

- Output Swing includes Both Supply Rails
- Low Noise . . . 12 nV/ $\sqrt{\text{Hz}}$ Typ at $f = 1 \text{ kHz}$
- Low Input Bias Current . . . 1 pA Typ
- Fully Specified for Both Single-Supply and Split-Supply Operation
- Low Power . . . 500 μA Max
- Common-Mode Input Voltage Range Includes Negative Rail

- Low Input Offset Voltage 950 μV Max at $T_A = 25^\circ\text{C}$ (TLC2262A)
- Macromodel Included
- Performance Upgrade for the TS27M2/M4 and TLC27M2/M4
- Available in Q-Temp Automotive HighRel Automotive Applications Configuration Control/Print Support Qualification to Automotive Standards

description

The TLC226x and TLC2264 are dual and quadruple operational amplifiers from Texas Instruments. Both devices exhibit rail-to-rail output performance for increased dynamic range in single- or split-supply applications. The TLC226x family offers a compromise between the micropower TLC225x and the ac performance of the TLC227x. It has low supply current for battery-powered applications, while still having adequate ac performance for applications that demand it. The noise performance has been dramatically improved over previous generations of CMOS amplifiers. Figure 1 depicts the low level of noise voltage for this CMOS amplifier, which has only 200 μA (typ) of supply current per amplifier.

The TLC226x, exhibiting high input impedance and low noise, are excellent for small-signal conditioning for high-impedance sources, such as piezoelectric transducers. Because of the micro-power dissipation levels, these devices work well in hand-held monitoring and remote-sensing applications. In addition, the rail-to-rail output feature with single or split supplies makes this family a great choice when interfacing with analog-to-digital converters (ADCs). For precision applications, the TLC226xA family is available and has a maximum input offset voltage of 950 μV . This family is fully characterized at 5 V and $\pm 5 \text{ V}$.

The TLC2262/4 also makes great upgrades to the TLC27M2/L4 or TS27M2/L4 in standard designs. They offer increased output dynamic range, lower noise voltage and lower input offset voltage. This enhanced feature set allows them to be used in a wider range of applications. For applications that require higher output drive and wider input voltage range, see the TLV2432 and TLV2442. If your design requires single amplifiers, please see the TLV2211/21/31 family. These devices are single rail-to-rail operational amplifiers in the SOT-23 package. Their small size and low power consumption, make them ideal for high density, battery-powered equipment.

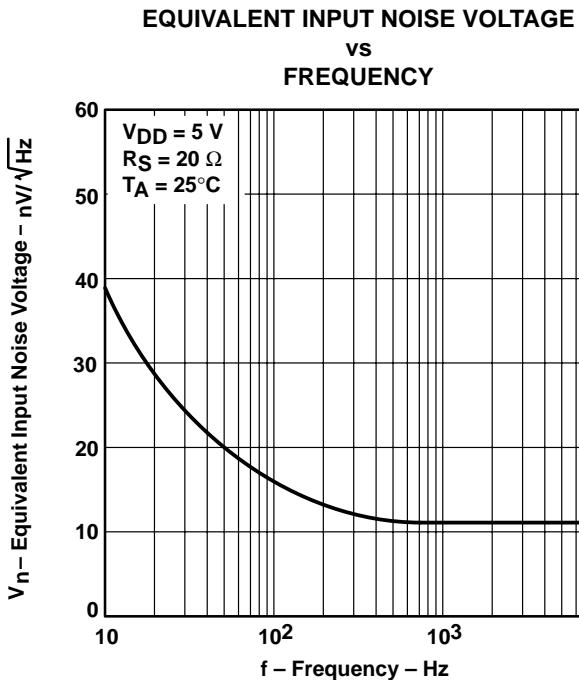


Figure 1

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



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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.

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TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262 AVAILABLE OPTIONS

T _A	V _{I0max} AT 25°C	PACKAGED DEVICES					
		SMALL OUTLINE (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	TSSOP (PW)	CERAMIC FLATPACK (U)
0°C to 70°C	2.5 mV	TLC2262CD	—	—	TLC2262CP	TLC2262CPW	—
–40°C to 125°C	950 µV 2.5 mV	TLC2262AID TLC2262ID	— —	— —	TLC2262AIP TLC2262IP	TLC2262AIPW —	— —
–40°C to 125°C	950 µV 2.5 mV	TLC2262AQD TLC2262QD	— —	— —	— —	— —	— —
–55°C to 125°C	950 µV 2.5 mV	— —	TLC2262AMFK TLC2262MFK	TLC2262AMJG TLC2262MJG	— —	— —	TLC2262AMU TLC2262MU

The D packages are available taped and reeled. Add R suffix to device type (e.g., TLC2262CDR). The PW package is available only left-end taped and reeled. Chips are tested at 25°C.

TLC2264 AVAILABLE OPTIONS

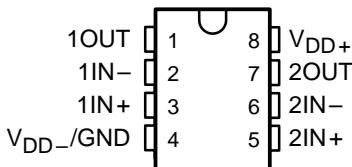
T _A	V _{I0max} AT 25°C	PACKAGED DEVICES					
		SMALL OUTLINE (D)	CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)	TSSOP (PW)	CERAMIC FLATPACK (W)
0°C to 70°C	2.5 mV	TLC2264CD	—	—	TLC2264CN	TLC2264CPW	—
–40°C to 125°C	950 µV 2.5 mV	TLC2264AID TLC2264ID	— —	— —	TLC2264AIN TLC2264IN	TLC2264AIPW —	— —
–40°C to 125°C	950 µV 2.5 mV	TLC2264AQD TLC2264QD	— —	— —	— —	— —	— —
–55°C to 125°C	950 µV 2.5 mV	— —	TLC2264AMFK TLC2264MFK	TLC2264AMJ TLC2264MJ	— —	— —	TLC2264AMW TLC2264MW

The D packages are available taped and reeled. Add R suffix to device type (e.g., TLC2264CDR). The PW package is available only left-end taped and reeled. Chips are tested at 25°C.

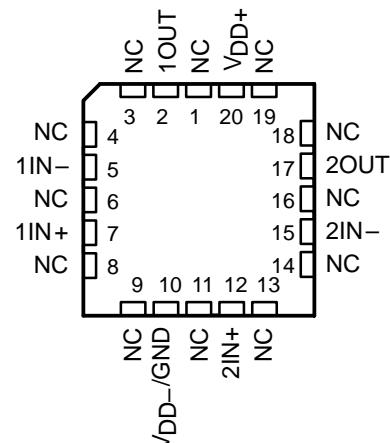
TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

**TLC2262C, TLC2262AC
 TLC2262I, TLC2262AI
 TLC2262Q, TLC2262AQ
 D, P, OR PW PACKAGE
 (TOP VIEW)**

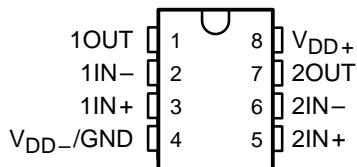


**TLC2262M, TLC2262AM . . . FK PACKAGE
 (TOP VIEW)**

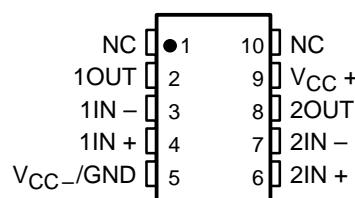


NC – No internal connection

**TLC2262M, TLC2262AM . . . JG PACKAGE
 (TOP VIEW)**

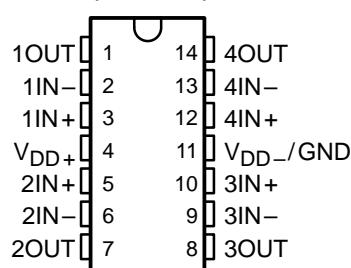


**TLC2262M, TLC2262AM . . . U PACKAGE
 (TOP VIEW)**

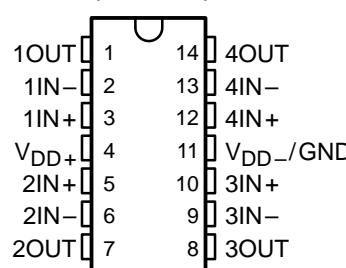


NC – No internal connection

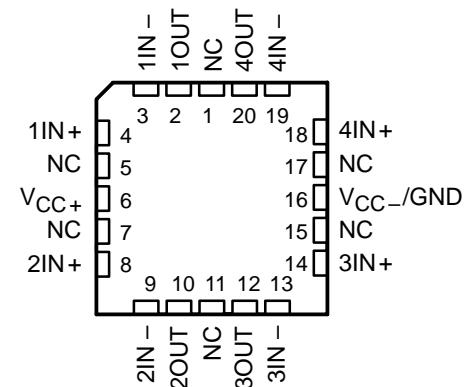
**TLC2264C, TLC2264AC
 TLC2264I, TLC2264AI
 TLC2264Q, TLC2264AQ
 D, N, OR PW PACKAGE
 (TOP VIEW)**



**TLC2264M, TLC2264AM . . . J OR W PACKAGE
 (TOP VIEW)**



**TLC2264M, TLC2264AM . . . FK PACKAGE
 (TOP VIEW)**

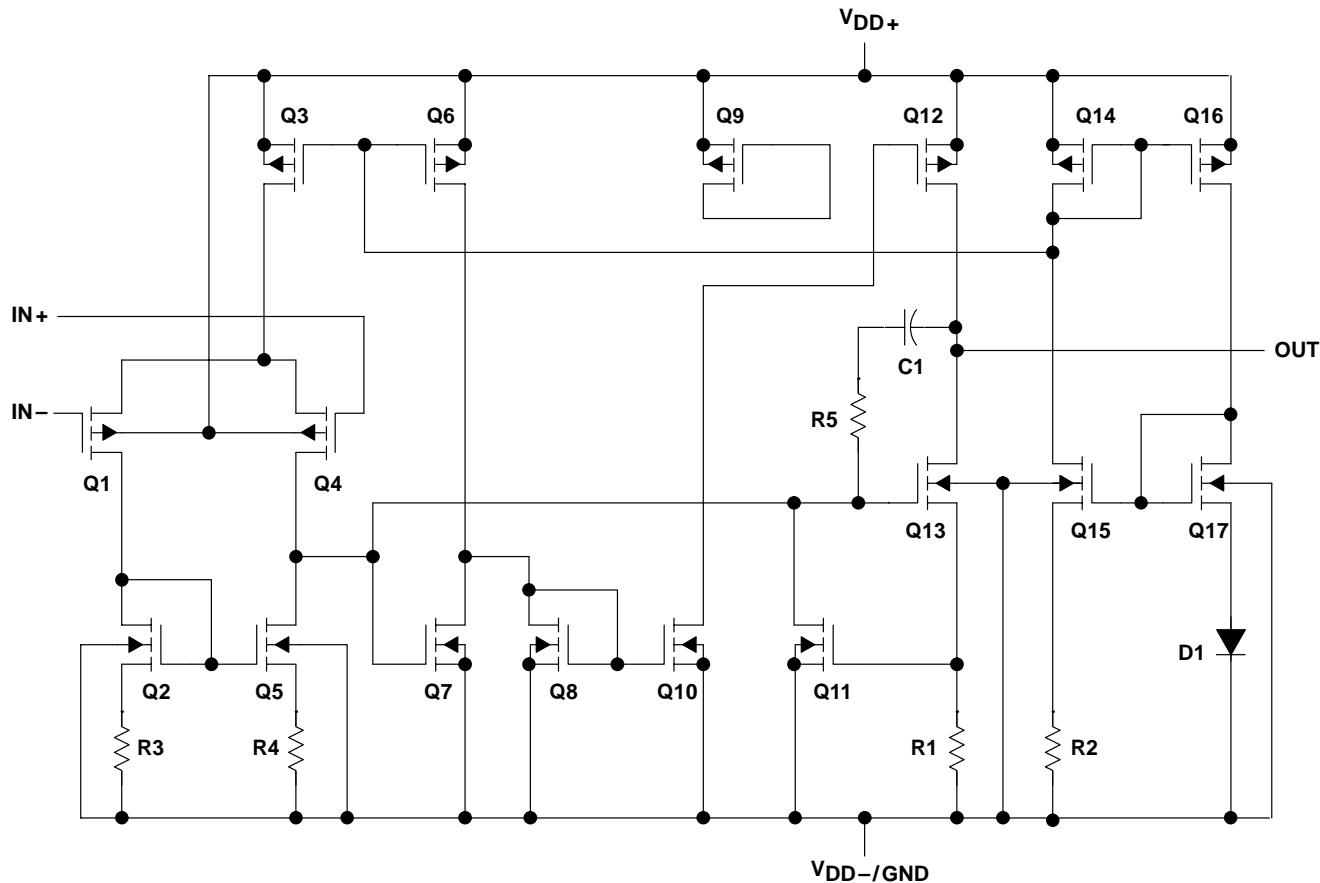


NC – No internal connection

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

equivalent schematic (each amplifier)



ACTUAL DEVICE COMPONENT COUNT†		
COMPONENT	TLC2262	TLC2264
Transistors	38	76
Resistors	28	56
Diodes	9	18
Capacitors	3	6

† Includes both amplifiers and all ESD, bias, and trim circuitry

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

Supply voltage, V_{DD+} (see Note 1)	.....	8 V
Supply voltage, V_{DD-} (see Note 1)	.....	-8 V
Differential input voltage, V_{ID} (see Note 2)	.....	±16 V
Input voltage, V_I (any input, see Note 1)	.....	$V_{DD-} - 0.3$ V to V_{DD+}
Input current, I_I (each input)	.....	±5 mA
Output current, I_O	.....	±50 mA
Total current into V_{DD+}	.....	±50 mA
Total current out of V_{DD-}	.....	±50 mA
Duration of short-circuit current at (or below) 25°C (see Note 3)	.....	unlimited
Continuous total dissipation	.....	See Dissipation Rating Table
Operating free-air temperature range, T_A :	C suffix	0°C to 70°C
	I suffix	-40°C to 125°C
	Q suffix	-40°C to 125°C
	M suffix	-55°C to 125°C
Storage temperature range, T_{STG}	.....	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds:	D, N, P, and PW packages	260°C
	J, LG, U, and W packages	300°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_{DD+} and V_{DD-} .
 2. Differential voltages are at $IN+$ with respect to $IN-$. Excessive current flows if input is brought below $V_{DD-} - 0.3$ V.
 3. The output may be shorted to either supply. Temperature and/or supply voltages must be limited to ensure that the maximum dissipation rating is not exceeded.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
D-8	725 mW	5.8 mW/°C	464 mW	377 mW	145 mW
D-14	950 mW	7.6 mW/°C	608 mW	494 mW	190 mW
FK	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW
J	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW
JG	1050 mW	8.4 mW/°C	672 mW	546 mW	210 mW
N	1150 mW	9.2 mW/°C	736 mW	598 mW	230 mW
P	1000 mW	8.0 mW/°C	640 mW	520 mW	200 mW
PW-8	525 mW	4.2 mW/°C	336 mW	273 mW	105 mW
PW-14	700 mW	5.6 mW/°C	448 mW	364 mW	140 mW
U	700 mW	5.5 mW/°C	452 mW	370 mW	150 mW
W	700 mW	5.5 mW/°C	452 mW	370 mW	150 mW

recommended operating conditions

	C SUFFIX		I SUFFIX		Q SUFFIX		M SUFFIX		UNIT
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Supply voltage, $V_{DD\pm}$	±2.2	±8	±2.2	±8	±2.2	±8	±2.2	±8	V
Input voltage range, V_I	$V_{DD-} - V_{DD+} - 1.5$	V							
Common-mode input voltage, V_{IC}	$V_{DD-} - V_{DD+} - 1.5$	V							
Operating free-air temperature, T_A	0	70	-40	125	-40	125	-55	125	°C

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262C electrical characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2262C			UNIT	
			MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0, V_O = 0, V_{DD} \pm = \pm 2.5\text{ V}, R_S = 50\Omega$	25°C	300	2500	μV	μV	
		Full range	3000				
αV_{IO} Temperature coefficient of input offset voltage		25°C to 70°C	2		$\mu\text{V}/^\circ\text{C}$		
		25°C	0.003		$\mu\text{V}/\text{mo}$		
$|I_{IO}|$ Input offset current		25°C	0.5		pA	pA	
		Full range	100				
$|I_{IB}|$ Input bias current		25°C	1		pA	pA	
		Full range	100				
V_{ICR} Common-mode input voltage range	$R_S = 50\Omega, |V_{IO}| \leq 5\text{ mV}$	25°C	0 to 4	-0.3 to 4.2		V	
		Full range	0 to 3.5				
V_{OH} High-level output voltage	$I_{OH} = -20\mu\text{A}, -100\mu\text{A}, -400\mu\text{A}$	25°C	4.99			V	
		25°C	4.85	4.94			
		Full range	4.82				
		25°C	4.70	4.85			
		Full range	4.60				
V_{OL} Low-level output voltage	$V_{IC} = 2.5\text{ V}, I_{OL} = 50\mu\text{A}, 500\mu\text{A}, 1\text{ mA}, 4\text{ mA}$	25°C	0.01			V	
		25°C	0.09	0.15			
		Full range	0.15				
		25°C	0.2	0.3			
		Full range	0.3				
		25°C	0.7	1			
		Full range	1.2				
A_{VD} Large-signal differential voltage amplification	$V_{IC} = 2.5\text{ V}, V_O = 1\text{ V to }4\text{ V}$	$R_L = 50\text{ k}\Omega^\ddagger$	25°C	80	170	V/mV	
		$R_L = 1\text{ M}\Omega^\ddagger$	Full range	55			
			25°C	550			
$r_{i(d)}$ Differential input resistance			25°C	10 ¹²		Ω	
$r_{i(c)}$ Common-mode input resistance			25°C	10 ¹²		Ω	
$c_{i(c)}$ Common-mode input capacitance	$f = 10\text{ kHz}$	P package	25°C	8		pF	
z_0 Closed-loop output impedance	$f = 100\text{ kHz}$	$A_V = 10$	25°C	240		Ω	
CMRR Common-mode rejection ratio	$V_{IC} = 0\text{ to }2.7\text{ V}, V_O = 2.5\text{ V}, R_S = 50\Omega$	$V_{DD} = 4.4\text{ V to }16\text{ V}, V_{IC} = V_{DD}/2, \text{ No load}$	25°C	70	83	dB	
		Full range	70				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$)	$V_{DD} = 4.4\text{ V to }16\text{ V}, V_{IC} = V_{DD}/2, \text{ No load}$	25°C	80	95	dB		
		Full range	80				
I_{DD} Supply current	$V_O = 2.5\text{ V}, \text{ No load}$	25°C	400	500	μA		
		Full range	500				

[†] Full range is 0°C to 70°C.

[‡] Referenced to 2.5 V

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at $T_A = 150^\circ\text{C}$ extrapolated to $T_A = 25^\circ\text{C}$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262C operating characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2262C			UNIT
			MIN	TYP	MAX	
SR	Slew rate at unity gain $V_O = 1.5\text{ V to }3.5\text{ V}, R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	25°C	0.35	0.55		$\text{V}/\mu\text{s}$
		Full range	0.3			
V_n	Equivalent input noise voltage $f = 10\text{ Hz}$	25°C	40			$\text{nV}/\sqrt{\text{Hz}}$
		25°C	12			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage $f = 0.1\text{ Hz to }1\text{ Hz}$	25°C	0.7			μV
		25°C	1.3			
I_n	Equivalent input noise current	25°C	0.6			$\text{fA}/\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion plus noise $V_O = 0.5\text{ V to }2.5\text{ V}, f = 20\text{ kHz}, R_L = 50\text{ k}\Omega^\ddagger$	$A_V = 1$ $A_V = 10$	25°C	0.017%		
				0.03%		
	Gain-bandwidth product	$f = 10\text{ kHz}, C_L = 100\text{ pF}^\ddagger$	$R_L = 50\text{ k}\Omega^\ddagger$	25°C	0.71	MHz
B _{OM}	Maximum output-swing bandwidth	$V_O(\text{PP}) = 2\text{ V}, R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	$A_V = 1, C_L = 100\text{ pF}^\ddagger$	25°C	185	kHz
t_S	Settling time $A_V = -1, \text{Step} = 0.5\text{ V to }2.5\text{ V}, R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	To 0.1%	25°C	6.4		μs
		To 0.01%		14.1		
ϕ_m	Phase margin at unity gain	$R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	25°C	56°		
	Gain margin		25°C	11		

† Full range is 0°C to 70°C.

