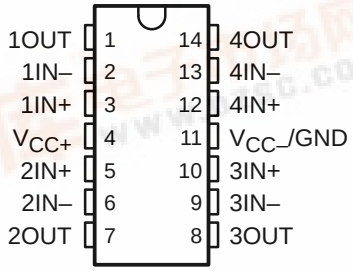
HIGH-SLEW-RATE, SINGLE-SUPPLY OPERATIONAL AMPLIFIERS

SLVS461B – JANUARY 2003 – REVISED JULY 2003

- Low Offset . . . 3 mV (Max) for A-Grade
- Wide Gain-Bandwidth Product . . . 4 MHz
- High Slew Rate . . . 13 V/μs
- Fast Settling Time . . . 1.1 μs to 0.1%
- Wide-Range Single-Supply Operation . . . 4 V to 36 V
- Wide Input Common-Mode Range Includes Ground (V_{CC-})
- Low Total Harmonic Distortion . . . 0.02%
- Large-Capacitance Drive Capability . . . 10,000 pF
- Output Short-Circuit Protection
- Alternative to MC33074/A and MC34074/A

D, N, OR PW PACKAGE
(TOP VIEW)



description/ordering information

ORDERING INFORMATION

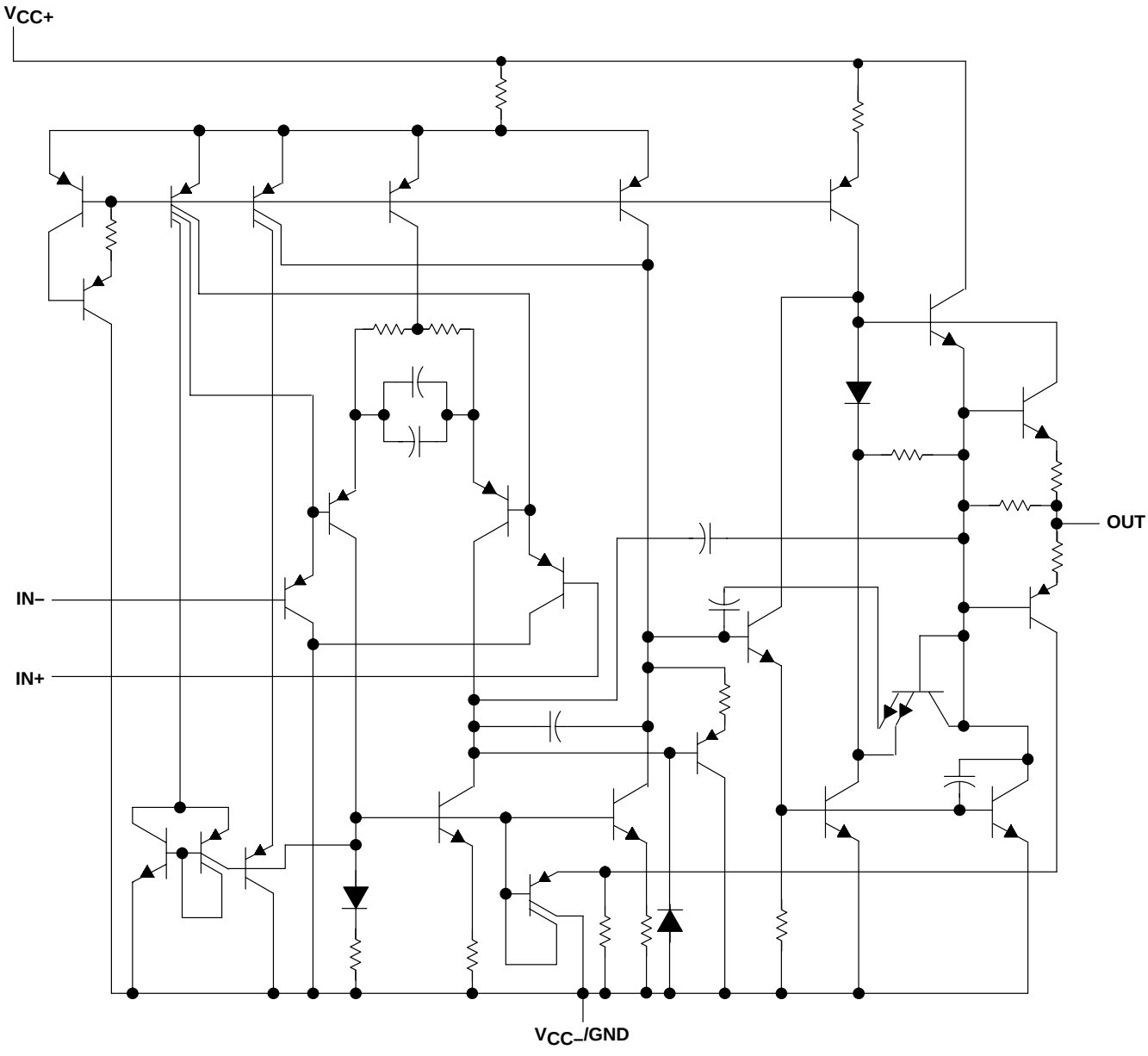
T_A	V_{IO}max AT 25°C	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	A-grade: 3 mV	PDIP (N)	Tube of 25	TL3474ACN	TL3474ACN
		SOIC (D)	Tube of 50	TL3474ACD	TL3474A
			Reel of 2500	TL3474ACDR	
		TSSOP (PW)	Tube of 90	TL3474ACPW	T3474A
			Reel of 2000	TL3474ACPWR	
	Standard grade: 10 mV	PDIP (N)	Tube of 25	TL3474CN	TL3474CN
		SOIC (D)	Tube of 50	TL3474CD	TL3474C
			Reel of 2500	TL3474CDR	
		TSSOP (PW)	Tube of 90	TL3474CPW	TL3474
			Reel of 2000	TL3474CPWR	
–40°C to 105°C	A-grade: 3 mV	PDIP (N)	Tube of 25	TL3474AIN	Z3474A
		SOIC (D)	Tube of 50	TL3474AID	TL3474AI
			Reel of 2500	TL3474AIDR	
		TSSOP (PW)	Tube of 90	TL3474AIPW	Z3474A
			Reel of 2000	TL3474AIPWR	
	Standard grade: 10 mV	PDIP (N)	Tube of 25	TL3474IN	TL3474IN
		SOIC (D)	Tube of 50	TL3474ID	TL3474I
			Reel of 2500	TL3474IDR	
		TSSOP (PW)	Tube of 90	TL3474IPW	Z3474
			Reel of 2000	TL3474IPWR	

