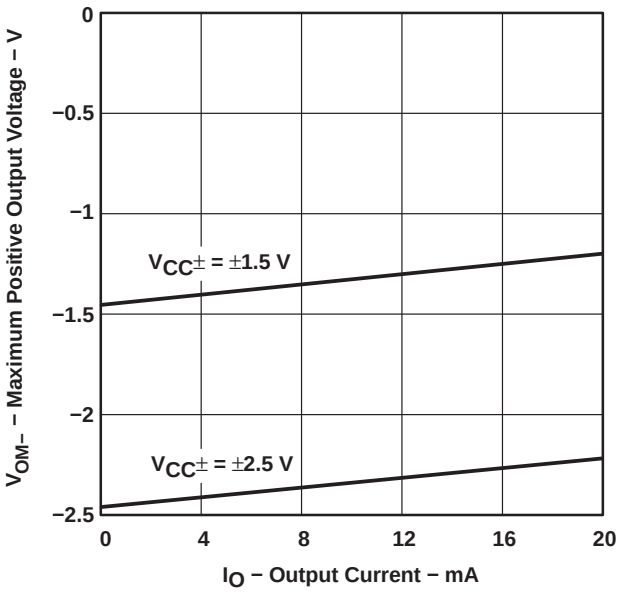


Figure 4

TYPICAL CHARACTERISTICS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs FREQUENCY