‡ Referenced to 2.5 V

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262C electrical characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V (unless otherwise specified)

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2262C			UNIT	
			MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0$, $R_S = 50 \Omega$	25°C	300	2500	μV		
		Full range		3000			
		25°C to 70°C		2	$\mu V/^\circ C$		
		25°C	0.003		$\mu V/mo$		
		25°C	0.5		pA		
		Full range	100				
		25°C	1		pA		
		Full range	100				
		25°C	-5 to 4	-5.3 to 4.2	V		
V_{ICR} Common-mode input voltage range		Full range	-5 to 3.5				
V_{OM+} Maximum positive peak output voltage	$I_O = -20 \mu A$ $I_O = -100 \mu A$ $I_O = -400 \mu A$	25°C	4.99		V		
		25°C	4.85	4.94			
		Full range	4.82				
		25°C	4.7	4.85			
		Full range	4.6				
		25°C	-4.99				
		25°C	-4.85	-4.91			
		Full range	-4.85				
V_{OM-} Maximum negative peak output voltage	$V_{IC} = 0$, $I_O = 1 mA$ $V_{IC} = 0$, $I_O = 4 mA$	25°C	-4.7	-4.8	V		
		Full range	-4.7				
		25°C	-4	-4.3			
		Full range	-3.8				
		25°C	80	200	V/mV		
		Full range	55				
		25°C	1000				
$r_{i(d)}$ Differential input resistance		25°C	1012		Ω		
$r_{i(c)}$ Common-mode input resistance		25°C	1012		Ω		
$c_{i(c)}$ Common-mode input capacitance	$f = 10$ kHz, P package	25°C	8		pF		
z_o Closed-loop output impedance	$f = 100$ kHz, $A_V = 10$	25°C	220		Ω		
CMRR Common-mode rejection ratio	$V_{IC} = -5$ V to 2.7 V, $V_O = 0$ V, $R_S = 50 \Omega$	25°C	75	88	dB		
		Full range	75				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{DD\pm} / \Delta V_{IO}$)	$V_{DD\pm} = 2.2$ V to ± 8 V, $V_{IC} = 0$, No load	25°C	80	95	dB		
		Full range	80				
I_{DD} Supply current	$V_O = 0$ V, No load	25°C	425	500	μA		
		Full range		500			

† Full range is 0°C to 70°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at $T_A = 150^\circ C$ extrapolated to $T_A = 25^\circ C$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262C operating characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2262C			UNIT
			MIN	TYP	MAX	
SR Slew rate at unity gain	$V_O = \pm 1.9$ V, $C_L = 100$ pF	$R_L = 50$ k Ω	25°C	0.35	0.55	V/ μ s
			Full range	0.3		
V_n Equivalent input noise voltage	$f = 10$ Hz	25°C	43			nV/ $\sqrt{\text{Hz}}$
	$f = 1$ kHz	25°C	12			
$V_{N(PP)}$ Peak-to-peak equivalent input noise voltage	$f = 0.1$ Hz to 1 Hz	25°C	0.8			μ V
	$f = 0.1$ Hz to 10 Hz	25°C	1.3			
I_n Equivalent input noise current		25°C	0.6			fA/ $\sqrt{\text{Hz}}$
THD + N Total harmonic distortion pulse duration	$V_O = \pm 2.3$ V, $f = 20$ kHz, $R_L = 50$ k Ω	$A_V = 1$	25°C	0.014%		
			$A_V = 10$	0.024%		
Gain-bandwidth product	$f = 10$ kHz, $C_L = 100$ pF	$R_L = 50$ k Ω	25°C	0.73		MHz
BOM Maximum output-swing bandwidth	$V_O(PP) = 4.6$ V, $R_L = 50$ k Ω ,	$A_V = 1$, $C_L = 100$ pF	25°C	85		kHz
t_s Settling time	$A_V = -1$, Step = -2.3 V to 2.3 V, $R_L = 50$ k Ω , $C_L = 100$ pF	To 0.1%	25°C	7.1		μ s
		To 0.01%		16.5		
ϕ_m Phase margin at unity gain	$R_L = 50$ k Ω ,	$C_L = 100$ pF	25°C	57°		dB
			25°C	11		

† Full range is 0°C to 70°C.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2264C electrical characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2264C			UNIT
			MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0$, $V_O = 0$, $V_{DD} \pm 2.5\text{ V}$, $R_S = 50\Omega$	25°C	300	2500	3000	μV
		Full range				
		25°C to 70°C		2	100	$\mu\text{V}/^\circ\text{C}$
		25°C	0.003			
		25°C	0.5		100	pA
		Full range				
αV_{IO} Temperature coefficient of input offset voltage		25°C	1		100	pA
		25°C				
		Full range			100	pA
		25°C to 70°C	0.003	0.5		
		25°C	0.5		100	pA
		Full range	1			
I_{IO} Input offset current		25°C	0	-0.3	4	V
		25°C	to	to		
		4	4.2			
		Full range	0		3.5	
		25°C				
		Full range				
V_{ICR} Common-mode input voltage range	$R_S = 50\Omega$, $|V_{IO}| \leq 5\text{ mV}$	25°C	4.99			V
		25°C	4.85	4.94		
		Full range	4.82			
		25°C	4.70	4.85		
		25°C	4.60			
		Full range				
V_{OH} High-level output voltage	$I_{OH} = -20\text{ }\mu\text{A}$	25°C	0.01			V
		25°C	0.09	0.15		
		Full range		0.15		
		25°C	0.2	0.3		
		25°C	0.7	1		
		Full range		1.2		
V_{OL} Low-level output voltage	$V_{IC} = 2.5\text{ V}$, $I_{OL} = 50\text{ }\mu\text{A}$	25°C	80	170		V/mV
		25°C	55			
		Full range				
		25°C	550			
		25°C				
		Full range				
A_{VD} Large-signal differential voltage amplification	$V_{IC} = 2.5\text{ V}$, $V_O = 1\text{ V to }4\text{ V}$	$R_L = 50\text{ k}\Omega^\ddagger$	25°C	80	170	
		$R_L = 1\text{ M}\Omega^\ddagger$	25°C	55		
			25°C	550		
$r_i(d)$ Differential input resistance			25°C	10^{12}		Ω
$r_i(c)$ Common-mode input resistance			25°C	10^{12}		Ω
$c_i(c)$ Common-mode input capacitance	$f = 10\text{ kHz}$	N package	25°C	8		pF
z_o Closed-loop output impedance	$f = 100\text{ kHz}$	$A_V = 10$	25°C	240		Ω
CMRR Common-mode rejection ratio	$V_{IC} = 0\text{ to }2.7\text{ V}$, $V_O = 2.5\text{ V}$, $R_S = 50\Omega$	25°C	70	83		dB
		Full range	70			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$)	$V_{DD} = 4.4\text{ V to }16\text{ V}$, $V_{IC} = V_{DD}/2$, No load	25°C	80	95		dB
		Full range	80			
I_{DD} Supply current (four amplifiers)	$V_O = 2.5\text{ V}$, No load	25°C	0.8	1		mA
		Full range		1		

[†] Full range is 0°C to 70°C.

[‡] Referenced to 2.5 V

NOTE 4. Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at $T_A = 150^\circ\text{C}$ extrapolated to $T_A = 25^\circ\text{C}$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2264C operating characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$

PARAMETER	TEST CONDITIONS	$T_A \dagger$	TLC2264C			UNIT
			MIN	TYP	MAX	
SR Slew rate at unity gain	$V_O = 1.4\text{ V to }2.6\text{ V}, R_L = 50\text{ k}\Omega \ddagger, C_L = 100\text{ pF} \ddagger$	25°C	0.35	0.55		$\text{V}/\mu\text{s}$
		Full range		0.3		
V_n Equivalent input noise voltage	$f = 10\text{ Hz}$	25°C		40		$\text{nV}/\sqrt{\text{Hz}}$
	$f = 1\text{ kHz}$	25°C		12		
$V_{N(PP)}$ Peak-to-peak equivalent input noise voltage	$f = 0.1\text{ Hz to }1\text{ Hz}$	25°C		0.7		μV
	$f = 0.1\text{ Hz to }10\text{ Hz}$	25°C		1.3		
I_n Equivalent input noise current		25°C		0.6		$\text{fA}/\sqrt{\text{Hz}}$
THD + N Total harmonic distortion plus noise	$V_O = 0.5\text{ V to }2.5\text{ V}, f = 20\text{ kHz}, R_L = 50\text{ k}\Omega \ddagger$	$A_V = 1$		0.017%		
		$A_V = 10$		0.03%		
Gain-bandwidth product	$f = 10\text{ kHz}, R_L = 50\text{ k}\Omega \ddagger, C_L = 100\text{ pF} \ddagger$	25°C		0.71		MHz
BOM Maximum output-swing bandwidth	$V_O(\text{PP}) = 2\text{ V}, R_L = 50\text{ k}\Omega \ddagger, C_L = 100\text{ pF} \ddagger$	$A_V = 1,$	25°C	185		kHz
t_s Settling time	$A_V = -1, Step = 0.5\text{ V to }2.5\text{ V}, R_L = 50\text{ k}\Omega \ddagger, C_L = 100\text{ pF} \ddagger$	To 0.1%		6.4		μs
		To 0.01%	25°C	14.1		
ϕ_m Phase margin at unity gain	$R_L = 50\text{ k}\Omega \ddagger, C_L = 100\text{ pF} \ddagger$	25°C		56°		
		25°C		11		

† Full range is 0°C to 70°C.

‡ Referenced to 2.5 V

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2264C electrical characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V (unless otherwise specified)

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2264C			UNIT
			MIN	TYP	MAX	
V_{IO}	Input offset voltage $V_{IC} = 0$, $R_S = 50 \Omega$	25°C	300	2500	3000	μV
αV_{IO}		Full range			2	
Temperature coefficient of input offset voltage		25°C to 70°C			0.003	$\mu V/^\circ C$
Input offset voltage long-term drift (see Note 4)		25°C	0.5	1	100	
I_{IO}		Full range			100	pA
I_{IB}		25°C			100	
Input offset current		Full range			100	pA
Input bias current		25°C	-5	-5.3	4.2	
V_{ICR}		Full range	-5	to	3.5	V
Common-mode input voltage range		25°C	4.85	4.94	4.99	
V_{OM+}	Maximum positive peak output voltage $I_O = -20 \mu A$	25°C	4.82			V
		Full range	4.7	4.85	4.99	
		25°C	4.6			
		25°C	-4.85	-4.85		
		Full range	-4.7			
V_{OM-}	Maximum negative peak output voltage $I_O = 50 \mu A$	25°C	-4.7	-4.8		V
		Full range	-4.7			
		25°C	-4	-4.3		
		Full range	-3.8			
		25°C	80	200		
A_{VD}	Large-signal differential voltage amplification $V_O = \pm 4 V$	Full range	55			V/mV
		25°C	1000			
		$R_L = 1 M\Omega$				
$r_{i(d)}$	Differential input resistance	25°C		10^{12}		Ω
$r_{i(c)}$	Common-mode input resistance	25°C		10^{12}		Ω
$C_{i(c)}$	Common-mode input capacitance	$f = 10$ kHz, N package	25°C	8	1000	pF
Z_0	Closed-loop output impedance	$f = 100$ kHz, $A_V = 10$	25°C	220		Ω
$CMRR$	Common-mode rejection ratio	$V_{IC} = -5$ V to 2.7 V, $V_O = 0$, $R_S = 50 \Omega$	25°C	75	88	dB
		Full range	75			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{DD\pm} / \Delta V_{IO}$)	$V_{DD\pm} = \pm 2.2$ V to ± 8 V, $V_{IC} = 0$, No load	25°C	80	95	dB
		Full range	80			
I_{DD}	Supply current (four amplifiers)	$V_O = 0$, No load	25°C	0.85	1	mA
		Full range			1	

† Full range is 0°C to 70°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at $T_A = 150^\circ C$ extrapolated to $T_A = 25^\circ C$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

TLC2264C operating characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2264C			UNIT	
			MIN	TYP	MAX		
SR Slew rate at unity gain	$V_O = \pm 1.9$ V, $C_L = 100$ pF	$R_L = 50$ k Ω ,	25°C	0.35	0.55	V/ μ s	
			Full range	0.3			
V_n Equivalent input noise voltage	$f = 10$ Hz		25°C	43		nV/ $\sqrt{\text{Hz}}$	
	$f = 1$ kHz		25°C	12			
$V_{N(PP)}$ Peak-to-peak equivalent input noise voltage	$f = 0.1$ Hz to 1 Hz		25°C	0.8		μ V	
	$f = 0.1$ Hz to 10 Hz		25°C	1.3			
I_n Equivalent input noise current			25°C	0.6		fA/ $\sqrt{\text{Hz}}$	
THD + N Total harmonic distortion plus noise	$V_O = \pm 2.3$ V, $f = 20$ kHz, $R_L = 50$ k Ω	$A_V = 1$	25°C	0.014%			
			25°C	0.024%			
Gain-bandwidth product	$f = 10$ kHz, $C_L = 100$ pF	$R_L = 50$ k Ω ,	25°C	0.73		MHz	
B_{OM} Maximum output-swing bandwidth	$V_O(PP) = 4.6$ V, $R_L = 50$ k Ω ,	$A_V = 1$, $C_L = 100$ pF	25°C	70		kHz	
t_s Settling time	$A_V = -1$, Step = -2.3 V to 2.3 V, $R_L = 50$ k Ω , $C_L = 100$ pF	To 0.1%	25°C	7.1		μ s	
		To 0.01%	25°C	16.5			
ϕ_m Phase margin at unity gain	$R_L = 50$ k Ω ,	$C_L = 100$ pF	25°C	57°		dB	
			25°C	11			

† Full range is 0°C to 70°C.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262I electrical characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A \dagger$	TLC2262I			TLC2262AI			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{DD} = \pm 2.5\text{ V}, V_{IC} = 0, V_O = 0, R_S = 50\Omega$	25°C	300	2500	300	950			μV	
		Full range		3000		1500				
		25°C to 85°C		2		2			$\mu\text{V}/^\circ\text{C}$	
		25°C		0.003		0.003			$\mu\text{V}/\text{mo}$	
		25°C		0.5		0.5			pA	
		85°C		150		150				
I_{IO} Input offset current		Full range		800		800			pA	
		25°C		1		1				
		85°C		150		150			pA	
		Full range		800		800				
I_{IB} Input bias current		25°C		0	-0.3	0	-0.3		pA	
		to		4	4.2	to	4			
		Full range		0	to	0	to		pA	
				3.5		3.5				
V_{ICR} Common-mode input voltage range	$R_S = 50\Omega, |V_{IO}| \leq 5\text{ mV}$	25°C	0	-0.3	0	-0.3			V	
		to		4	4.2	to	4			
		Full range		0	to	0	to		V	
				3.5		3.5				
V_{OH} High-level output voltage	$I_{OH} = -20\text{ }\mu\text{A}$	25°C		4.99		4.99			V	
		25°C		4.85	4.94	4.85	4.94			
		Full range		4.82		4.82				
		25°C		4.7	4.85	4.7	4.85			
		Full range		4.5		4.5				
V_{OL} Low-level output voltage	$V_{IC} = 2.5\text{ V}, I_{OL} = 50\text{ }\mu\text{A}$	25°C		0.01		0.01			V	
		25°C		0.09	0.15	0.09	0.15			
		Full range		0.15		0.15				
	$V_{IC} = 2.5\text{ V}, I_{OL} = 500\text{ }\mu\text{A}$	25°C		0.8	1	0.7	1			
		Full range		1.2		1.2				
A_{VD} Large-signal differential voltage amplification	$V_{IC} = 2.5\text{ V}, V_O = 1\text{ V to }4\text{ V}$	25°C	80	100	80	170			V/mV	
		Full range	50		50					
		$R_L = 1\text{ M}\Omega \ddagger$	25°C		550		550			
$r_{i(d)}$ Differential input resistance		25°C		10 ¹²		10 ¹²			Ω	
$r_{i(c)}$ Common-mode input resistance		25°C		10 ¹²		10 ¹²			Ω	
$c_{i(c)}$ Common-mode input capacitance	$f = 10\text{ kHz}$, P package	25°C		8		8			pF	
z_o Closed-loop output impedance	$f = 100\text{ kHz}, A_V = 10$	25°C		240		240			Ω	
CMRR Common-mode rejection ratio	$V_{IC} = 0\text{ to }2.7\text{ V}, V_O = 2.5\text{ V}, R_S = 50\Omega$	25°C	70	83	70	83			dB	
		Full range	70		70					

† Full range is –40°C to 125°C.

‡ Referenced to 2.5 V

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at $T_A = 150^\circ\text{C}$ extrapolated to $T_A = 25^\circ\text{C}$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262I operating characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2262I			TLC2262AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$)	$V_{DD} = 4.4\text{ V to }16\text{ V}, V_{IC} = V_{DD}/2$, No load	25°C	80	95	80	95		dB
			Full range	80		80			
I_{DD}	Supply current	$V_O = 2.5\text{ V}$, No load	25°C	400	500	400	500		μA
			Full range		500			500	
SR	Slew rate at unity gain	$V_O = 1.5\text{ V to }3.5\text{ V}, R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	25°C	0.35	0.55	0.35	0.55		$\text{V}/\mu\text{s}$
			Full range	0.25		0.25			
V_n	Equivalent input noise voltage	f = 10 Hz	25°C	40		40			$\text{nV}/\sqrt{\text{Hz}}$
		f = 1 kHz	25°C	12		12			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz	25°C	0.7		0.7			μV
		f = 0.1 Hz to 10 Hz	25°C	1.3		1.3			
I_n	Equivalent input noise current		25°C	0.6		0.6			$\text{fA}/\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion plus noise	$V_O = 0.5\text{ V to }2.5\text{ V}, f = 20\text{ kHz}, R_L = 50\text{ k}\Omega^\ddagger$	$A_V = 1$		0.017%	0.017%			
			$A_V = 10$		0.03%	0.03%			
	Gain-bandwidth product	f = 50 kHz, $C_L = 100\text{ pF}^\ddagger$	$R_L = 50\text{ k}\Omega^\ddagger$	25°C	0.82		0.82		MHz
BOM	Maximum output-swing bandwidth	$V_O(\text{PP}) = 2\text{ V}, R_L = 50\text{ k}\Omega^\ddagger$	$A_V = 1, C_L = 100\text{ pF}^\ddagger$	25°C	185		185		kHz
t_s	Settling time	$A_V = -1, \text{Step} = 0.5\text{ V to }2.5\text{ V}, R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	To 0.1%	25°C	6.4		6.4		μs
			To 0.01%		14.1		14.1		
ϕ_m	Phase margin at unity gain	$R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	25°C	56°		56°			
	Gain margin		25°C	11		11			

† Full range is -40°C to 125°C .

‡ Referenced to 2.5 V

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262I electrical characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2262I			TLC2262AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	$V_{IC} = 0, V_O = 0$ $R_S = 50 \Omega$	25°C	300	2500		300	950		μV
		Full range		3000			1500		
		25°C to 85°C		2		2			$\mu V/^\circ C$
		25°C	0.003			0.003			$\mu V/mo$
		25°C	0.5			0.5			pA
		85°C	150			150			pA
		Full range	800			800			pA
		25°C	1			1			pA
		85°C	150			150			pA
		Full range	800			800			pA
V_{ICR}	$R_S = 50 \Omega, |V_{IO}| \leq 5 mV$	25°C	-5 to 4	-5.3 to 4.2		-5 to 4	-5.3 to 4.2		V
		Full range	-5 to 3.5			-5 to 3.5			
V_{OM+}	$I_O = -20 \mu A$ $I_O = -100 \mu A$ $I_O = -400 \mu A$	25°C	4.99			4.99			V
		25°C	4.85	4.94		4.85	4.94		
		Full range	4.82			4.82			
		25°C	4.7	4.85		4.7	4.85		
		Full range	4.5			4.5			
V_{OM-}	$V_{IC} = 0, I_O = 50 \mu A$ $V_{IC} = 0, I_O = 500 \mu A$ $V_{IC} = 0, I_O = 4 mA$	25°C	-4.99			-4.99			V
		25°C	-4.85	-4.91		-4.85	-4.91		
		Full range	-4.85			-4.85			
		25°C	-4	-4.3		-4	-4.3		
		Full range	-3.8			-3.8			
AVD	$V_O = \pm 4 V$	$R_L = 50 k\Omega$	25°C	80	200	80	200		V/mV
			Full range	50		50			
		$R_L = 1 M\Omega$	25°C	1000		1000			
$r_{i(d)}$	Differential input resistance		25°C	10 ¹²		10 ¹²			Ω
$r_{i(c)}$	Common-mode input resistance		25°C	10 ¹²		10 ¹²			Ω
$c_{i(c)}$	Common-mode input capacitance	$f = 10 kHz, P$ package	25°C	8		8			pF
z_o	Closed-loop output impedance	$f = 100 kHz, A_V = 10$	25°C	220		220			Ω
$CMRR$	Common-mode rejection ratio	$V_{IC} = -5 V$ to $2.7 V$, $V_O = 0, R_S = 50 \Omega$	25°C	75	88	75	88		dB
		Full range	75			75			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{DD\pm} / \Delta V_{IO}$)	$V_{DD} = 4.4 V$ to $16 V$, $V_{IC} = V_{DD}/2$, No load	25°C	80	95	80	95		dB
		Full range	80			80			

[†] Full range is -40°C to 125°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at $T_A = 150^\circ C$ extrapolated to $T_A = 25^\circ C$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262I operating characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V

PARAMETER	TEST CONDITIONS	TA†	TLC2262I			TLC2262AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I _{DD}	Supply Current	$V_O = 2.5$ V, No load	25°C	425	500	425	500	500	
			Full range		500			500	
SR	Slew rate at unity gain	$V_O = \pm 1.9$ V, $C_L = 100$ pF	25°C	0.35	0.55	0.35	0.55	0.55	V/ μ s
			Full range	0.25		0.25		0.25	
V _n	Equivalent input noise voltage	f = 10 Hz	25°C	43		43		43	nV/ $\sqrt{\text{Hz}}$
		f = 1 kHz	25°C	12		12		12	
V _{N(PP)}	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz	25°C	0.8		0.8		0.8	μ V
		f = 0.1 Hz to 10 Hz	25°C	1.3		1.3		1.3	
I _n	Equivalent input noise current		25°C	0.6		0.6		0.6	fA/ $\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion plus noise	$V_O = \pm 2.3$ V, $R_L = 50$ k Ω , f = 20 kHz	A _V = 1		0.014%	0.014%		0.014%	
			A _V = 10		0.024%	0.024%		0.024%	
Gain-bandwidth product		f = 10 kHz, $C_L = 100$ pF	$R_L = 50$ k Ω ,	25°C	0.73	0.73		0.73	MHz
B _{OM}	Maximum output-swing bandwidth	$V_O(PP) = 4.6$ V, $R_L = 50$ k Ω ,	A _V = 1, $C_L = 100$ pF	25°C	85	85		85	kHz
t _s	Settling time	A _V = -1, Step = -2.3 V to 2.3 V, $R_L = 50$ k Ω , $C_L = 100$ pF	To 0.1%	25°C	7.1	7.1		7.1	μ s
			To 0.01%		16.5	16.5		16.5	
ϕ_m	Phase margin at unity gain	$R_L = 50$ k Ω ,	$C_L = 100$ pF	25°C	57°	57°		57°	
	Gain margin			25°C	11	11		11	
									dB