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

description/ordering information (continued)

Quality, low-cost, bipolar fabrication with innovative design concepts is employed for the TL3474, TL3474A operational amplifiers. These devices offer 4 MHz of gain-bandwidth product, 13-V/μs slew rate, and fast settling time without the use of JFET device technology. Although the TL3474 and TL3474A can be operated from split supplies, they are particularly suited for single-supply operation because the common-mode input voltage range includes ground potential (V_{CC-}). With a Darlington transistor input stage, these devices exhibit high input resistance, low input offset voltage, and high gain. The all-npn output stage, characterized by no dead-band crossover distortion and large output voltage swing, provides high-capacitance drive capability, excellent phase and gain margins, low open-loop high-frequency output impedance, and symmetrical source/sink ac frequency response. These low-cost amplifiers are an alternative to the MC34074/A and MC33074/A operational amplifiers.

schematic (each amplifier)



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

Supply voltage: V_{CC+} (see Note 1) . . . . . 18 V
V_{CC-} . . . . . –18 V
Differential input voltage, V_{ID} (see Note 2) . . . . . ±36 V
Input voltage, V_I (any input) . . . . . $V_{CC±}$
Input current, I_I (each input) . . . . . ±1 mA
Output current, I_O . . . . . ±80 mA
Total current into V_{CC+} . . . . . 80 mA
Total current out of V_{CC-} . . . . . 80 mA
Duration of short-circuit current at (or below) 25°C (see Note 3) . . . . . Unlimited
Package thermal impedance, θ_{JA} (see Notes 4 and 5): D package . . . . . 86°C/W
N package . . . . . 80°C/W
PW package . . . . . 113°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-}/GND.
2. Differential voltages are at the noninverting input with respect to the inverting input. Excessive input current can flow when the input is less than V_{CC-} – 0.3 V.
3. The output can be shorted to either supply. Temperature and/or supply voltages must be limited to ensure that the maximum dissipation rating is not exceeded.
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 $P_D = (T_J(max) – T_A)/\theta_{JA}$. Operating at the absolute maximum T_J 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		4	36	V
V_{IC}	Common-mode input voltage	V_{CC} = 5 V	0	2.8	V
		$V_{CC±}$ = ±15 V	–15	12.8	
T_A	Operating free-air temperature	TL3474C, TL3474AC	0	70	°C
		TL3474I, TL3474AI	–40	105	