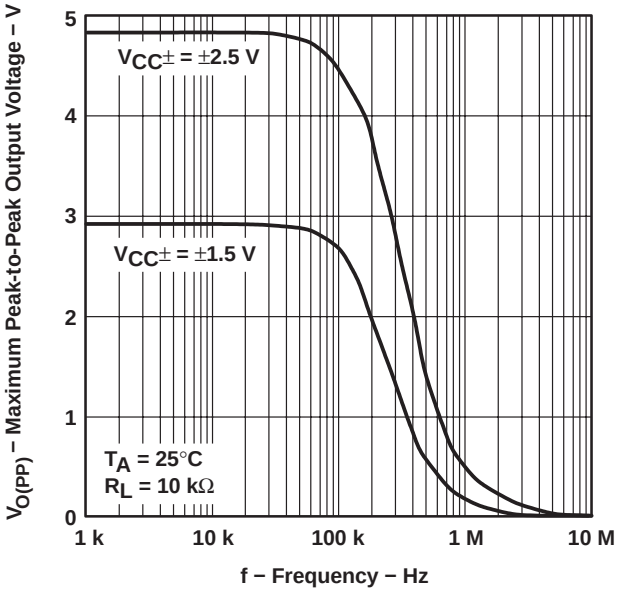


Figure 5

EQUIVALENT INPUT NOISE VOLTAGE vs FREQUENCY

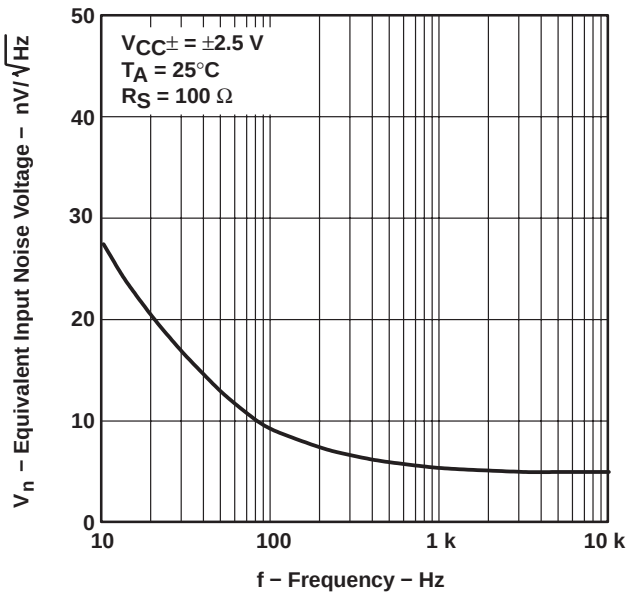


Figure 6

TOTAL HARMONIC DISTORTION vs FREQUENCY

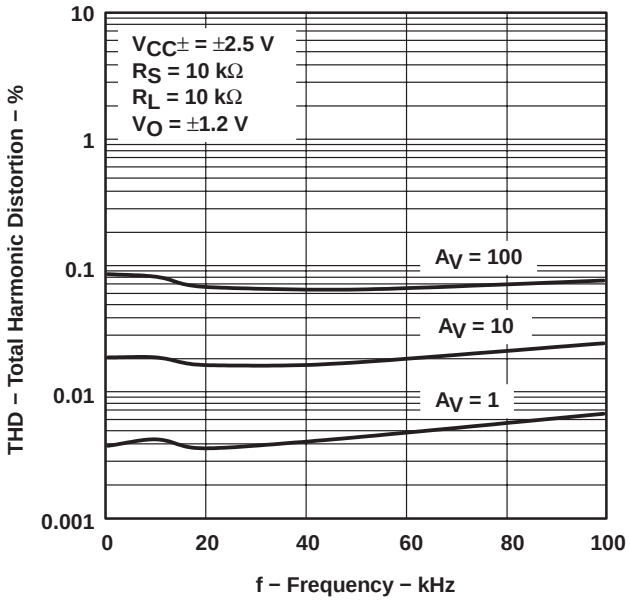


Figure 7

TOTAL HARMONIC DISTORTION vs OUTPUT VOLTAGE

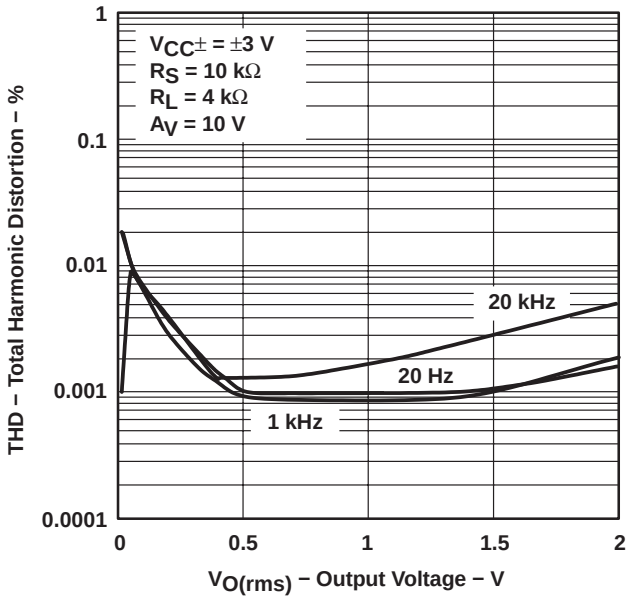
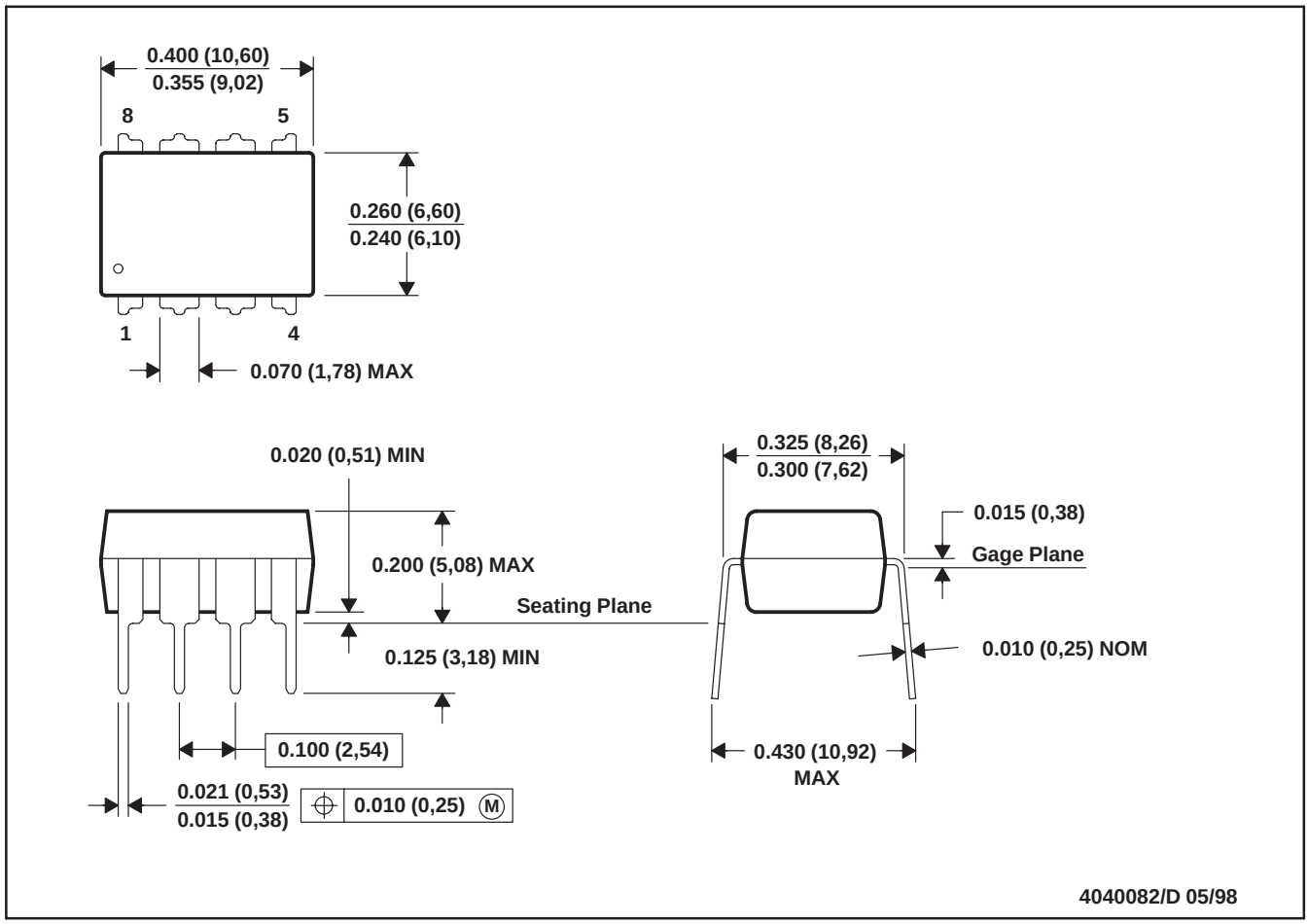