† Full range is -40°C to 125°C.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2264I electrical characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2264I			TLC2264AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	$V_{DD} \pm \pm 2.5\text{ V}, V_{IC} = 0, V_O = 0, R_S = 50\Omega$	25°C	300	2500		300	950		μV
		Full range		3000			1500		
		25°C to 125°C		2		2			$\mu\text{V}/^\circ\text{C}$
		25°C	0.003			0.003			$\mu\text{V}/\text{mo}$
		25°C	0.5			0.5			pA
		85°C	150			150			
		Full range	800			800			
		25°C	1			1			pA
		85°C	150			150			
I_{IO}	$R_S = 50\Omega, |V_{IO}| \leq 5\text{ mV}$	Full range	800			800			
		25°C	0	-0.3		0	-0.3		V
			to	to		to	to		
			4	4.2		4	4.2		
		Full range	0			0			
			to			to			
			3.5			3.5			
V_{OH}	$I_{OH} = -20\text{ }\mu\text{A}$	25°C	4.99			4.99			V
		25°C	4.85	4.94		4.85	4.94		
		Full range	4.82			4.82			
		25°C	4.7	4.85		4.7	4.85		
		Full range	4.5			4.5			
V_{OL}	$V_{IC} = 2.5\text{ V}, I_{OL} = 50\text{ }\mu\text{A}$	25°C	0.01			0.01			V
		25°C	0.09	0.15		0.09	0.15		
		Full range	0.15			0.15			
		25°C	0.8	1		0.7	1		
		Full range	1.2			1.2			
A_{VD}	$V_{IC} = 2.5\text{ V}, V_O = 1\text{ V to }4\text{ V}$	$R_L = 50\text{ k}\Omega^\ddagger$	25°C	80	100	80	170		V/mV
			Full range	50		50			
		$R_L = 1\text{ M}\Omega^\ddagger$	25°C	550		550			
$r_{i(d)}$	Differential input resistance		25°C	10^{12}		10^{12}			Ω
$r_{i(c)}$	Common-mode input resistance		25°C	10^{12}		10^{12}			Ω
$c_{i(c)}$	Common-mode input capacitance	$f = 10\text{ kHz}$, N package	25°C	8		8			pF
z_o	Closed-loop output impedance	$f = 100\text{ kHz}$, $A_V = 10$	25°C	240		240			Ω
CMRR	Common-mode rejection ratio	$V_{IC} = 0\text{ to }2.7\text{ V}, V_O = 2.5\text{ V}, R_S = 50\Omega$	25°C	70	83	70	83		dB
			Full range	70		70			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$)	$V_{DD} = 4.4\text{ V to }16\text{ V}, V_{IC} = V_{DD}/2, \text{ No load}$	25°C	80	95	80	95		dB
			Full range	80		80			

† Full range is -40°C to 125°C .

‡ Referenced to 2.5 V .

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at $T_A = 150^\circ\text{C}$ extrapolated to $T_A = 25^\circ\text{C}$ using the Arrhenius equation and assuming an activation energy of 0.96 eV .

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2264I operating characteristics at specified free-air temperature, $V_{DD} = 5$ V

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2264I			TLC2264AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{DD}	Supply current (four amplifiers)	$V_O = 2.5$ V, No load	25°C	0.8	1	0.8	0.8	1	V/ μ s
			Full range		1			1	
SR	Slew rate at unity gain	$V_O = 1.4$ V to 2.6 V, $R_L = 50$ k Ω \ddagger , $C_L = 100$ pF \ddagger	25°C	0.35	0.55	0.35	0.55		V/ μ s
			Full range	0.25		0.25			
V_n	Equivalent input noise voltage	f = 10 Hz	25°C	40		40			nV/ $\sqrt{\text{Hz}}$
		f = 1 kHz	25°C	12		12			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz	25°C	0.7		0.7			μ V
		f = 0.1 Hz to 10 Hz	25°C	1.3		1.3			
I_n	Equivalent input noise current		25°C	0.6		0.6			fA/ $\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion plus noise	$V_O = 0.5$ V to 2.5 V, f = 20 kHz, $R_L = 50$ k Ω \ddagger	Av = 1 Av = 10	25°C	0.017%	0.017%	0.03%	0.03%	
					0.03%				
	Gain-bandwidth product	f = 50 kHz, $C_L = 100$ pF \ddagger	$R_L = 50$ k Ω \ddagger ,	25°C	0.71		0.71		MHz
BOM	Maximum output- swing bandwidth	$V_O(PP) = 2$ V, $R_L = 50$ k Ω \ddagger ,	Av = 1, $C_L = 100$ pF \ddagger	25°C	185		185		kHz
t_s	Settling time	Av = -1, Step = 0.5 V to 2.5 V, $R_L = 50$ k Ω \ddagger , $C_L = 100$ pF \ddagger	To 0.1%	25°C	6.4	6.4	14.1	14.1	μ s
			To 0.01%		14.1				
ϕ_m	Phase margin at unity gain	$R_L = 50$ k Ω \ddagger ,	$C_L = 100$ pF \ddagger	25°C	56°	56°	11	11	dB
	Gain margin			25°C	11				

\dagger Full range is -40°C to 125°C.

\ddagger Referenced to 2.5 V

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2264I electrical characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2264I			TLC2264AI			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0$, $V_O = 0$, $R_S = 50 \Omega$	25°C	300	2500		300	950		μV	
		Full range		3000			1500			
		25°C to 125°C		2		2			$\mu V/^\circ C$	
		25°C	0.003			0.003			$\mu V/mo$	
		25°C	0.5		0.5				pA	
		85°C	150			150				
I_{IO} Input offset current		Full range	800			800				
		25°C	1			1			pA	
		85°C	150			150			pA	
		Full range	800			800			pA	
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$, $|V_{IO}| \leq 5$ mV	25°C	-5 to 4	-5.3 to 4.2		-5 to 4	-5.3 to 4.2		V	
		Full range	-5 to 3.5			-5 to 3.5				
		$I_O = -20 \mu A$	25°C	4.99		4.99			V	
		$I_O = -100 \mu A$	25°C	4.85	4.94	4.85	4.94			
V_{OM+} Maximum positive peak output voltage		Full range	4.82			4.82			V	
		$I_O = -400 \mu A$	25°C	4.7	4.85	4.7	4.85			
		Full range	4.5			4.5				
		$V_{IC} = 0$, $I_O = 50 \mu A$	25°C	-4.99		-4.99				
V_{OM-} Maximum negative peak output voltage		$V_{IC} = 0$, $I_O = 500 \mu A$	25°C	-4.85	-4.91	-4.85	-4.91		V	
		Full range	-4.85			-4.85				
		$V_{IC} = 0$, $I_O = 4 mA$	25°C	-4	-4.3	-4	-4.3			
		Full range	-3.8			-3.8				
AVD Large-signal differential voltage amplification	$V_O = \pm 4$ V	$R_L = 50 k\Omega$	25°C	80	200	80	200		V/mV	
		Full range	50			50				
		$R_L = 1 M\Omega$	25°C	1000			1000			
$r_{i(d)}$ Differential input resistance			25°C	1012		1012			Ω	
$r_{i(c)}$ Common-mode input resistance			25°C	1012		1012			Ω	
$c_{i(c)}$ Common-mode input capacitance	$f = 10$ kHz, N package		25°C	8		8			pF	
z_o Closed-loop output impedance	$f = 100$ kHz, $A_V = 10$		25°C	220		220			Ω	
$CMRR$ Common-mode rejection ratio	$V_{IC} = -5$ V to 2.7 V, $V_O = 0$, $R_S = 50 \Omega$	25°C	75	88		75	88		dB	
		Full range	75			75				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	$V_{DD\pm} = \pm 2.2$ V to ± 8 V, $V_{IC} = V_{DD}/2$, No load	25°C	80	95		80	95		dB	
		Full range	80			80				

[†] Full range is -40°C to 125°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at $T_A = 150^\circ C$ extrapolated to $T_A = 25^\circ C$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2264I operating characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2264I			TLC2264AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{DD}	Supply current (four amplifiers)	$V_O = 0$, No load	25°C	0.85	1	0.85	1	1	
			Full range		1			1	
SR	Slew rate at unity gain	$V_O = \pm 1.9$ V, $C_L = 100$ pF	25°C	0.35	0.55	0.35	0.55		V/ μ s
			Full range	0.25		0.25			
V_n	Equivalent input noise voltage	$f = 10$ Hz $f = 1$ kHz	25°C	43		43			nV/ $\sqrt{\text{Hz}}$
			25°C	12		12			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$f = 0.1$ Hz to 1 Hz $f = 0.1$ Hz to 10 Hz	25°C	0.8		0.8			μ V
			25°C	1.3		1.3			
I_n	Equivalent input noise current		25°C	0.6		0.6			fA/ $\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion plus noise	$V_O = \pm 2.3$ V, $R_L = 50$ k Ω , $f = 20$ kHz	$A_V = 1$		0.014%		0.014%		
			$A_V = 10$		0.024%		0.024%		
Gain-bandwidth product	$f = 10$ kHz, $C_L = 100$ pF	$R_L = 50$ k Ω ,	25°C	0.73		0.73			MHz
BOM	Maximum output- swing bandwidth	$V_O(PP) = 4.6$ V, $R_L = 50$ k Ω ,	$A_V = 1$, $C_L = 100$ pF	25°C	70		70		kHz
t_s	Settling time	$A_V = -1$, Step = -2.3 V to 2.3 V, $R_L = 50$ k Ω , $C_L = 100$ pF	To 0.1%	25°C	7.1		7.1		μ s
			To 0.01%	25°C	16.5		16.5		
ϕ_m	Phase margin at unity gain	$R_L = 50$ k Ω ,	$C_L = 100$ pF	25°C	57°		57°		
	Gain margin			25°C	11		11		

† Full range is -40°C to 125°C.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262Q/M electrical characteristics at specified free-air temperature, $V_{DD} = 5$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2262Q, TLC2262M			TLC2262AQ, TLC2262AM			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO}	$V_{DD} \pm 2.5$ V, $V_{IC} = 0$, $V_O = 0$, $R_S = 50$ Ω	25°C	300	2500		300	950		μV	
		Full range		3000			1500			
αV_{IO}		Full range		5		5			$\mu\text{V}/^\circ\text{C}$	
		25°C	0.003			0.003			$\mu\text{V}/\text{mo}$	
I_{IO}		25°C	0.5		0.5		0.5		pA	
		125°C	800		800		800			
I_{IB}		25°C	1		1		1		pA	
		125°C	800		800		800			
V_{ICR}	$R_S = 50$ Ω , $ V_{IO}| \leq 5$ mV	25°C	0 to 4	-0.3 to 4.2		0 to 4	-0.3 to 4.2		V	
		Full range	0 to 3.5			0 to 3.5				
V_{OH}	$I_{OH} = -20$ μA	25°C	4.99		4.99		4.99		V	
		25°C	4.85	4.94		4.85	4.94			
		Full range	4.82			4.82				
		25°C	4.7	4.85		4.7	4.85			
V_{OL}	$I_{OH} = -100$ μA	Full range	4.5		4.5		4.5		V	
		25°C	0.01		0.01		0.01			
		25°C	0.09	0.15		0.09	0.15			
		Full range		0.15			0.15			
V_{OL}	$I_{OH} = -400$ μA	25°C	0.8	1		0.7	1		V	
		25°C	1.2			1.2				
		Full range								
		Full range								
A_{VD}	$V_{IC} = 2.5$ V, $V_O = 1$ V to 4 V	$R_L = 50$ k Ω [‡]	25°C	80	100	80	170		V/mV	
		$R_L = 1$ M Ω [‡]	Full range	50		50				
		$R_L = 1$ M Ω [‡]	25°C	550		550				
$r_{i(d)}$	Differential input resistance		25°C	10^{12}		10^{12}		Ω		
$r_{i(c)}$	Common-mode input resistance		25°C	10^{12}		10^{12}		Ω		
$c_{i(c)}$	Common-mode input capacitance	$f = 10$ kHz, P package	25°C	8		8		pF		
z_o	Closed-loop output impedance	$f = 100$ kHz, $A_V = 10$	25°C	240		240		Ω		
$CMRR$	Common-mode rejection ratio	$V_{IC} = 0$ to 2.7 V, $V_O = 2.5$ V, $R_S = 50$ Ω	25°C	70	83	70	83	dB		
			Full range	70		70				
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$)	$V_{DD} = 4.4$ V to 16 V, $V_{IC} = V_{DD}/2$, No load	25°C	80	95	80	95	dB		
			Full range	80		80				
I_{DD}	Supply current	$V_O = 2.5$ V, No load	25°C	400	500	400	500	μA		
			Full range		500		500			

[†] Full range is -40°C to 125°C for Q suffix, -55°C to 125°C for M suffix.

[‡] Referenced to 2.5 V

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at $T_A = 150^\circ\text{C}$ extrapolated to $T_A = 25^\circ\text{C}$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262Q/M operating characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2262Q, TLC2262M			TLC2262AQ, TLC2262AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain $V_O = 0.5\text{ V to }3.5\text{ V}, R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	25°C	0.35	0.55		0.35	0.55		V/ μs
		Full range	0.25			0.25			
V_n	Equivalent input noise voltage $f = 10\text{ Hz}$	25°C	40			40			nV/ $\sqrt{\text{Hz}}$
		25°C	12			12			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage $f = 0.1\text{ Hz to }1\text{ Hz}$	25°C	0.7			0.7			μV
		25°C	1.3			1.3			
I_n	Equivalent input noise current	25°C	0.6			0.6			fA/ $\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion plus noise $V_O = 0.5\text{ V to }2.5\text{ V}, f = 20\text{ kHz}, R_L = 50\text{ k}\Omega^\ddagger$	$A_V = 1$	25°C	0.017%		0.017%			
				$A_V = 10$		0.03%		0.03%	
	Gain-bandwidth product $f = 50\text{ kHz}, C_L = 100\text{ pF}^\ddagger$	$R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	25°C	0.82		0.82		MHz	
B_{OM}	Maximum output-swing bandwidth $V_O(PP) = 2\text{ V}, R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	$A_V = 1, C_L = 100\text{ pF}^\ddagger$	25°C	185		185		kHz	
t_s	Settling time $A_V = -1, Step = 0.5\text{ V to }2.5\text{ V}, R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	To 0.1% To 0.01%	25°C	6.4		6.4			μs
				14.1		14.1			
ϕ_m	Phase margin at unity gain $R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$		25°C	56°		56°			
			25°C	11		11		dB	

† Full range is -40°C to 125°C for Q suffix, -55°C to 125°C for M suffix.

‡ Referenced to 2.5 V

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262Q/M electrical characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2262Q, TLC2262M			TLC2262AQ, TLC2262AM			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0$, $V_O = 0$, $R_S = 50 \Omega$	25°C	300	2500		300	950		μV	
		Full range		3000			1500			
		Full range		5		5			$\mu V/^\circ C$	
		25°C	0.003			0.003			$\mu V/mo$	
		25°C	0.5			0.5			pA	
		125°C	800			800				
I_{IO} Input offset current		25°C	1			1			pA	
		125°C	800			800				
I_{IB} Input bias current		25°C	-5 to 4	-5.3 to 4		-5 to 4	-5.3 to 4.2		V	
		Full range	-5 to 3.5			-5 to 3.5				
		25°C	4.99			4.99			V	
		25°C	4.85	4.94		4.85	4.94			
		Full range	4.82			4.82				
		25°C	4.7	4.85		4.7	4.85			
		Full range	4.5			4.5				
V_{OM+} Maximum positive peak output voltage		$V_{IC} = 0$, $I_O = 50 \mu A$	25°C	-4.99		-4.99			V	
		$I_O = -100 \mu A$	25°C	-4.85	-4.91	-4.85	-4.91			
		Full range	-4.85			-4.85				
		$I_O = -400 \mu A$	25°C	-4	-4.3	-4	-4.3			
		Full range	-3.8			-3.8				
		$V_{IC} = 0$, $I_O = 500 \mu A$	25°C	80	200	80	200			
V_{OM-} Maximum negative peak output voltage		$V_{IC} = 0$, $I_O = 500 \mu A$	Full range	50		50			V/mV	
		$V_{IC} = 0$, $I_O = 4 mA$	25°C	1000		1000				
		$V_{IC} = 0$, $I_O = 4 mA$	Full range	-4.85		-4.85				
		$V_{IC} = 0$, $I_O = 50 \mu A$	25°C	-4.99		-4.99			V	
		$V_{IC} = 0$, $I_O = 500 \mu A$	25°C	-4.85	-4.91	-4.85	-4.91			
		Full range	-4.85			-4.85				
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 4 V$	$V_{IC} = 0$, $I_O = 50 \mu A$	25°C	-4	-4.3	-4	-4.3			
		$V_{IC} = 0$, $I_O = 500 \mu A$	Full range	-3.8		-3.8				
		$V_{IC} = 0$, $I_O = 4 mA$	25°C	80	200	80	200		V/mV	
		$V_{IC} = 0$, $I_O = 4 mA$	Full range	50		50				
$r_{i(d)}$ Differential input resistance		$V_{IC} = 0$, $I_O = 50 \mu A$	25°C	1012		1012			Ω	
		$V_{IC} = 0$, $I_O = 500 \mu A$	25°C	1012		1012			Ω	
$c_{i(c)}$ Common-mode input capacitance		$f = 10$ kHz, P package	25°C	8		8			pF	
		$f = 100$ kHz, A package	25°C	220		220			Ω	
$CMRR$ Common-mode rejection ratio	$V_{IC} = -5$ V to 2.7 V, $V_O = 0$, $R_S = 50 \Omega$	25°C	75	88		75	88		dB	
		Full range	75			75				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{DD\pm} / \Delta V_{IO}$)	$V_{DD} = 4.4$ V to 16 V, $V_{IC} = V_{DD}/2$, No load	25°C	80	95		80	95		dB	
		Full range	80			80				
I_{DD} Supply current	$V_O = 0$, No load	25°C	425	500		425	500		μA	
		Full range		500			500			

† Full range is -40°C to 125°C for Q suffix, -55°C to 125°C for M suffix.

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at $T_A = 150^\circ C$ extrapolated to $T_A = 25^\circ C$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2262Q/M operating characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2262Q, TLC2262M			TLC2262AQ, TLC2262AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain $V_O = \pm 2$ V, $C_L = 100$ pF	$R_L = 50$ kΩ, $f = 10$ Hz	25°C	0.35	0.55	0.35	0.55		V/μs
			Full range	0.25		0.25			
V_n	Equivalent input noise voltage $f = 1$ kHz	$f = 10$ Hz	25°C	43	43				nV/√Hz
			25°C	12		12			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage $f = 0.1$ Hz to 1 Hz	$f = 0.1$ Hz to 10 Hz	25°C	0.8		0.8			μV
			25°C	1.3		1.3			
I_n	Equivalent input noise current		25°C	0.6		0.6			fA√Hz
THD + N	Total harmonic distortion plus noise $V_O = \pm 2.3$ V, $R_L = 50$ kΩ, $f = 20$ kHz	$A_V = 1$	25°C	0.014%		0.014%			
				0.024%		0.024%			
	Gain-bandwidth product $f = 10$ kHz, $C_L = 100$ pF	$R_L = 50$ kΩ,	25°C	0.73		0.73			MHz
BOM	Maximum output-swing bandwidth	$V_O(PP) = 4.6$ V, $R_L = 50$ kΩ, $C_L = 100$ pF	25°C	85		85			kHz
t_s	Settling time $A_V = -1$, Step = -2.3 V to 2.3 V, $R_L = 50$ kΩ, $C_L = 100$ pF	To 0.1%	25°C	7.1		7.1			μs
		To 0.01%		16.5		16.5			
ϕ_m	Phase margin at unity gain	$R_L = 50$ kΩ, $C_L = 100$ pF	25°C	57°		57°			
	Gain margin		25°C	11		11			dB

† Full range is -40°C to 125°C for Q suffix, -55°C to 125°C for M suffix.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2264Q/M electrical characteristics at specified free-air temperature, $V_{DD} = 5$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2264Q, TLC2264M			TLC2264AQ, TLC2264AM			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{DD} \pm 2.5$ V, $V_{IC} = 0$, $V_O = 0$, $R_S = 50 \Omega$	25°C	300	2500	300	950			μV	
		Full range		3000		1500				
		Full range		2		2			$\mu\text{V}/^\circ\text{C}$	
		25°C		0.003		0.003			$\mu\text{V}/\text{mo}$	
		25°C		0.5		0.5			pA	
		125°C		800		800				
I_{IO} Input offset current		25°C		1		1			pA	
		125°C		800		800				
I_{IB} Input bias current	$R_S = 50 \Omega$, $|V_{IO}| \leq 5 \text{ mV}$	25°C	0 to 4	-0.3 to 4.2	0 to 4	-0.3 to 4.2			V	
		Full range	0 to 3.5		0 to 3.5					
V_{OH} High-level output voltage	$I_{OH} = -20 \mu\text{A}$ $I_{OH} = -100 \mu\text{A}$ $I_{OH} = -400 \mu\text{A}$	25°C		4.99		4.99			V	
		25°C		4.85	4.94	4.85	4.94			
		Full range		4.82		4.82				
		25°C		4.7	4.85	4.7	4.85			
		Full range		4.5		4.5				
V_{OL} Low-level output voltage	$V_{IC} = 2.5 \text{ V}$, $I_{OL} = 50 \mu\text{A}$ $V_{IC} = 2.5 \text{ V}$, $I_{OL} = 500 \mu\text{A}$ $V_{IC} = 2.5 \text{ V}$, $I_{OL} = 4 \text{ mA}$	25°C		0.01		0.01			V	
		25°C		0.09	0.15	0.09	0.15			
		Full range			0.15		0.15			
		25°C		0.8	1	0.7	1			
		Full range			1.2		1.2			
A_{VD} Large-signal differential voltage amplification	$V_{IC} = 2.5 \text{ V}$, $V_O = 1 \text{ V to } 4 \text{ V}$ $R_L = 50 \text{ k}\Omega^\ddagger$ $R_L = 1 \text{ M}\Omega^\ddagger$	25°C	80	100	80	170			V/mV	
		Full range	50		50					
		25°C		550		550				
$r_{i(d)}$ Differential input resistance		25°C		10^{12}		10^{12}			Ω	
$r_{i(c)}$ Common-mode input resistance		25°C		10^{12}		10^{12}			Ω	
$c_{i(c)}$ Common-mode input capacitance	$f = 10 \text{ kHz}$, N package	25°C		8		8			pF	
z_o Closed-loop output impedance	$f = 100 \text{ kHz}$, $A_V = 10$	25°C		240		240			Ω	
$CMRR$ Common-mode rejection ratio	$V_{IC} = 0$ to 2.7 V , $V_O = 2.5 \text{ V}$, $R_S = 50 \Omega$	25°C	70	83	70	83			dB	
		Full range	70		70					
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$)	$V_{DD} = 4.4 \text{ V to } 16 \text{ V}$,	25°C	80	95	80	95			dB	
I_{DD} Supply current (four amplifiers)	$V_O = 2.5 \text{ V}$, No load	25°C		0.8	1	0.8	1		mA	
		Full range			1		1			

[†] Full range is -40°C to 125°C for Q suffix, -55°C to 125°C for M suffix.