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

PARAMETER		TEST CONDITIONS		T_A	TL3474			TL3474A			UNIT
					MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, R_S = 50 Ω	V_{CC} = 5 V	25°C		1.5	10		1.5	3	mV
			V_{CC} = ±15 V	25°C		1.0	10		1.0	3	
				Full range‡			12			5	
αV_{IO}	Temperature coefficient of input offset voltage		V_{CC} = ±15 V	Full range‡		10			10		µV/°C
I_{IO}	Input offset current		V_{CC} = ±15 V	25°C		6	75		6	75	nA
				Full range‡			300			300	
I_{IB}	Input bias current		V_{CC} = ±15 V	25°C		100	500		100	500	nA
				Full range‡			700			700	
V_{ICR}	Common-mode input voltage range	R_S = 50 Ω		25°C		–15 to 12.8			–15 to 12.8		V
				Full range‡		–15 to 12.8			–15 to 12.8		
V_{OH}	High-level output voltage	V_{CC+} = 5 V, V_{CC-} = 0, R_L = 2 kΩ		25°C	3.7	4		3.7	4		V
		R_L = 10 kΩ		25°C	13.6	14		13.6	14		
		R_L = 2 kΩ		Full range‡	13.4			13.4			
V_{OL}	Low-level output voltage	V_{CC+} = 5 V, V_{CC-} = 0, R_L = 2 kΩ		25°C		0.1	0.3		0.1	0.3	V
		R_L = 10 kΩ		25°C		–14.7	–14.3		–14.7	–14.3	
		R_L = 2 kΩ		Full range‡			–13.5			–13.5	
A_{VD}	Large-signal differential voltage amplification	V_O = ±10 V, R_L = 2 kΩ		25°C	25	100		25	100		V/mV
				Full range‡	20			20			
I_{OS}	Short-circuit output current	Source: V_{ID} = 1 V,	V_O = 0	25°C	–10	–34		–10	–34		mA
		Sink: V_{ID} = –1 V,	V_O = 0		20	27		20	27		
CMRR	Common-mode rejection ratio	V_{IC} = V_{ICR}(min),	R_S = 50 Ω	25°C	65	97		80	97		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm}$ = ±13.5 V to ±16.5 V, R_S = 100 Ω		25°C	70	97		70	97		dB
I_{CC}	Supply current (per channel)	V_O = 0,	No load	25°C		3.5	4.5		3.5	4.5	mA
				Full range‡		4.5	5.5		4.5	5.5	
		V_{CC+} = 5 V, V_O = 2.5 V, V_{CC-} = 0, No load		25°C		3.5	4.5		3.5	4.5	

† All typical values are at T_A = 25°C.
‡ Full range is 0°C to 70°C for the TL3474C, TL3474AC devices and –40°C to 105°C for the TL3474I, TL3474AI devices.

operating characteristics, $V_{CC\pm}$ = ±15 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		TL3474			TL3474A			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	V_I = –10 V to 10 V, R_L = 2 kΩ, C_L = 300 pF	A_V = 1	8	10		8	10		V/μs
SR–	Negative slew rate		A_V = –1		13			13		
t_s	Settling time	A_{VD} = –1, 10-V step	To 0.1%		1.1			1.1		μs
			To 0.01%		2.2			2.2		
V_n	Equivalent input noise voltage	f = 1 kHz,	R_S = 100 Ω		49			49		nV/√Hz
I_n	Equivalent input noise current	f = 1 kHz			0.22			0.22		pA/√Hz
THD	Total harmonic distortion	$V_{O(PP)}$ = 2 V to 20 V, R_L = 2 kΩ, A_{VD} = 10, f = 10 kHz			0.02			0.02		%
GBW	Gain-bandwidth product	f =100 kHz		3	4		3	4		MHz
BW	Power bandwidth	$V_{O(PP)}$ = 20 V, R_L = 2 kΩ, A_{VD} = 1, THD = 5.0%			160			160		kHz
ϕ_m	Phase margin	R_L = 2 kΩ,	C_L = 0		70			70		deg
		R_L = 2 kΩ,	C_L = 300 pF		50			50		
	Gain margin	R_L = 2 kΩ,	C_L = 0		12			12		dB
		R_L = 2 kΩ,	C_L = 300 pF		4			4		
r_i	Differential input resistance	V_{IC} = 0			150			150		MΩ
C_i	Input capacitance	V_{IC} = 0			2.5			2.5		pF
	Channel separation	f = 10 kHz			101			101		dB
z_o	Open-loop output impedance	f = 1 MHz,	A_V = 1		20			20		Ω

TYPICAL CHARACTERISTICS (T_A = 25°C UNLESS OTHERWISE NOTED)