Figure 8

MPDI001A – JANUARY 1995 – REVISED JUNE 1999

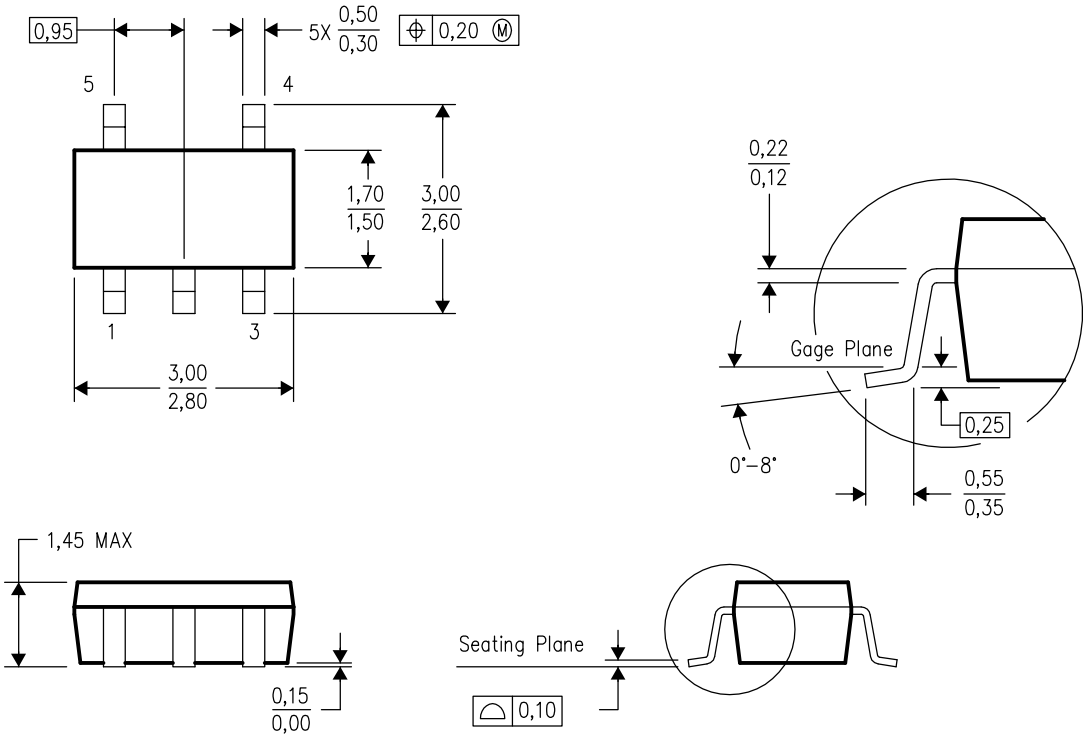
P (R-PDIP-T8) **PLASTIC DUAL-IN-LINE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001