[‡] Referenced to 2.5 V .

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at $T_A = 150^\circ\text{C}$ extrapolated to $T_A = 25^\circ\text{C}$ using the Arrhenius equation and assuming an activation energy of 0.96 eV .

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2264Q/M operating characteristics at specified free-air temperature, $V_{DD} = 5\text{ V}$

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2264Q, TLC2264M			TLC2264AQ, TLC2264AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain $V_O = 0.5\text{ V to }3.5\text{ V}, R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	25°C	0.35	0.55		0.35	0.55		$\text{V}/\mu\text{s}$
		Full range	0.25			0.25			
V_n	Equivalent input noise voltage $f = 10\text{ Hz}$	25°C	40			40			$\text{nV}/\sqrt{\text{Hz}}$
		25°C	12			12			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage $f = 0.1\text{ Hz to }1\text{ Hz}$	25°C	0.7			0.7			μV
		25°C	1.3			1.3			
I_n	Equivalent input noise current	25°C	0.6			0.6			$\text{fA}/\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion plus noise $V_O = 0.5\text{ V to }2.5\text{ V}, f = 20\text{ kHz}, R_L = 50\text{ k}\Omega^\ddagger$	$A_V = 1$	25°C	0.017%		0.017%			
				$A_V = 10$		0.03%		0.03%	
	Gain-bandwidth product $f = 50\text{ kHz}, C_L = 100\text{ pF}^\ddagger$	$R_L = 50\text{ k}\Omega^\ddagger$	25°C	0.71		0.71			MHz
BOM	Maximum output-swing bandwidth $V_O(PP) = 2\text{ V}, R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	$A_V = 1, C_L = 100\text{ pF}^\ddagger$	25°C	185		185			kHz
t_s	Settling time $A_V = -1, Step = 0.5\text{ V to }2.5\text{ V}, R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$	To 0.1% To 0.01%	25°C	6.4		6.4			μs
				14.1		14.1			
ϕ_m	Phase margin at unity gain $R_L = 50\text{ k}\Omega^\ddagger, C_L = 100\text{ pF}^\ddagger$		25°C	56°		56°			
	Gain margin		25°C	11		11			
									dB

† Full range is -40°C to 125°C for Q suffix, -55°C to 125°C for M suffix.

‡ Referenced to 2.5 V

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2264Q/M electrical characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2264Q, TLC2264M			TLC2264AQ, TLC2264AM			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0$, $R_S = 50 \Omega$	25°C	300	2500		300	950		μV	
		Full range		3000			1500			
		Full range		2			2		$\mu V/^\circ C$	
		25°C		0.003			0.003		$\mu V/mo$	
		25°C		0.5			0.5		pA	
		125°C		800			800			
I_{IO} Input offset current		25°C		1			1		pA	
		125°C		800			800			
I_{IB} Input bias current		25°C							pA	
		125°C								
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$, $|V_{IO}| \leq 5$ mV	25°C	-5 to 4	-5.3 to 4.2		-5 to 4	-5.3 to 4.2		V	
		Full range		-5 to 3.5			-5 to 3.5			
V_{OM+} Maximum positive peak output voltage	$I_O = -20 \mu A$ $I_O = -100 \mu A$ $I_O = -400 \mu A$	25°C		4.99			4.99		V	
		25°C		4.85	4.94		4.85	4.94		
		Full range		4.82			4.82			
		25°C		4.7	4.85		4.7	4.85		
		Full range		4.5			4.5			
V_{OM-} Maximum negative peak output voltage	$V_{IC} = 0$, $I_O = 50 \mu A$ $V_{IC} = 0$, $I_O = 500 \mu A$ $V_{IC} = 0$, $I_O = 4 mA$	25°C		-4.99			-4.99		V	
		25°C		-4.85	-4.91		-4.85	-4.91		
		Full range		-4.85			-4.85			
		25°C		-4	-4.3		-4	-4.3		
		Full range		-3.8			-3.8			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 4$ V	$R_L = 50 k\Omega$	25°C	80	200		80	200	V/mV	
			Full range	50			50			
		$R_L = 1 M\Omega$	25°C		1000			1000		
$r_{i(d)}$ Differential input resistance			25°C		10^{12}			10^{12}	Ω	
$r_{i(c)}$ Common-mode input resistance			25°C		10^{12}			10^{12}	Ω	
$c_{i(c)}$ Common-mode input capacitance	$f = 10$ kHz,	N package	25°C		8			8	pF	
z_o Closed-loop output impedance	$f = 100$ kHz,	$A_y = 10$	25°C		220			220	Ω	
CMRR Common-mode rejection ratio	$V_{IC} = -5$ V to 2.7 V, $V_O = 0$,	$R_S = 50 \Omega$	25°C	75	88		75	88	dB	
			Full range	75			75			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$)	$V_{DD\pm} = \pm 2.2$ V to ± 8 V, $V_{IC} = V_{DD}/2$, No load		25°C	80	95		80	95	dB	
			Full range	80			80			
I_{DD} Supply current (four amplifiers)	$V_O = 0$,	No load	25°C	0.85	1		0.85	1	mA	
			Full range		1			1		

[†] Full range is -40°C to 125°C for Q suffix, -55°C to 125°C for M suffix.

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at $T_A = 150^\circ C$ extrapolated to $T_A = 25^\circ C$ using the Arrhenius equation and assuming an activation energy of 0.96 eV.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TLC2264Q/M operating characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLC2264Q, TLC2264M			TLC2264AQ, TLC2264AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain $V_O = \pm 2$ V, $C_L = 100$ pF	$R_L = 50$ k Ω	25°C	0.35	0.55	0.35	0.55		V/ μ s
			Full range	0.25		0.25			
V_n	Equivalent input noise voltage $f = 10$ Hz		25°C	43		43			nV/ $\sqrt{\text{Hz}}$
			25°C	12		12			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage $f = 0.1$ Hz to 1 Hz		25°C	0.8		0.8			μ V
			25°C	1.3		1.3			
I_n	Equivalent input noise current		25°C	0.6		0.6			fA/ $\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion plus noise $V_O = \pm 2.3$ V, $R_L = 50$ k Ω , $f = 20$ kHz	$A_V = 1$	25°C	0.014%		0.014%			
				0.024%		0.024%			
	Gain-bandwidth product $f = 10$ kHz, $C_L = 100$ pF	$R_L = 50$ k Ω ,	25°C	0.73		0.73			MHz
BOM	Maximum output-swing bandwidth	$V_O(PP) = 4.6$ V, $R_L = 50$ k Ω ,	$A_V = 1$, $C_L = 100$ pF	25°C	70		70		kHz
t_s	Settling time $A_V = -1$, Step = -2.3 V to 2.3 V, $R_L = 50$ k Ω , $C_L = 100$ pF	To 0.1% To 0.01%	25°C	7.1		7.1			μ s
				16.5		16.5			
ϕ_m	Phase margin at unity gain $R_L = 50$ k Ω ,	$C_L = 100$ pF	25°C	57°		57°			
			25°C	11		11			
	Gain margin								dB

† Full range is -40°C to 125°C for Q suffix, -55°C to 125°C for M suffix.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
V_{IO}	Input offset voltage	Distribution vs Common-mode input voltage	2 – 5 6, 7
αV_{IO}	Input offset voltage temperature coefficient	Distribution	8 – 11
I_{IB}/I_{IO}	Input bias and input offset currents	vs Free-air temperature	12
V_I	Input voltage range	vs Supply voltage vs Free-air temperature	13 14
V_{OH}	High-level output voltage	vs High-level output current	15
V_{OL}	Low-level output voltage	vs Low-level output current	16, 17
V_{OM+}	Maximum positive output voltage	vs Output current	18
V_{OM-}	Maximum negative output voltage	vs Output current	19
$V_{O(PP)}$	Maximum peak-to-peak output voltage	vs Frequency	20
I_{OS}	Short-circuit output current	vs Supply voltage vs Free-air temperature	21 22
V_O	Output voltage	vs Differential input voltage	23, 24
	Differential gain	vs Load resistance	25
A_{VD}	Large-signal differential voltage amplification	vs Frequency vs Free-air temperature	26, 27 28, 29
Z_0	Output impedance	vs Frequency	30, 31
CMRR	Common-mode rejection ratio	vs Frequency vs Free-air temperature	32 33
k_{SVR}	Supply-voltage rejection ratio	vs Frequency vs Free-air temperature	34, 35 36
I_{DD}	Supply current	vs Supply voltage vs Free-air temperature	37, 38 39, 40
SR	Slew rate	vs Load capacitance vs Free-air temperature	41 42
V_O	Inverting large-signal pulse response		43, 44
	Voltage-follower large-signal pulse response		45, 46
	Inverting small-signal pulse response		47, 48
	Voltage-follower small-signal pulse response		49, 50
V_n	Equivalent input noise voltage	vs Frequency	51, 52
	Noise voltage (referred to input)	Over a 10-second period	53
	Integrated noise voltage	vs Frequency	54
THD + N	Total harmonic distortion plus noise	vs Frequency	55
	Gain-bandwidth product	vs Supply voltage vs Free-air temperature	56 57
ϕ_m	Phase margin	vs Frequency vs Load capacitance	26, 27 58
	Gain margin	vs Load capacitance	59
B_1	Unity-gain bandwidth	vs Load capacitance	60
	Overestimation of phase margin	vs Load capacitance	61

TYPICAL CHARACTERISTICS

**DISTRIBUTION OF TLC2262
 INPUT OFFSET VOLTAGE**

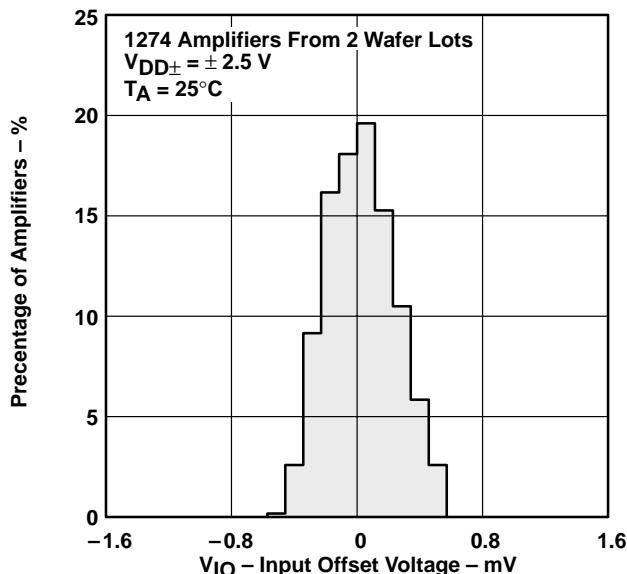


Figure 2

**DISTRIBUTION OF TLC2262
 INPUT OFFSET VOLTAGE**

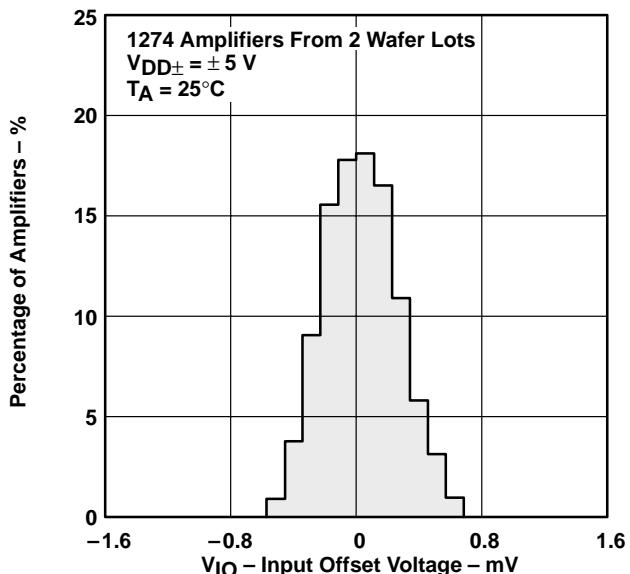


Figure 3

**DISTRIBUTION OF TLC2264
 INPUT OFFSET VOLTAGE**

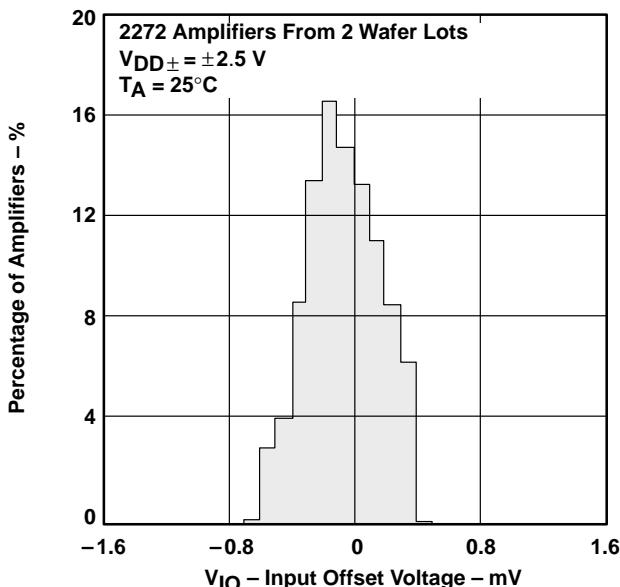


Figure 4

**DISTRIBUTION OF TLC2264
 INPUT OFFSET VOLTAGE**

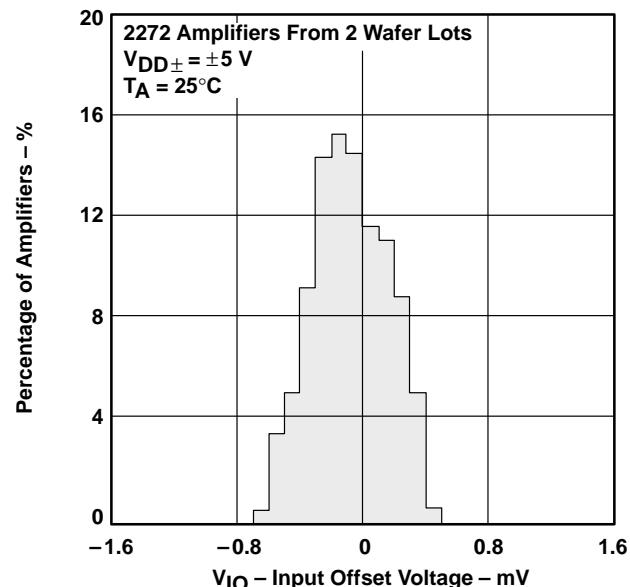
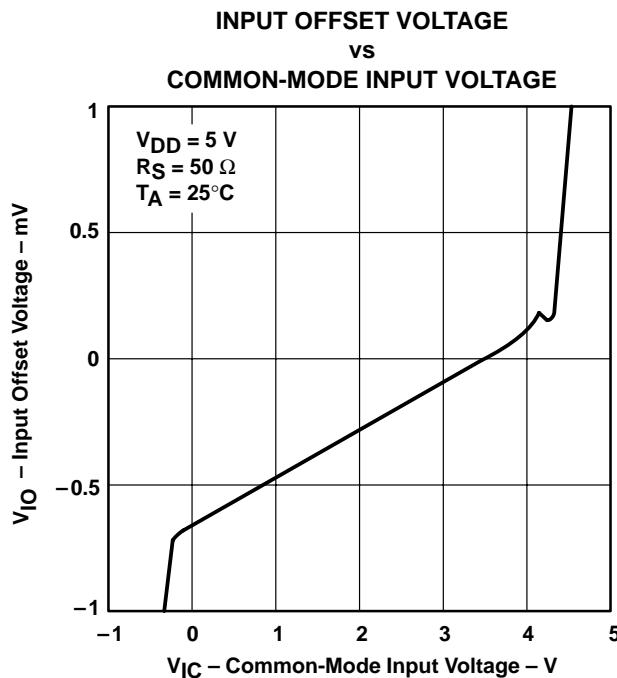


Figure 5

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TYPICAL CHARACTERISTICS



† For curves where $V_{DD} = 5\text{ V}$, all loads are referenced to 2.5 V.