OUTPUT IMPEDANCE vs FREQUENCY

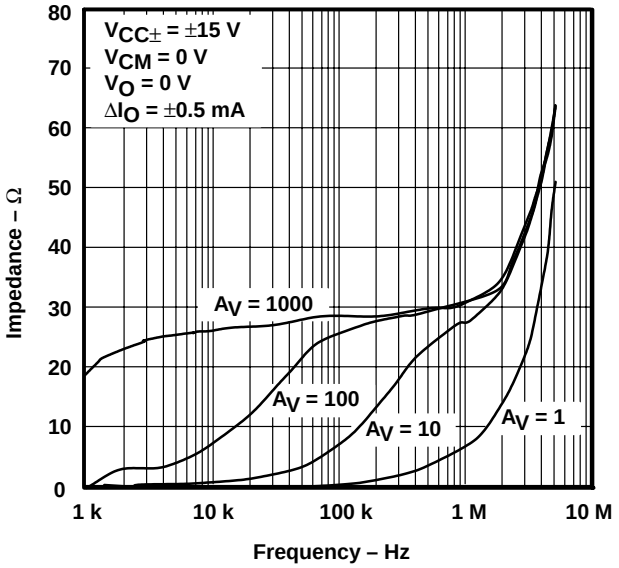


Figure 1

TOTAL HARMONIC DISTORTION vs FREQUENCY

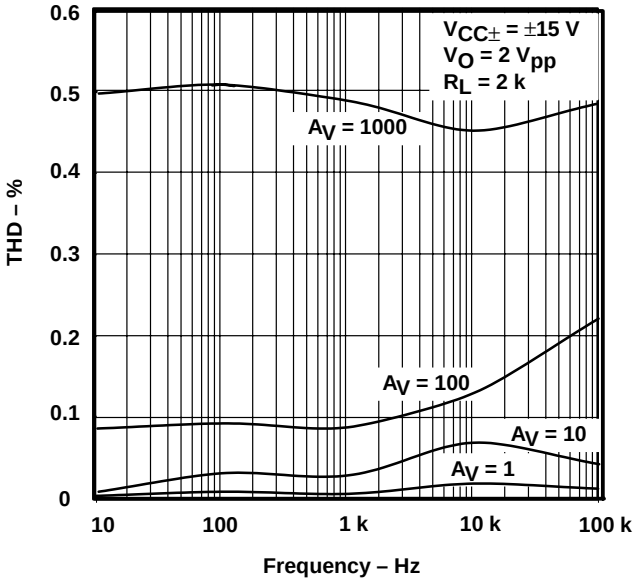


Figure 2

GAIN AND PHASE vs FREQUENCY

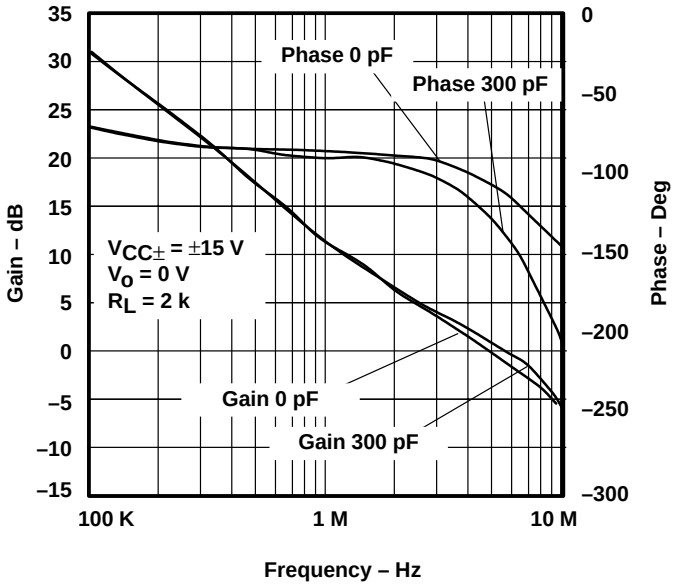


Figure 3

NORMALIZED INPUT BIAS CURRENT vs TEMPERATURE

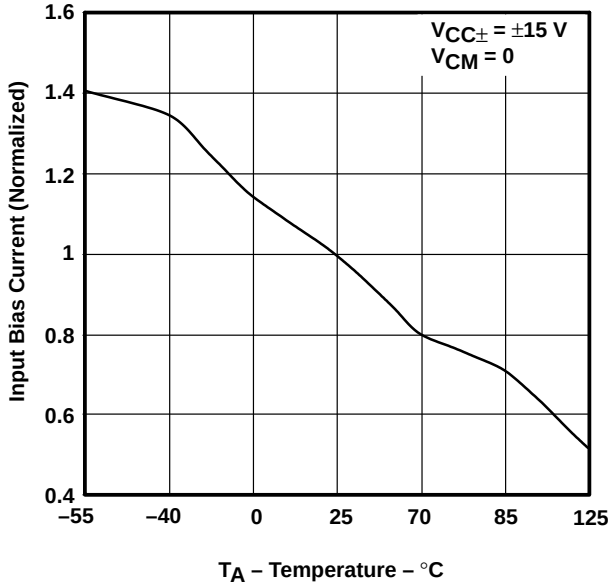


Figure 4

TYPICAL CHARACTERISTICS (T_A = 25°C UNLESS OTHERWISE NOTED)