For the latest package information, go to http://www.ti.com/sc/docs/package/pkg_info.htm

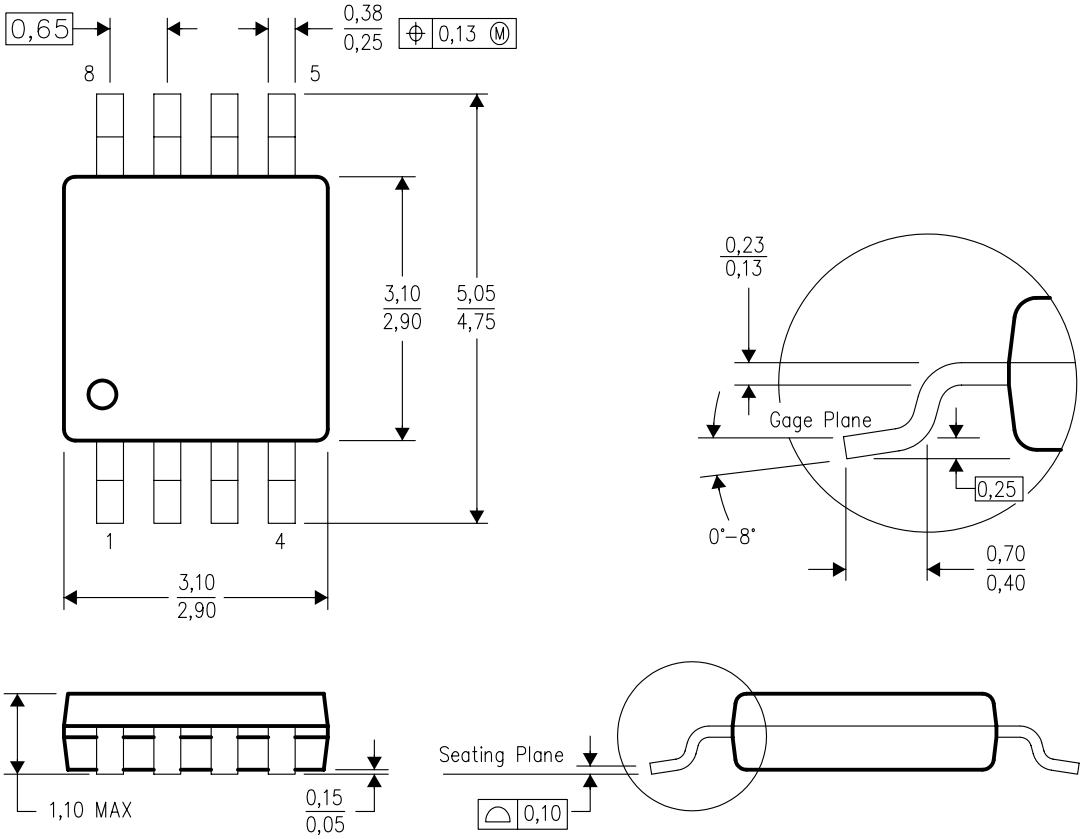
DBV (R–PDSO–G5) PLASTIC SMALL–OUTLINE PACKAGE



4073253–4/H 10/2003

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.
D. Falls within JEDEC MO–178 Variation AA.