Figure 6

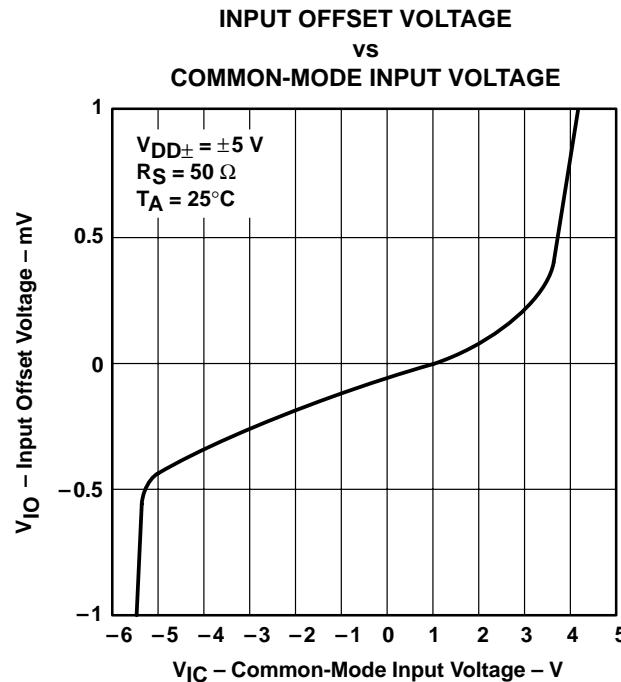


Figure 7

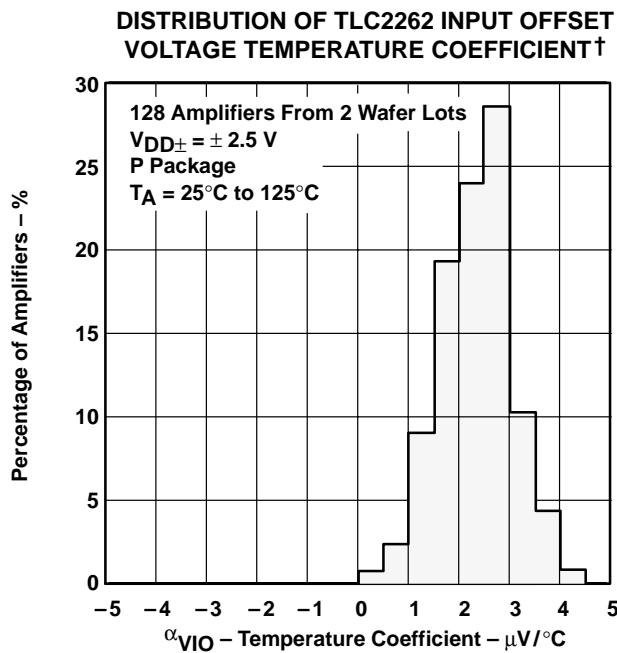


Figure 8

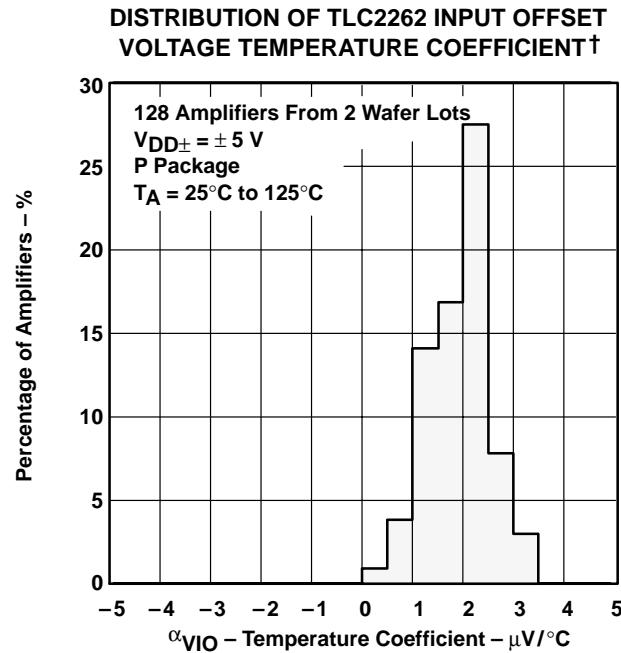


Figure 9

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TYPICAL CHARACTERISTICS

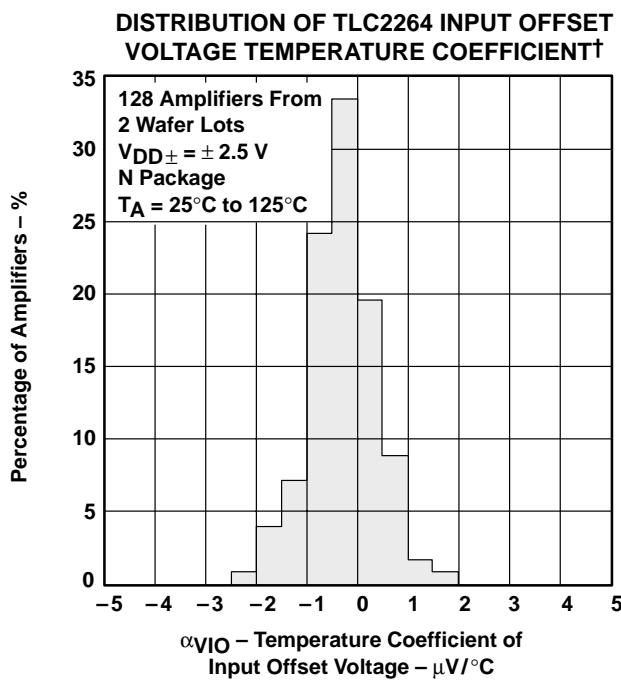


Figure 10

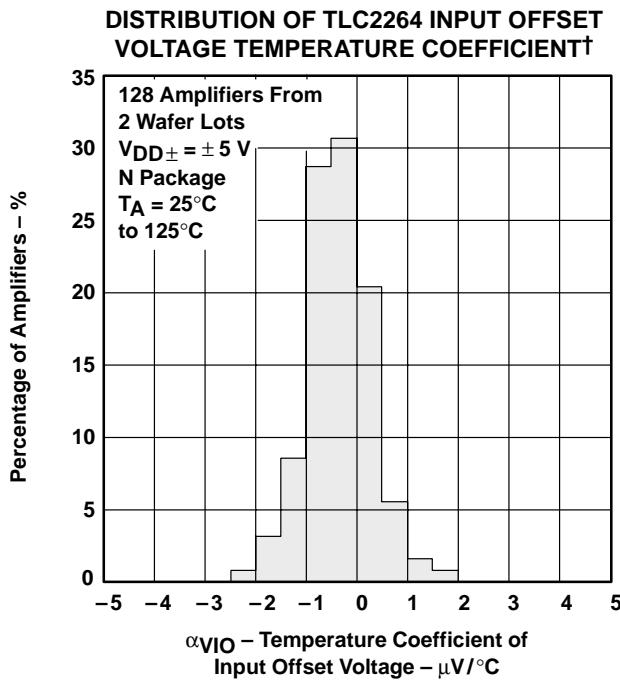


Figure 11

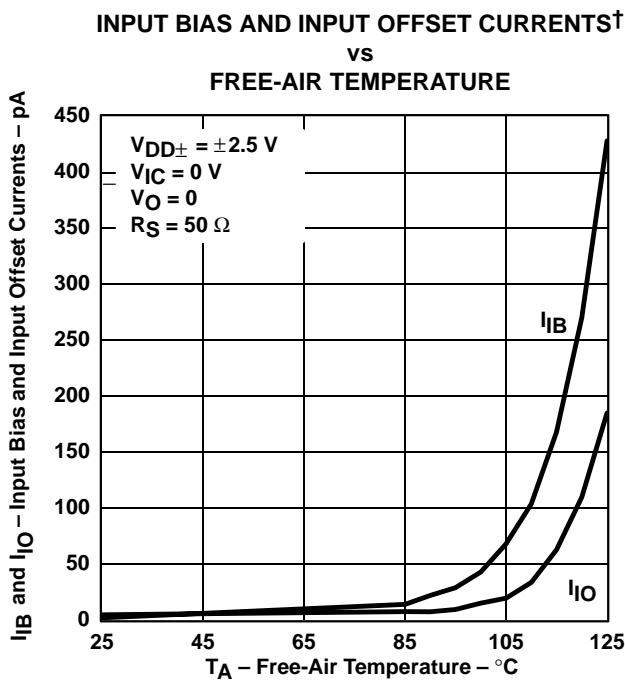


Figure 12

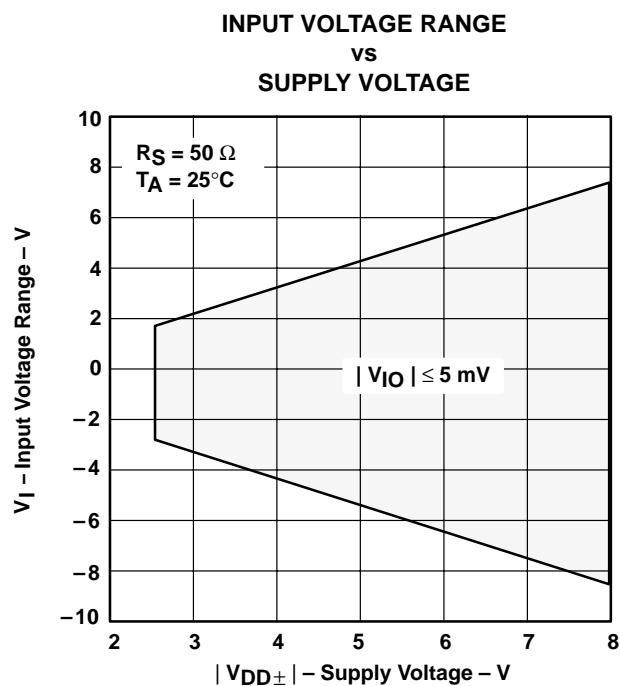


Figure 13

[†] Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TYPICAL CHARACTERISTICS

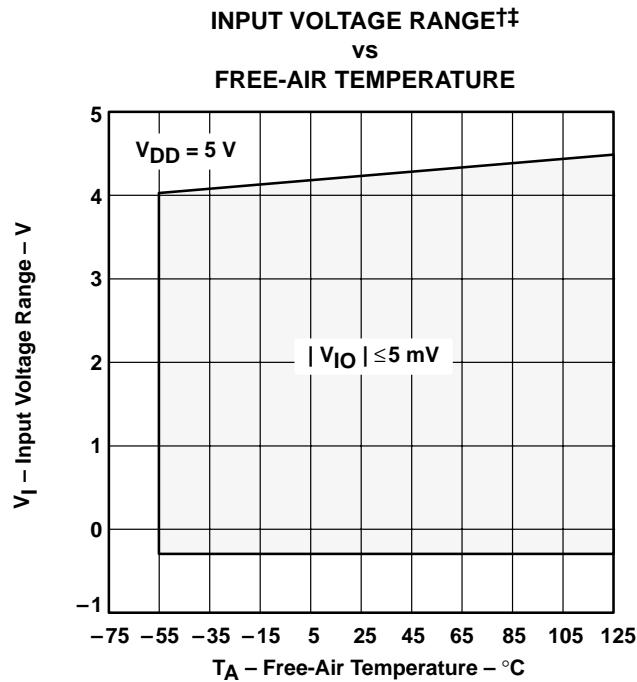


Figure 14

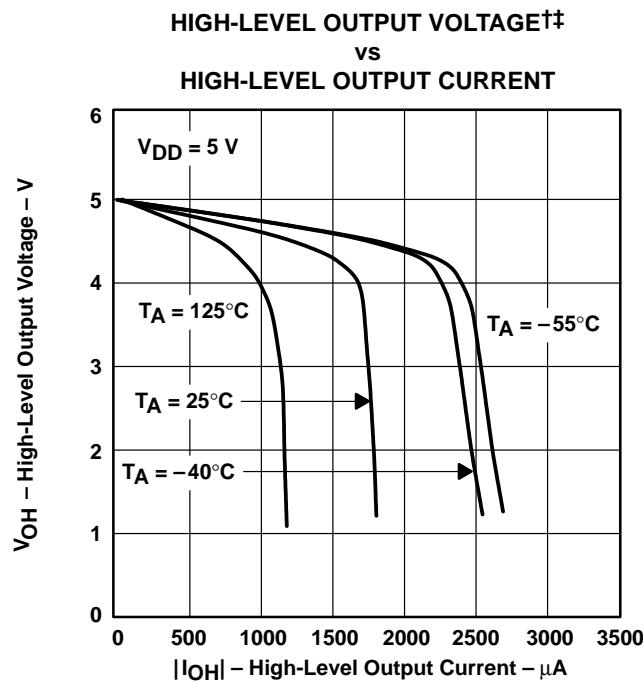


Figure 15

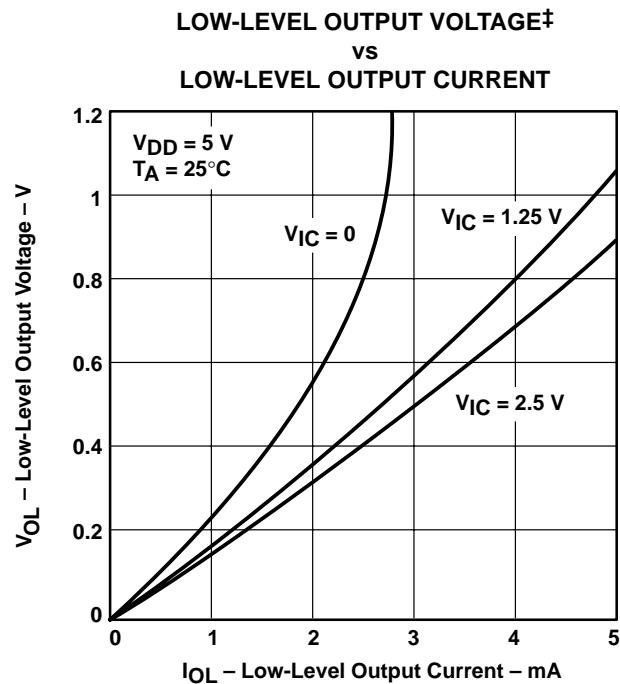


Figure 16

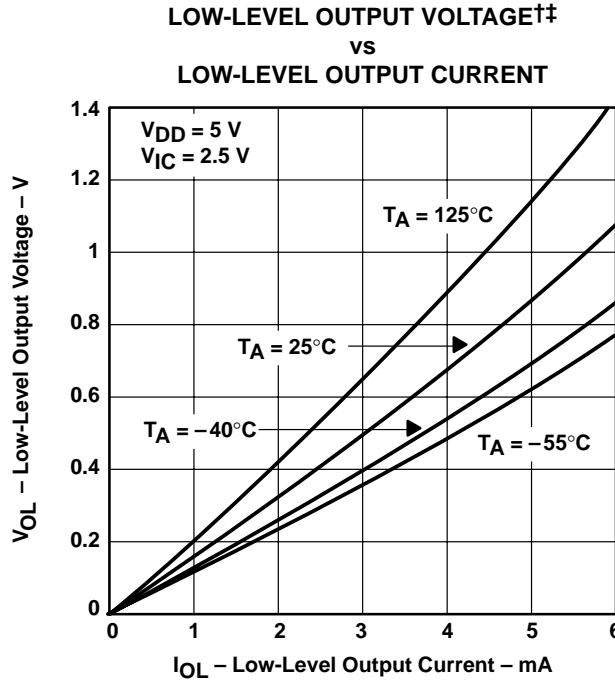


Figure 17

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

‡ For curves where $V_{DD} = 5 \text{ V}$, all loads are referenced to 2.5 V.

TYPICAL CHARACTERISTICS

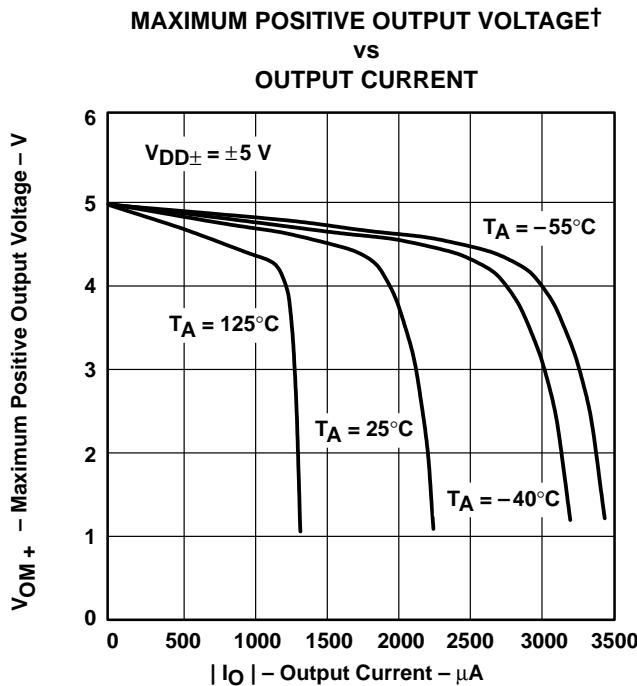


Figure 18

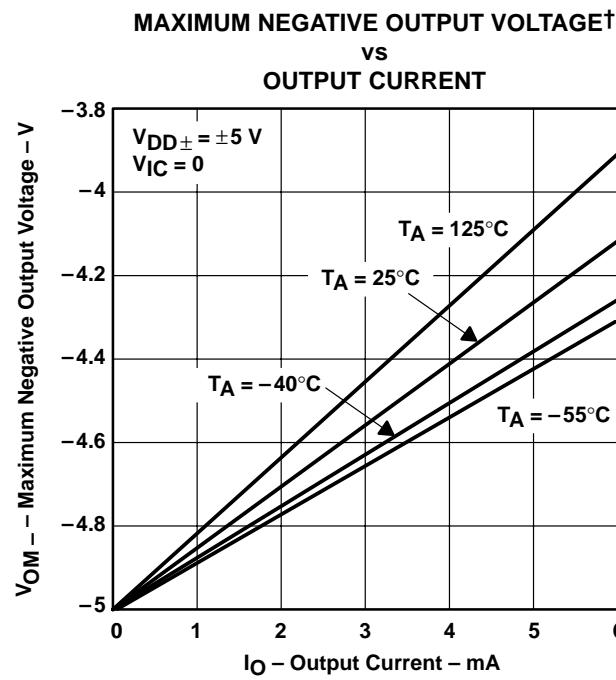
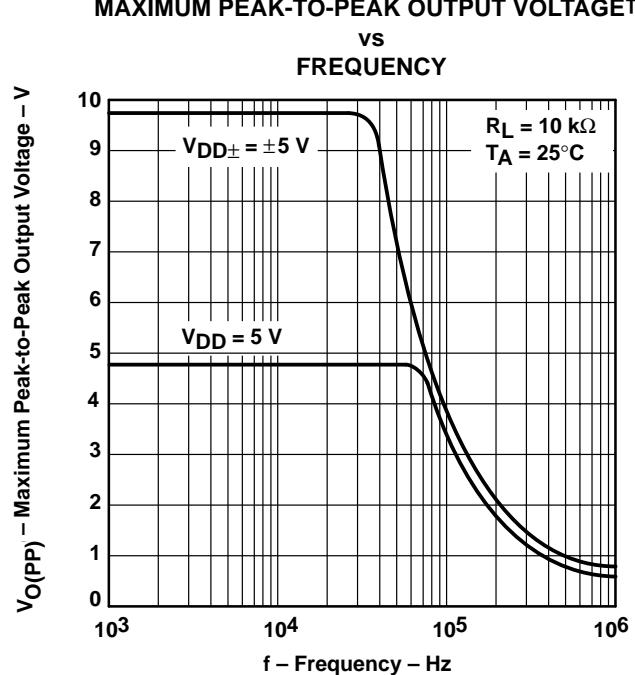


Figure 19



† For curves where $V_{DD} = 5 V$, all loads are referenced to 2.5 V.