SUPPLY CURRENT vs SUPPLY VOLTAGE

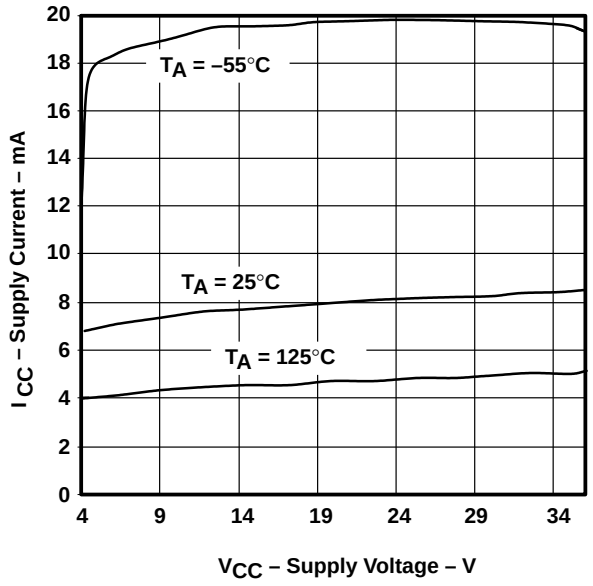


Figure 5

OFFSET VOLTAGE DRIFT vs TEMPERATURE

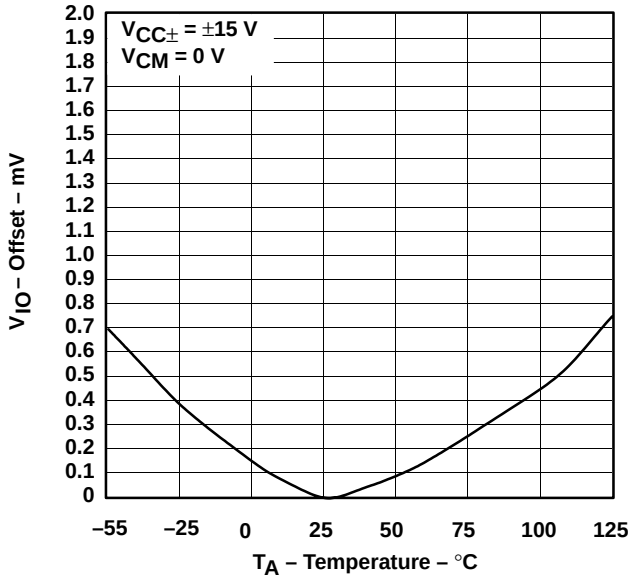


Figure 6

NORMALIZED INPUT BIAS CURRENT vs INPUT COMMON-MODE VOLTAGE

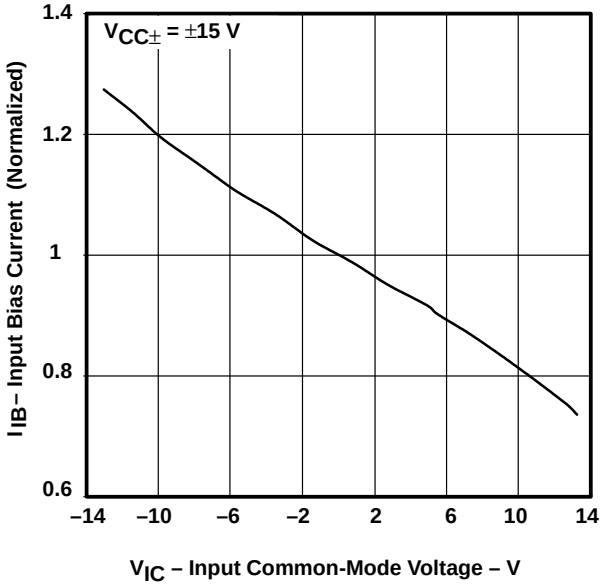


Figure 7

NORMALIZED SLEW RATE vs TEMPERATURE

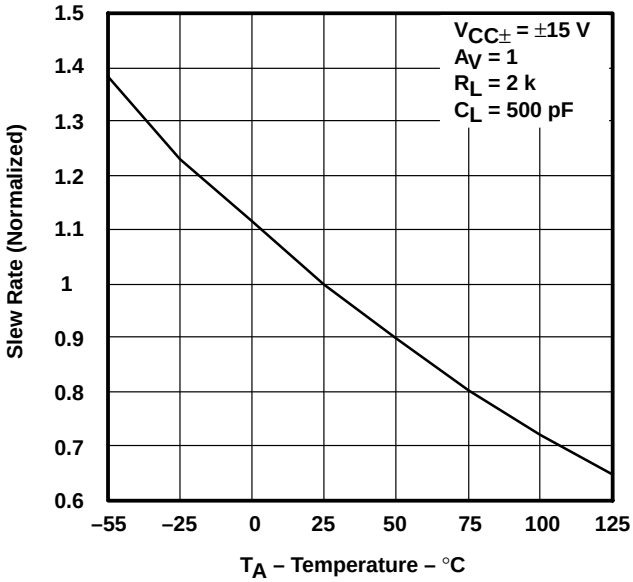


Figure 8

TYPICAL CHARACTERISTICS (T_A = 25°C UNLESS OTHERWISE NOTED)