DGK (S–PDSO–G8) PLASTIC SMALL–OUTLINE PACKAGE



4073329/D 12/03

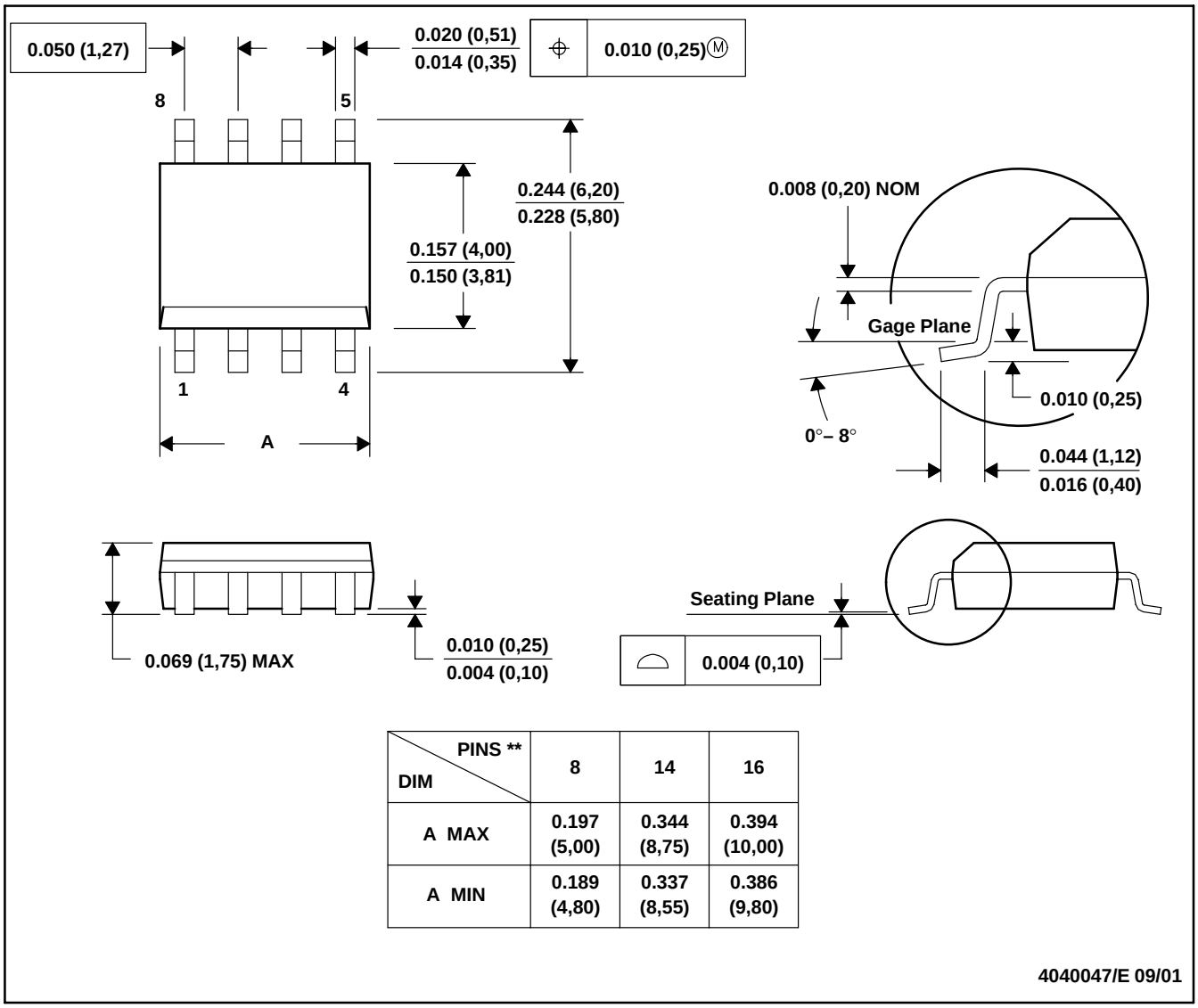
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.
D. Falls within JEDEC MO–187 variation AA.