Figure 20

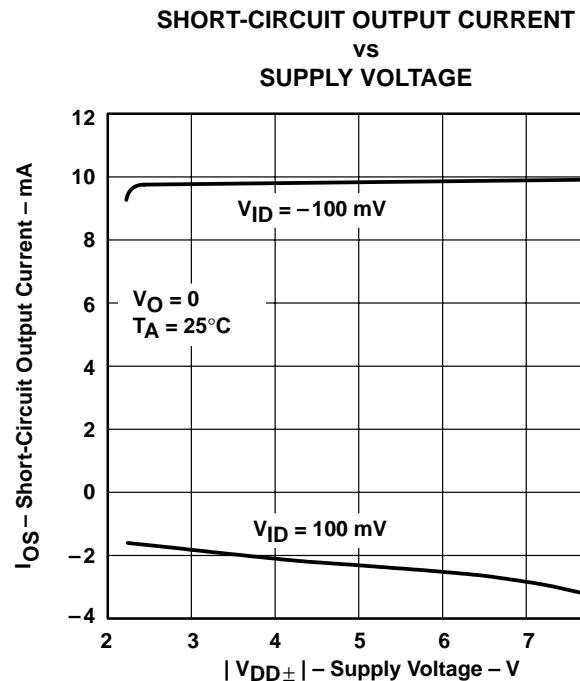


Figure 21

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TYPICAL CHARACTERISTICS

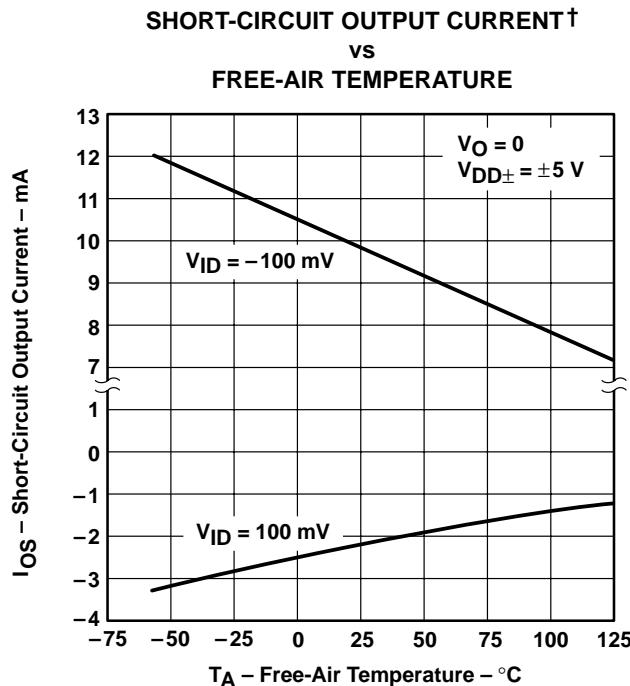


Figure 22

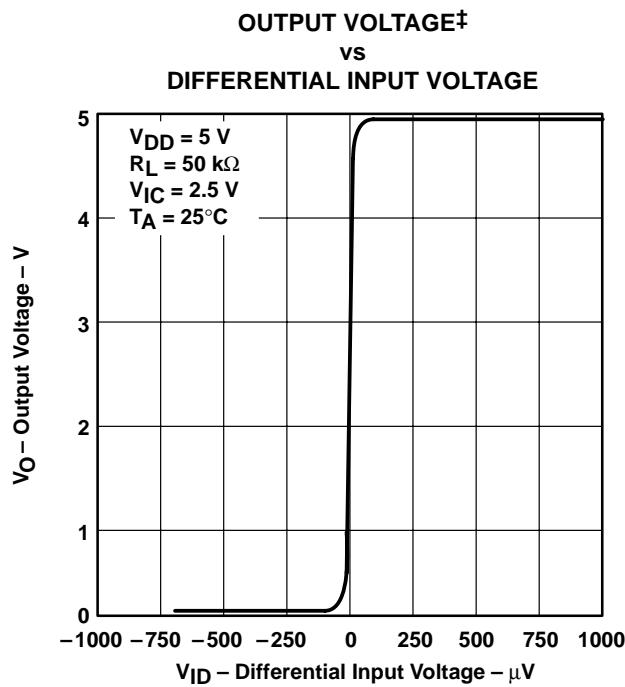


Figure 23

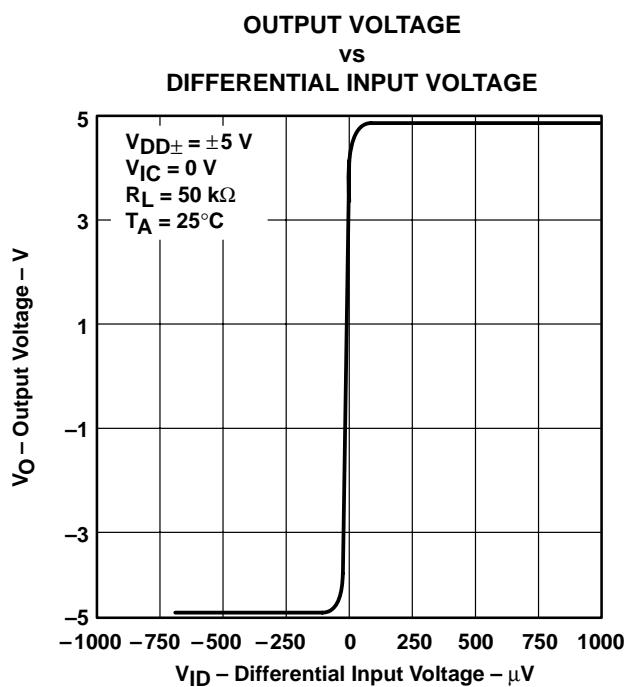


Figure 24

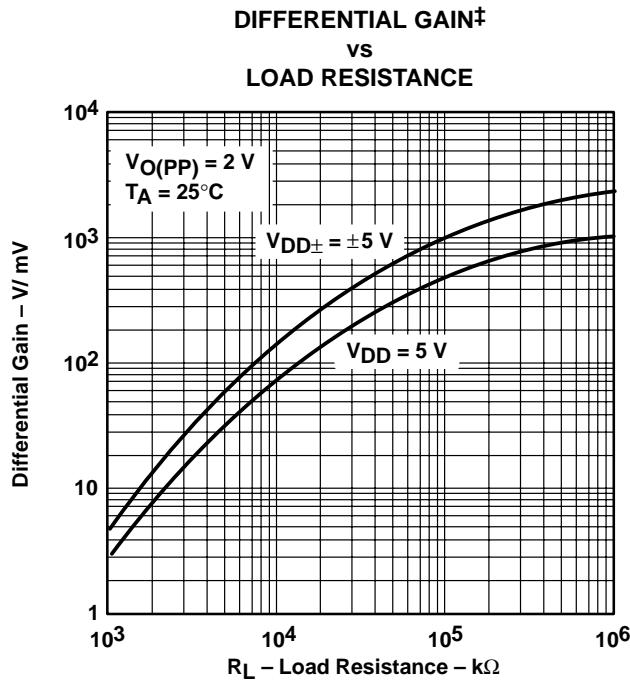
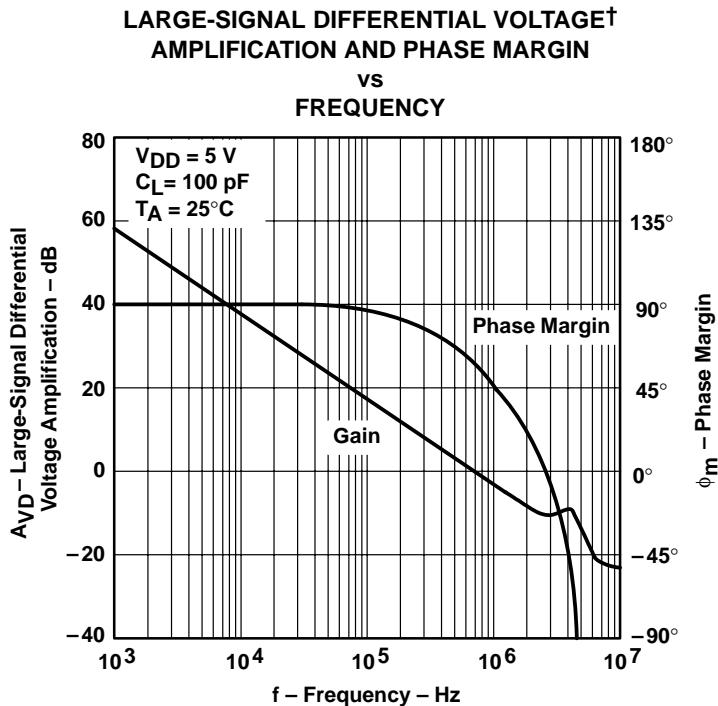


Figure 25

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.
‡ For curves where $V_{DD} = 5\text{ V}$, all loads are referenced to 2.5 V.

TYPICAL CHARACTERISTICS



[†] For curves where $V_{DD} = 5 \text{ V}$, all loads are referenced to 2.5 V.

Figure 26

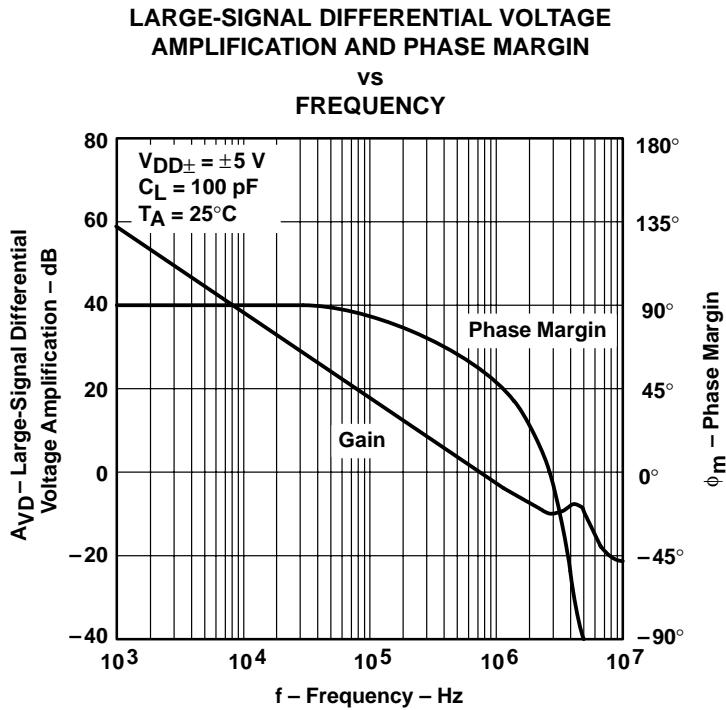


Figure 27

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TYPICAL CHARACTERISTICS

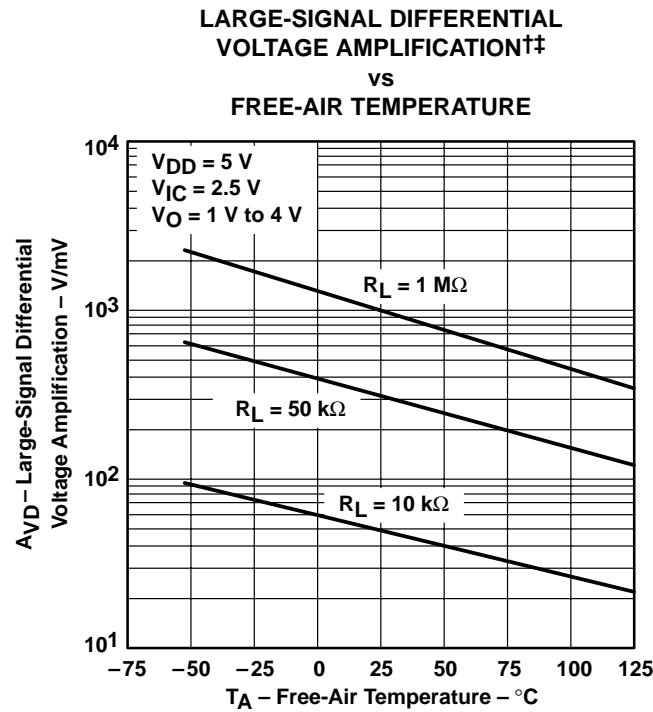


Figure 28

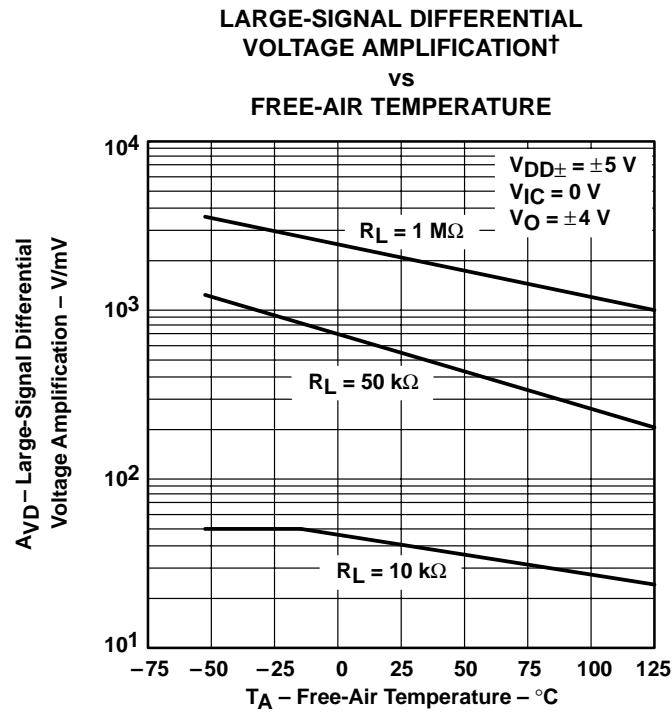


Figure 29

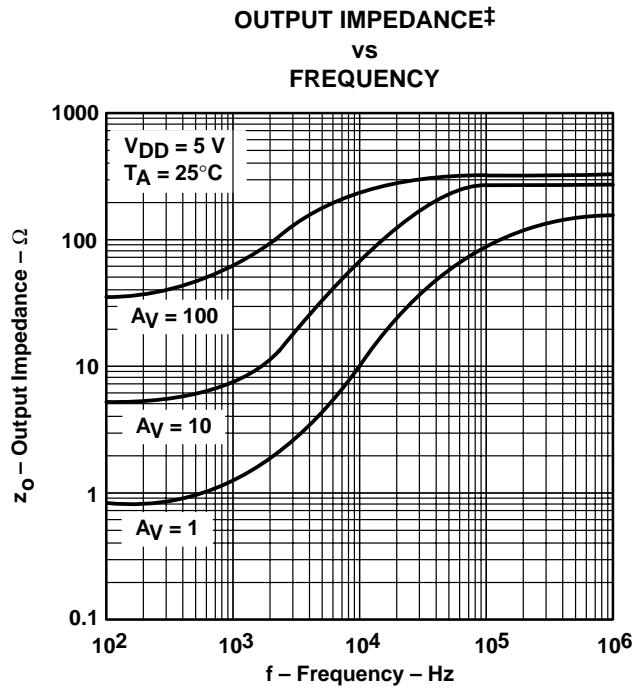


Figure 30

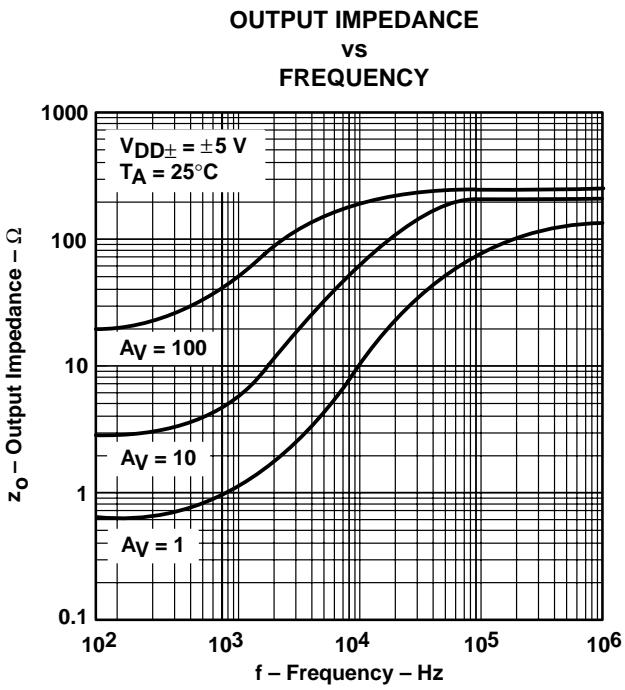


Figure 31

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

‡ For curves where $V_{DD} = 5 \text{ V}$, all loads are referenced to 2.5 V.

TYPICAL CHARACTERISTICS

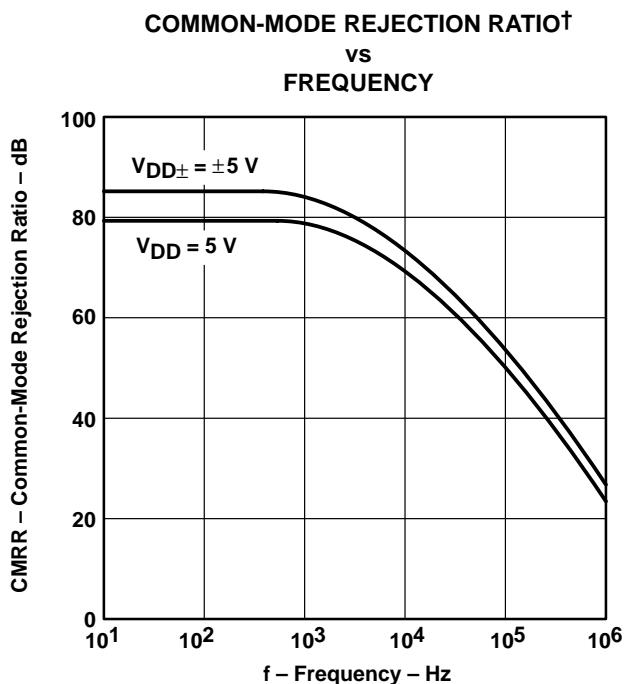


Figure 32

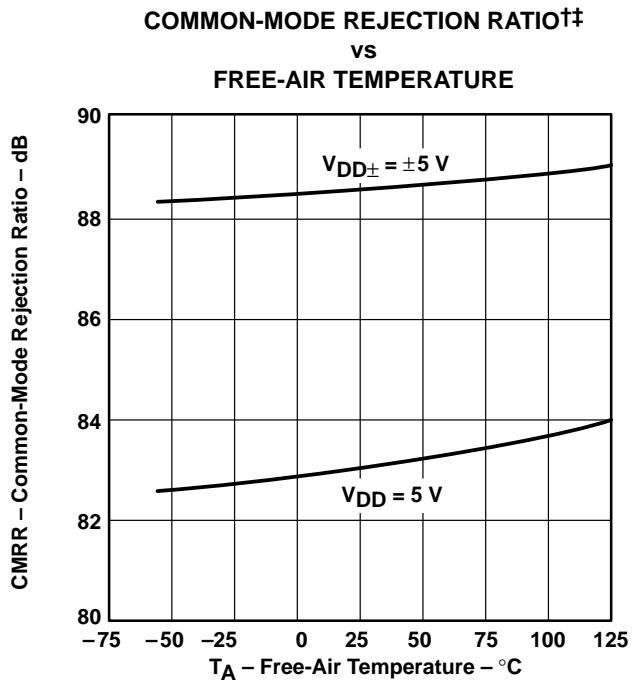


Figure 33

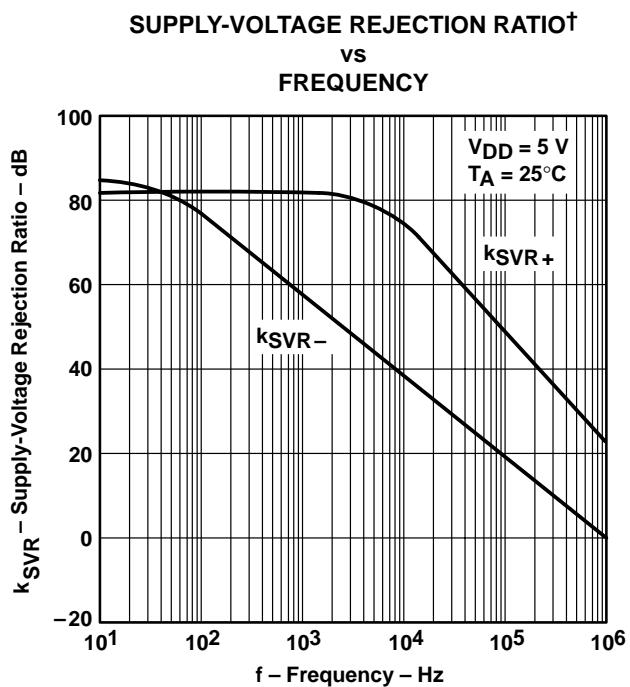


Figure 34

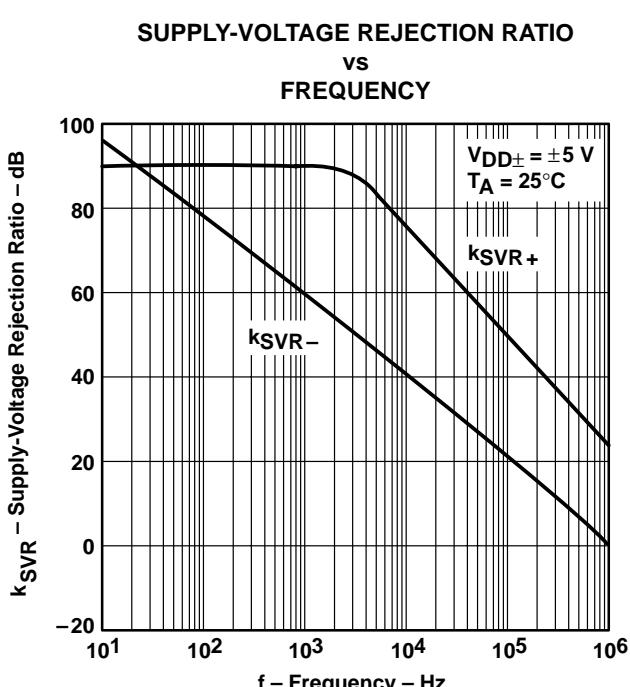


Figure 35

[†] For curves where $V_{DD} = 5 \text{ V}$, all loads are referenced to 2.5 V.

[‡] Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TYPICAL CHARACTERISTICS

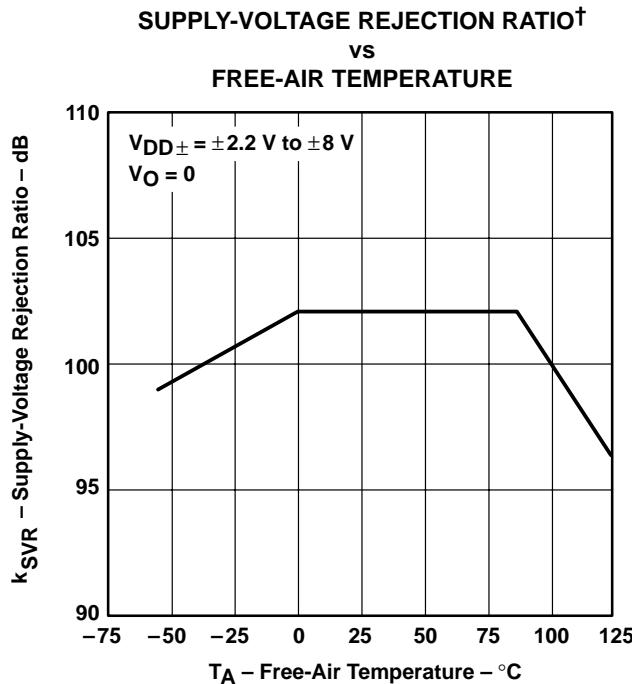


Figure 36

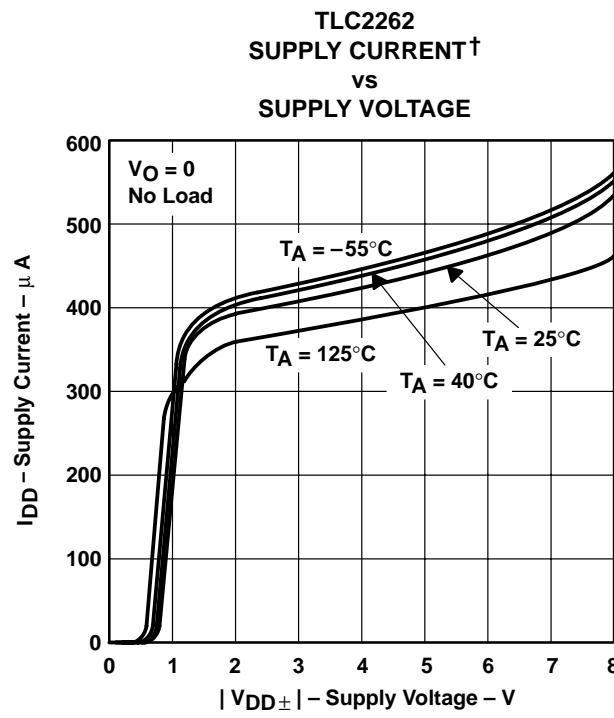


Figure 37

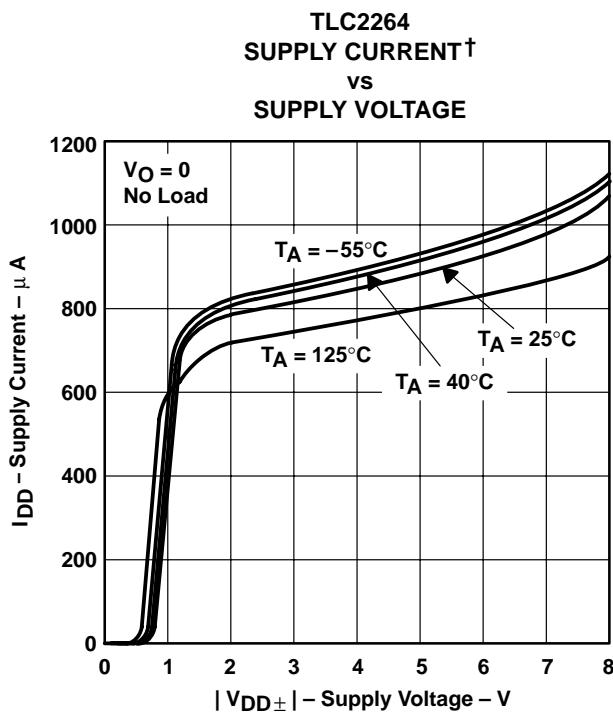


Figure 38

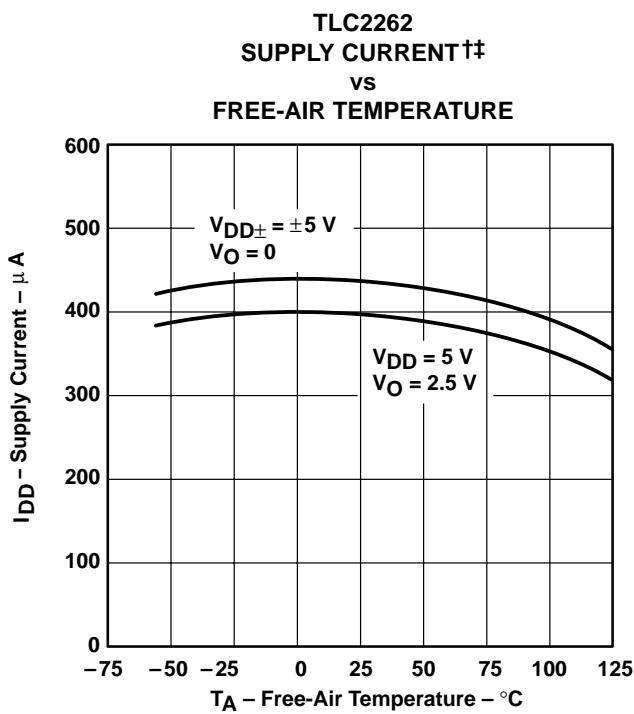


Figure 39

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

‡ For curves where V_{DD} = 5 V, all loads are referenced to 2.5 V.