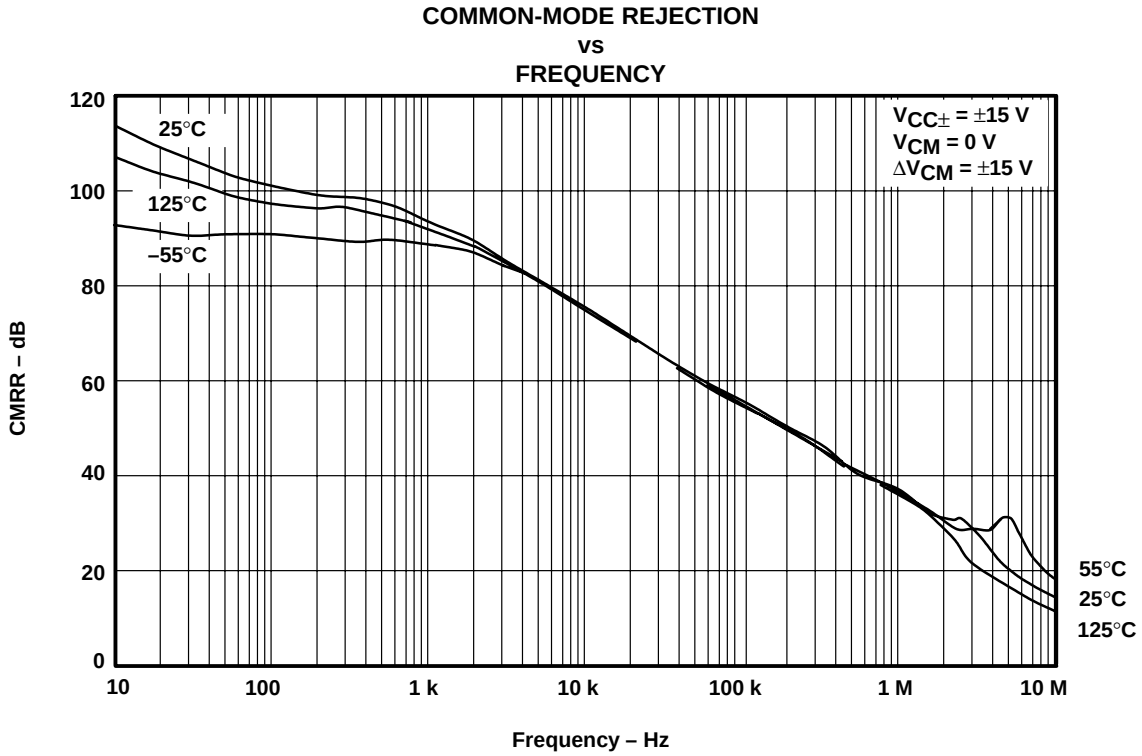
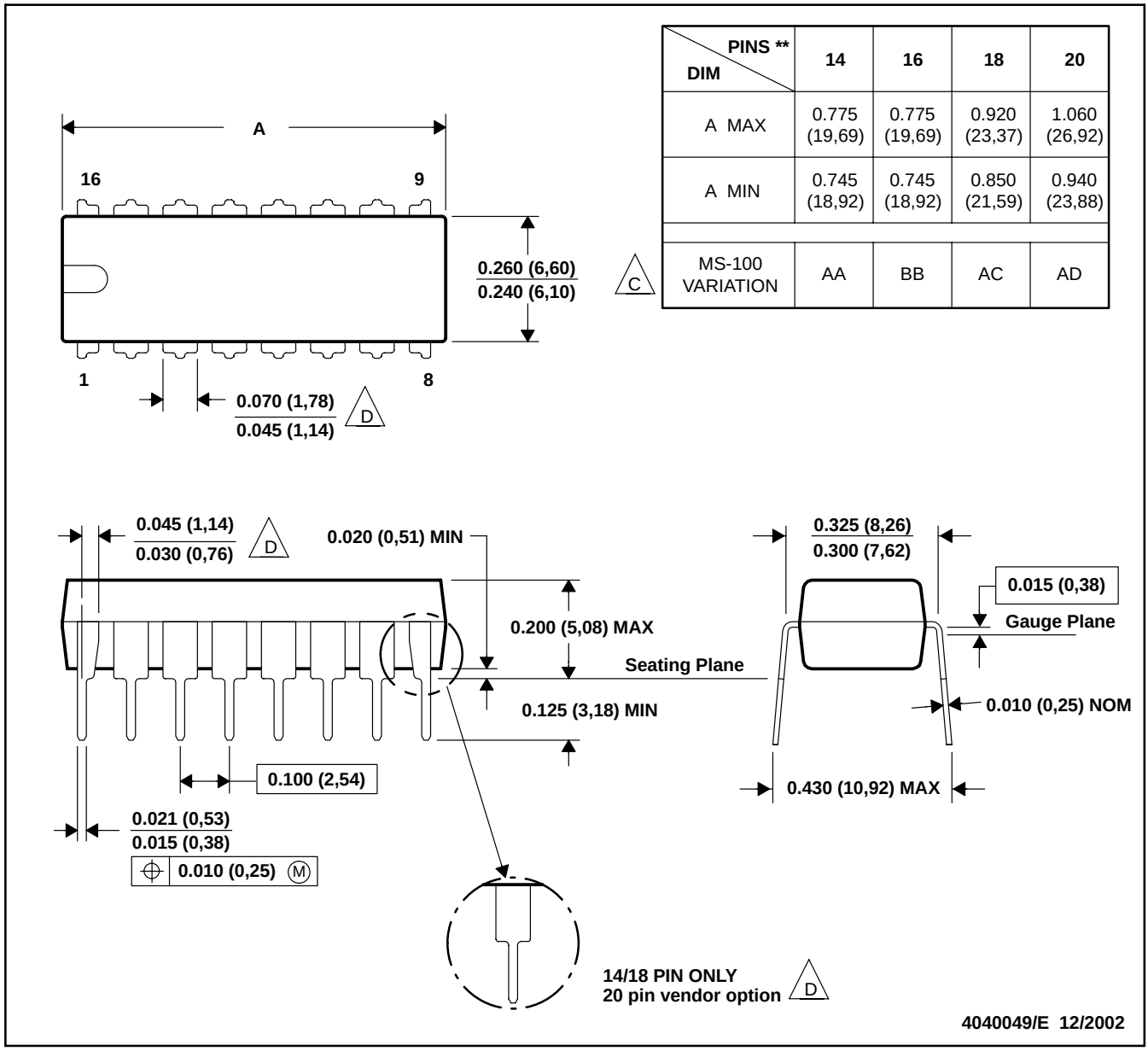