MSOI002B – JANUARY 1995 – REVISED SEPTEMBER 2001

D (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

8 PINS SHOWN



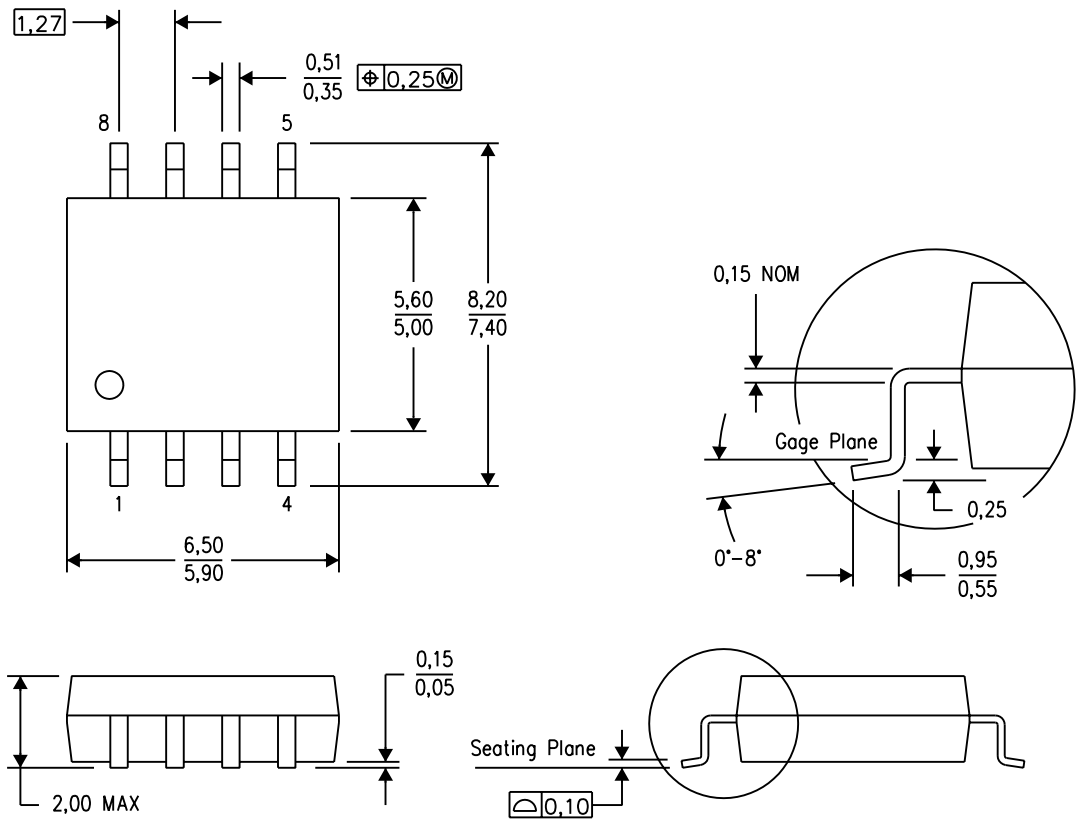
DIM \ PINS **	8	14	16
A MAX	0.197 (5,00)	0.344 (8,75)	0.394 (10,00)
A MIN	0.189 (4,80)	0.337 (8,55)	0.386 (9,80)

4040047/E 09/01

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-012

MECHANICAL DATA

PS (R-PDSO-G8) **PLASTIC SMALL-OUTLINE PACKAGE**

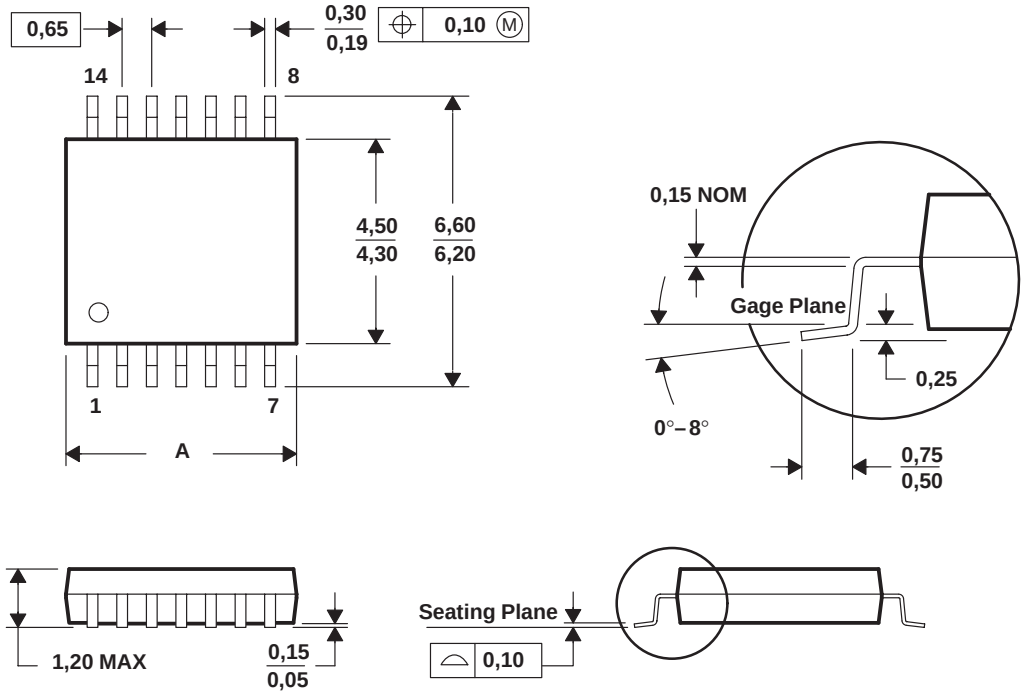


4040063/C 03/03

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

PW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN



DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

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