TYPICAL CHARACTERISTICS

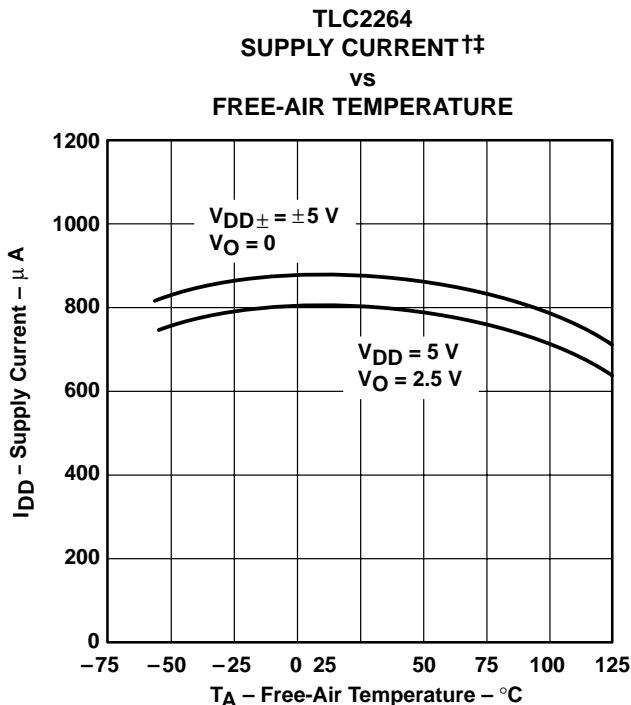


Figure 40

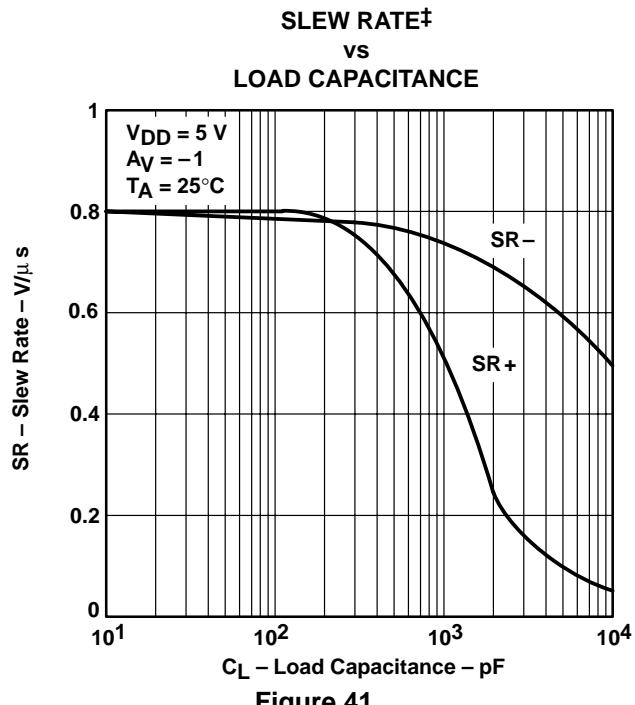


Figure 41

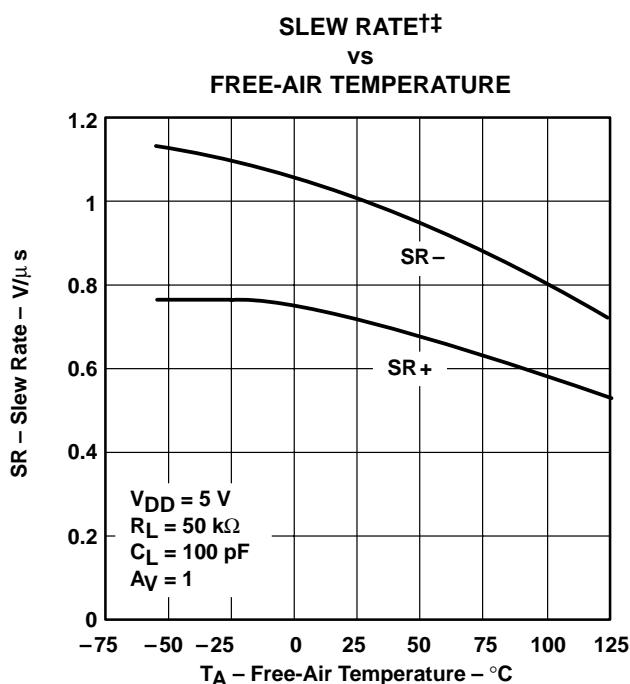


Figure 42

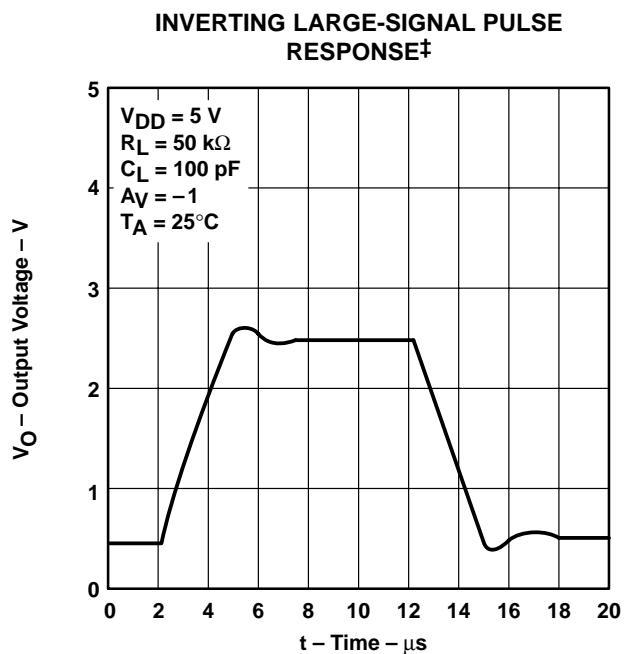


Figure 43

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

‡ For curves where $V_{DD} = 5$ V, all loads are referenced to 2.5 V.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TYPICAL CHARACTERISTICS

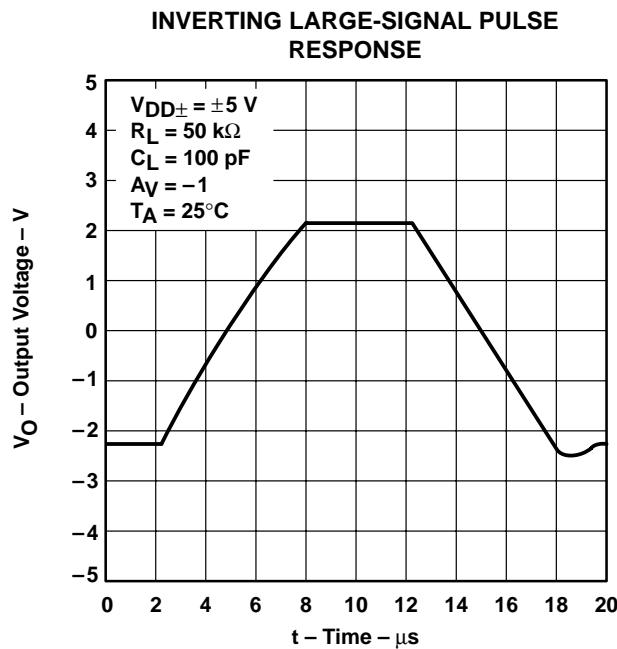


Figure 44

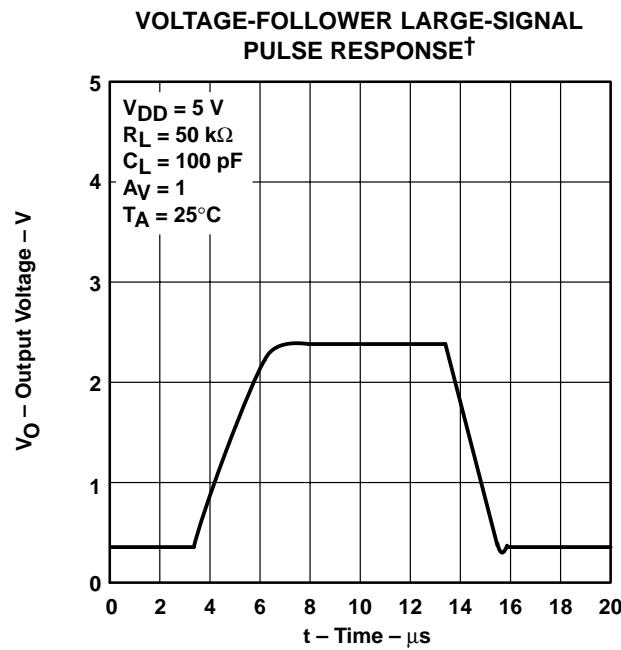


Figure 45

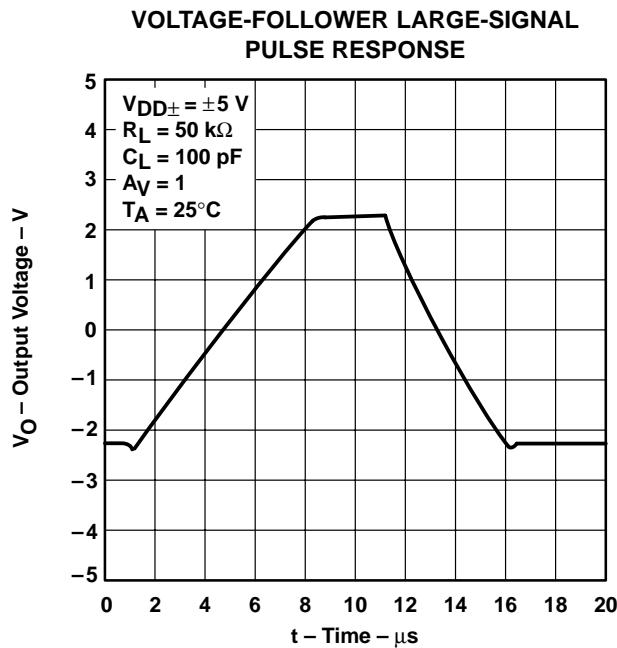


Figure 46

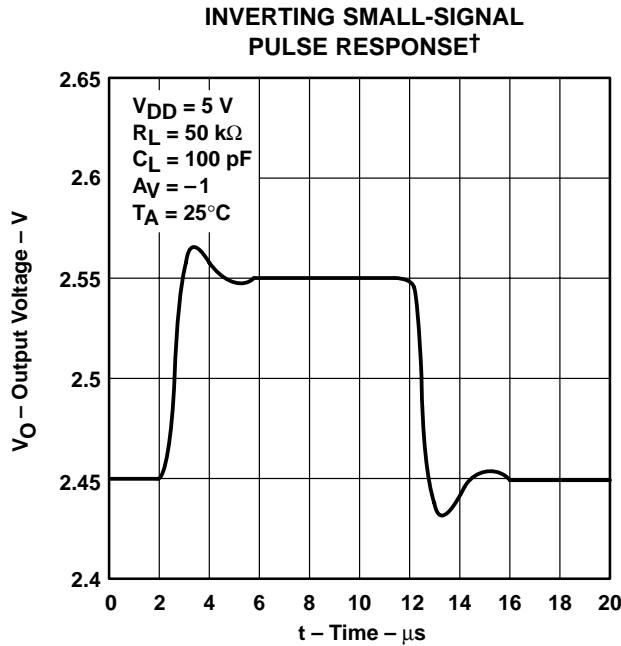


Figure 47

† For curves where $V_{DD} = 5\text{ V}$, all loads are referenced to 2.5 V.

TYPICAL CHARACTERISTICS

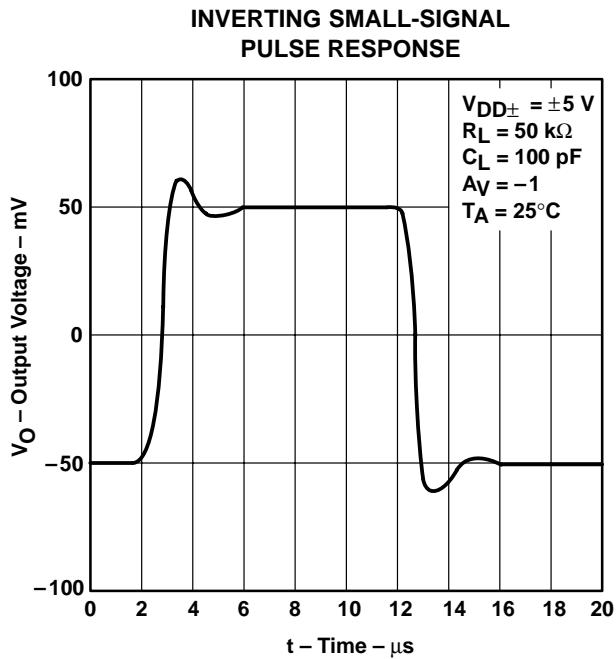


Figure 48

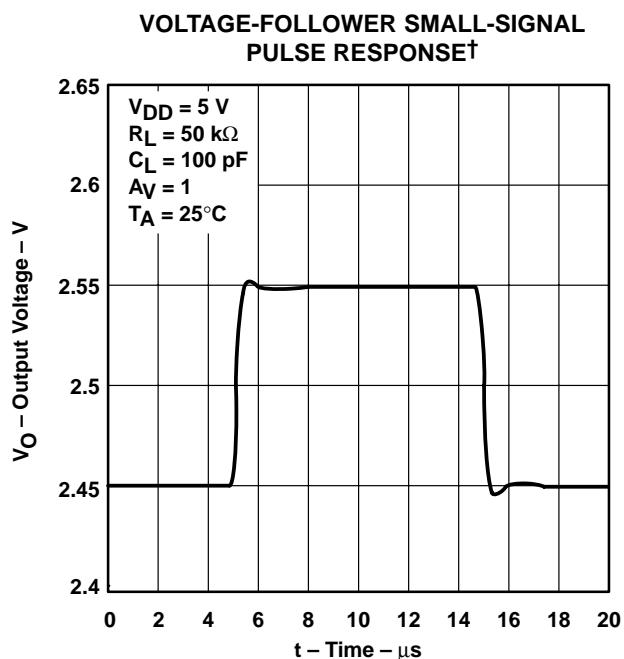


Figure 49

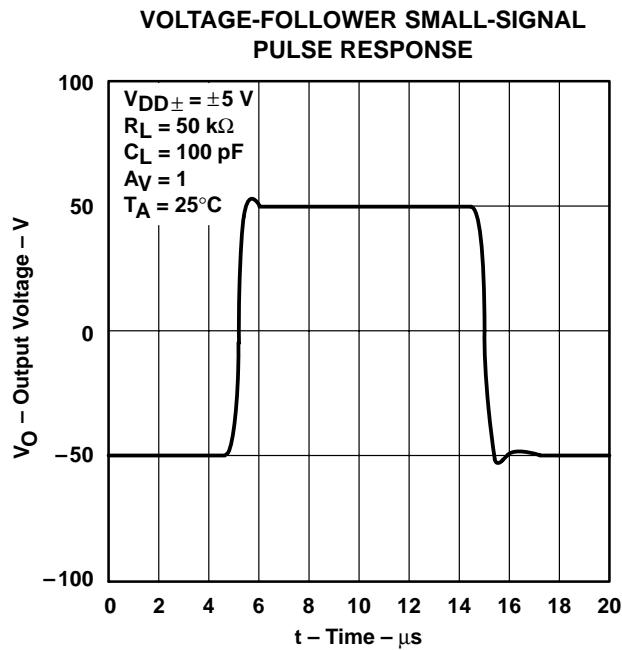


Figure 50

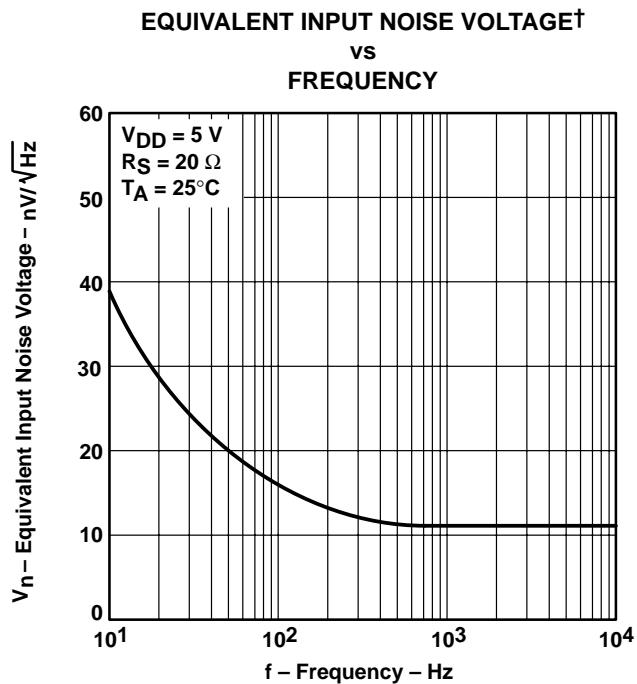


Figure 51

† For curves where $V_{DD} = 5 \text{ V}$, all loads are referenced to 2.5 V.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TYPICAL CHARACTERISTICS