Figure 9

MECHANICAL

N (R-PDIP-T)** **PLASTIC DUAL-IN-LINE PACKAGE**

16 PINS SHOWN

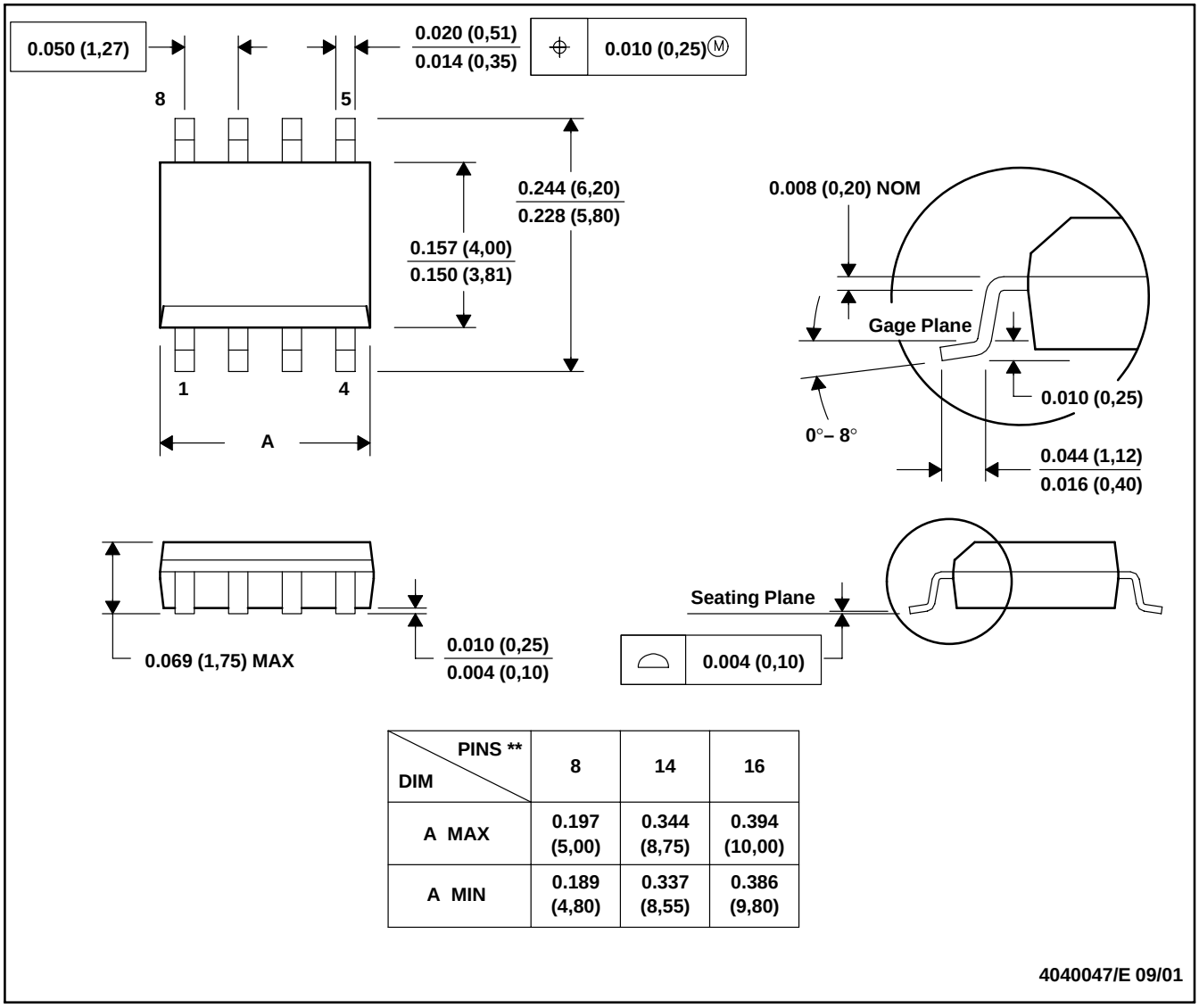


DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-100 VARIATION	AA	BB	AC	AD

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001, except 18 and 20 pin minimum body lrngth (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

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

8 PINS SHOWN



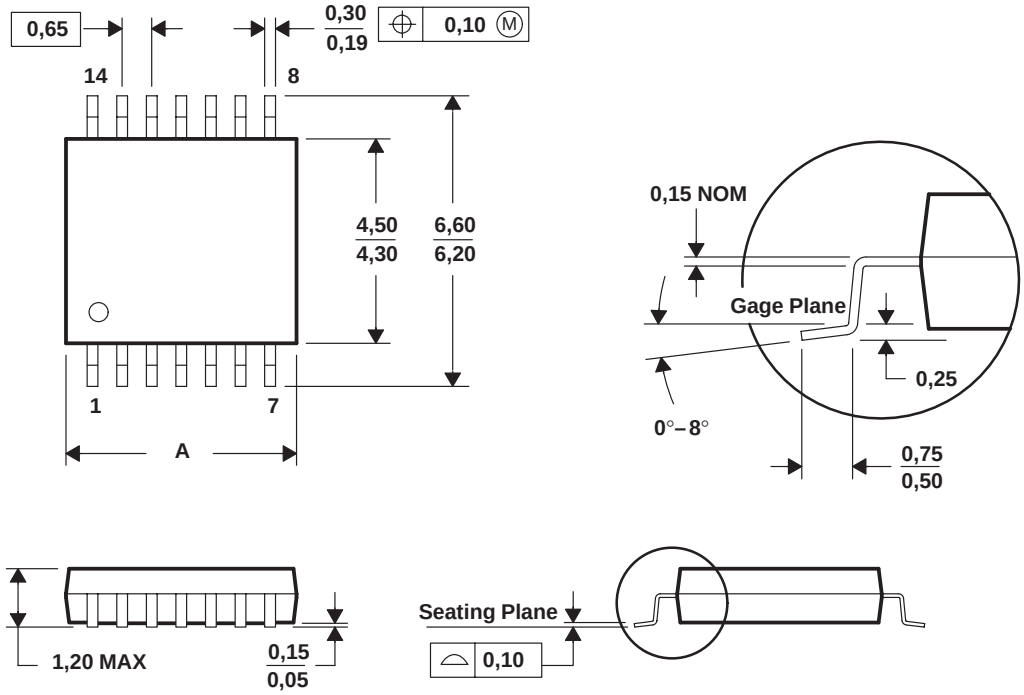
DIM \ PINS **	8	14	16
A MAX	0.197 (5,00)	0.344 (8,75)	0.394 (10,00)
A MIN	0.189 (4,80)	0.337 (8,55)	0.386 (9,80)

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

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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Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265