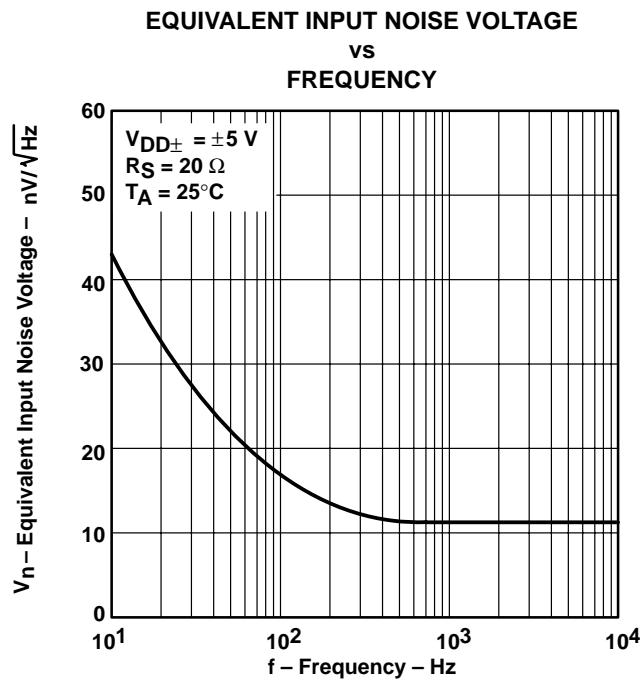


Figure 52

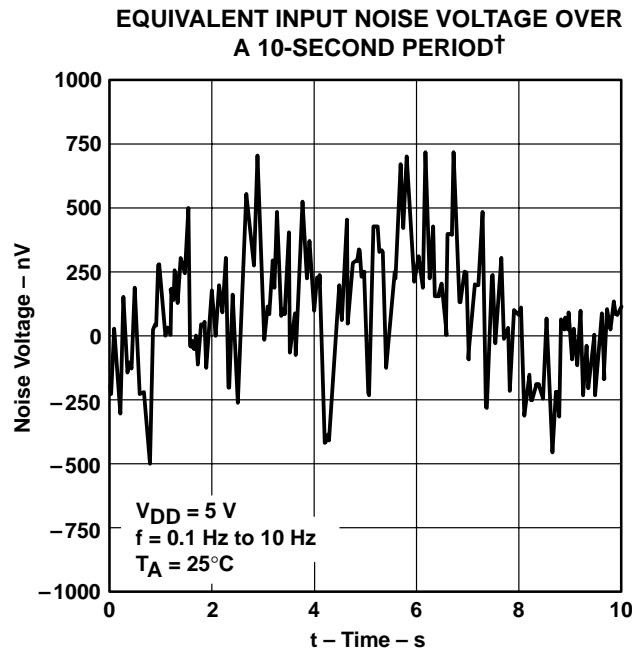


Figure 53

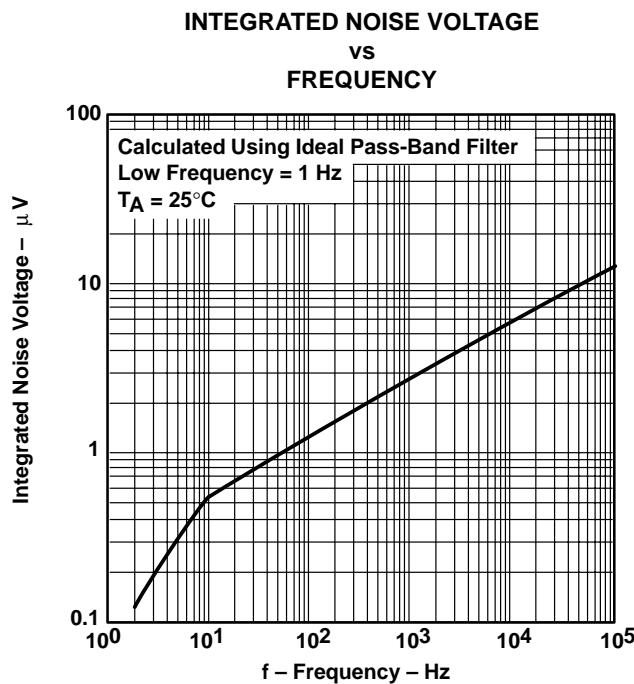


Figure 54

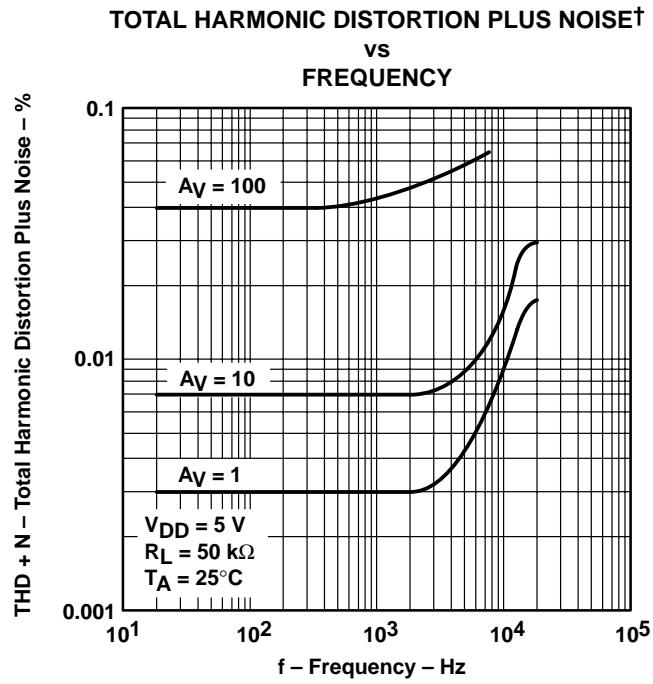


Figure 55

† For curves where $V_{DD} = 5 V$, all loads are referenced to 2.5 V.

TYPICAL CHARACTERISTICS

**GAIN-BANDWIDTH PRODUCT
vs
SUPPLY VOLTAGE**

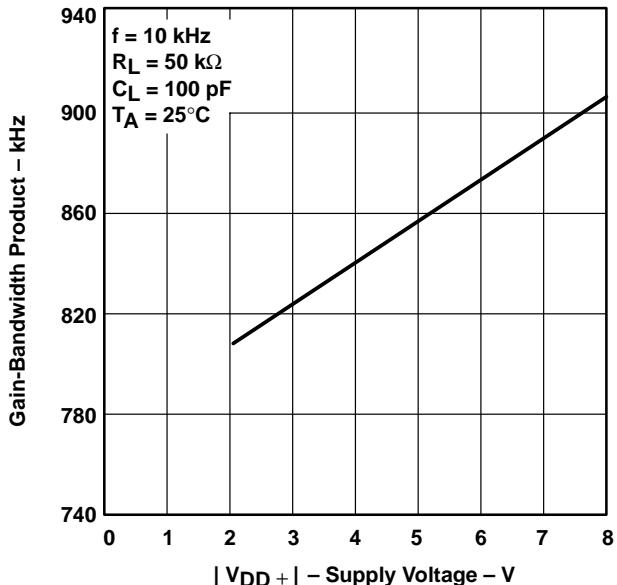


Figure 56

**GAIN-BANDWIDTH PRODUCT†‡
vs
FREE-AIR TEMPERATURE**

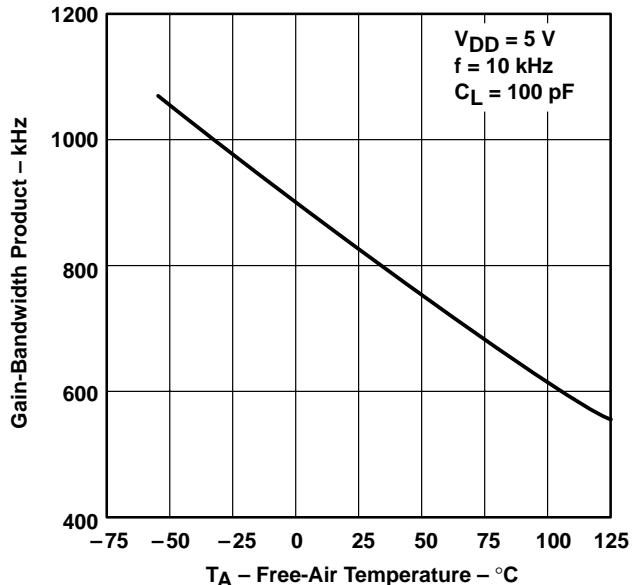


Figure 57

**PHASE MARGIN
vs
LOAD CAPACITANCE**

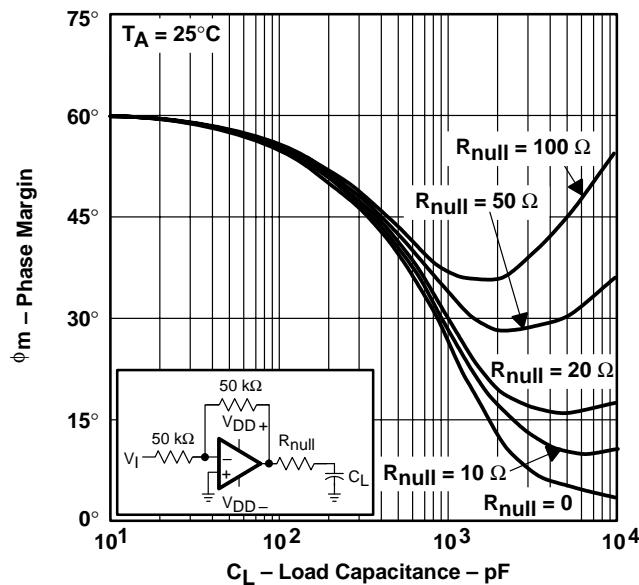


Figure 58

**GAIN MARGIN
vs
LOAD CAPACITANCE**

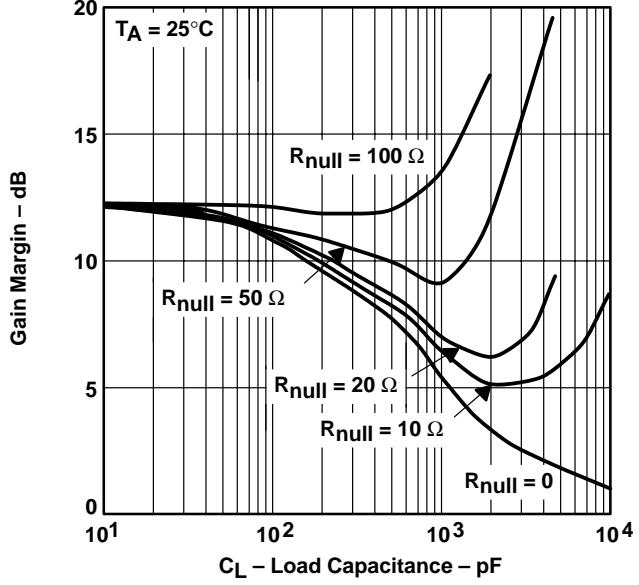


Figure 59

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

‡ For curves where $V_{DD} = 5 \text{ V}$, all loads are referenced to 2.5 V.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

TYPICAL CHARACTERISTICS

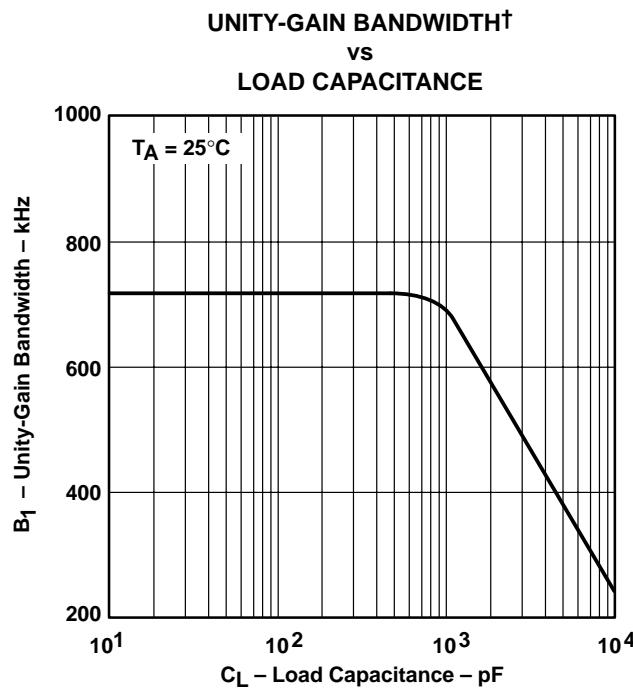


Figure 60

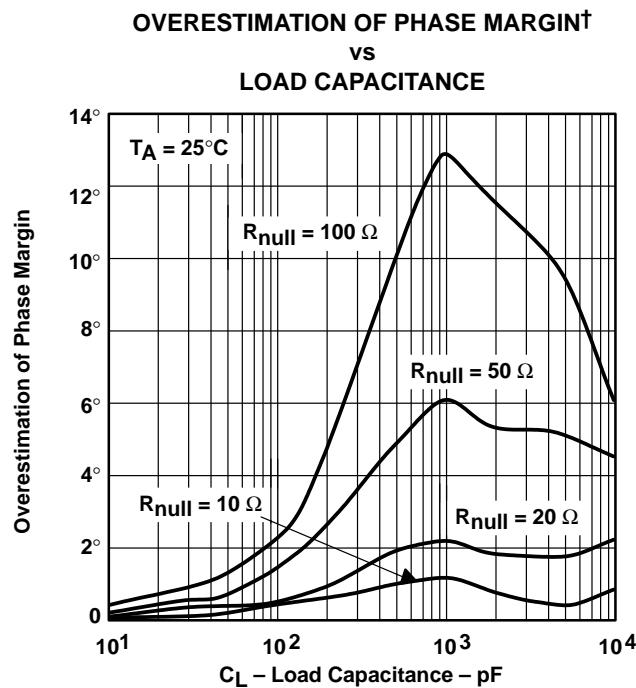


Figure 61

[†] See application information

APPLICATION INFORMATION

driving large capacitive loads

The TLC226x is designed to drive larger capacitive loads than most CMOS operational amplifiers. Figure 58 and Figure 59 illustrate its ability to drive loads greater than 400 pF while maintaining good gain and phase margins ($R_{\text{null}} = 0$).

A smaller series resistor (R_{null}) at the output of the device (see Figure 62) improves the gain and phase margins when driving large capacitive loads. Figure 58 and Figure 59 show the effects of adding series resistances of 10 Ω, 20 Ω, 50 Ω, and 100 Ω. The addition of this series resistor has two effects: the first is that it adds a zero to the transfer function and the second is that it reduces the frequency of the pole associated with the output load in the transfer function.

The zero introduced to the transfer function is equal to the series resistance times the load capacitance. To calculate the improvement in phase margin, equation 1 can be used.

$$\Delta\Theta_{m1} = \tan^{-1} \left(2 \times \pi \times \text{UGBW} \times R_{\text{null}} \times C_L \right) \quad (1)$$

Where :

$\Delta\Theta_{m1}$ = improvement in phase margin

UGBW = unity-gain bandwidth frequency

R_{null} = output series resistance

C_L = load capacitance

The unity-gain bandwidth (UGBW) frequency decreases as the capacitive load increases (see Figure 60). To use equation 1, UGBW must be approximated from Figure 60.

Using equation 1 alone overestimates the improvement in phase margin, as illustrated in Figure 61. The overestimation is caused by the decrease in the frequency of the pole associated with the load, thus providing additional phase shift and reducing the overall improvement in phase margin. The pole associated with the load is reduced by the factor calculated in equation 2.

$$F = \frac{1}{1 + g_m \times R_{\text{null}}} \quad (2)$$

Where :

F = factor reducing frequency of pole

g_m = small-signal output transconductance (typically 4.83×10^{-3} mhos)

R_{null} = output series resistance

For the TLC226x, the pole associated with the load is typically 7 MHz with 100-pF load capacitance. This value varies inversely with C_L : at $C_L = 10$ pF, use 70 MHz, at $C_L = 1000$ pF, use 700 kHz, and so on.

Reducing the pole associated with the load introduces phase shift, thereby reducing phase margin. This results in an error in the increase in phase margin expected by considering the zero alone (equation 1). Equation 3 approximates the reduction in phase margin due to the movement of the pole associated with the load. The result of this equation can be subtracted from the result of the equation in equation 1 to better approximate the improvement in phase margin.

TLC226x, TLC226xA
Advanced LinCMOS™ RAIL-TO-RAIL
OPERATIONAL AMPLIFIERS

SLOS177D – FEBRUARY 1997 – REVISED MARCH 2001

APPLICATION INFORMATION

driving large capacitive loads (continued)

$$\Delta\Theta_{m2} = \tan^{-1} \left[\frac{UGBW}{(F \times P_2)} \right] - \tan^{-1} \left(\frac{UGBW}{P_2} \right) \quad (3)$$

Where :

$\Delta\Theta_{m2}$ = reduction in phase margin

UGBW = unity-gain bandwidth frequency

F = factor from equation 2

P_2 = unadjusted pole (70 MHz@10 pF, 7 MHz@100 pF, etc.)

Using these equations with Figure 60 and Figure 61 enables the designer to choose the appropriate output series resistance to optimize the design of circuits driving large capacitive loads.

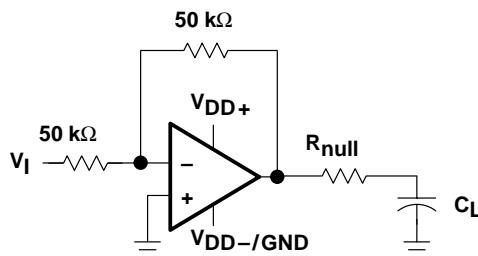


Figure 62. Series-Resistance Circuit

APPLICATION INFORMATION

macromodel information

Macromodel information provided was derived using Microsim *Parts*™, the model generation software used with Microsim *PSpice*™. The Boyle macromodel (see Note 5) and subcircuit in Figure 63 are generated using the TLC226x typical electrical and operating characteristics at $T_A = 25^\circ\text{C}$. Using this information, output simulations of the following key parameters can be generated to a tolerance of 20% (in most cases):

- Maximum positive output voltage swing
- Maximum negative output voltage swing
- Slew rate
- Quiescent power dissipation
- Input bias current
- Open-loop voltage amplification
- Unity-gain frequency
- Common-mode rejection ratio
- Phase margin
- DC output resistance
- AC output resistance
- Short-circuit output current limit

NOTE 5: G. R. Boyle, B. M. Cohn, D. O. Pederson, and J. E. Solomon, "Macromodeling of Integrated Circuit Operational Amplifiers," *IEEE Journal of Solid-State Circuits*, SC-9, 353 (1974).

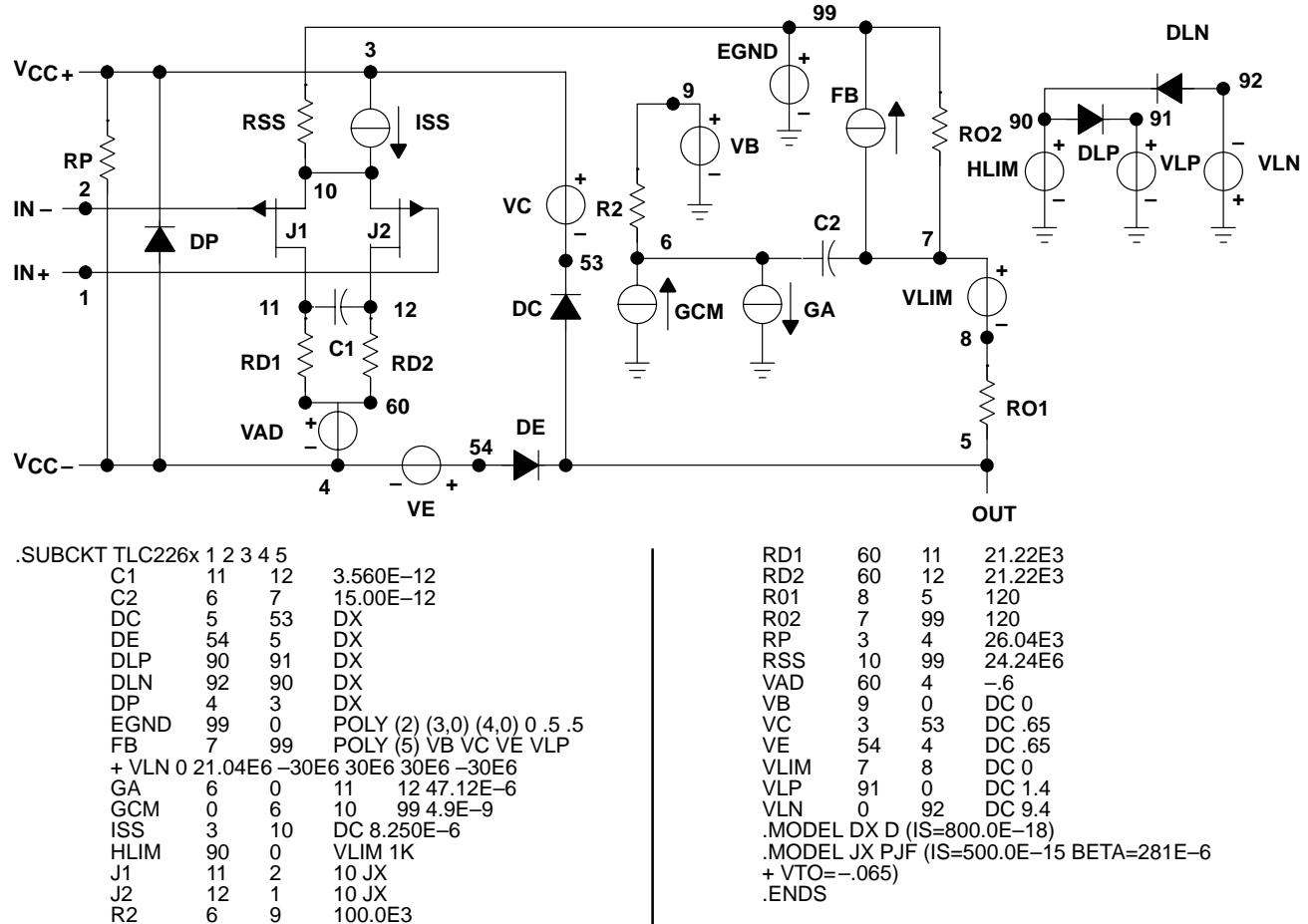


Figure 63. Boyle Macromodel and Subcircuit

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-9469201Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-9469201QHA	ACTIVE	CFP	U	10	1	TBD	A42	N / A for Pkg Type
5962-9469201QPA	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type
5962-9469202Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-9469202QCA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type
5962-9469202QDA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
5962-9469203Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-9469203QHA	ACTIVE	CFP	U	10	1	TBD	A42	N / A for Pkg Type
5962-9469203QPA	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type
5962-9469204Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-9469204QCA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type
5962-9469204QDA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
TLC2262AID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262AIDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262AIDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262AIDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262AIP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC2262AIPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC2262AIPW	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262AIPWG4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262AIPWLE	OBSOLETE	TSSOP	PW	8		TBD	Call TI	Call TI
TLC2262AIPWR	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262AIPWRG4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262AMFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
TLC2262AMJG	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type
TLC2262AMJGB	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type
TLC2262AMUB	ACTIVE	CFP	U	10	1	TBD	A42	N / A for Pkg Type
TLC2262AQD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262AQDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262AQDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262AQDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262CD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
no Sb/Br)								
TLC2262CDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262CDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262CDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262CP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC2262CPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC2262CPW	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262CPWG4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262CPWLE	OBsolete	TSSOP	PW	8		TBD	Call TI	Call TI
TLC2262CPWR	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262CPWRG4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262ID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262IDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262IDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262IDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262IP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC2262IPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC2262MFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
TLC2262MJGB	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type
TLC2262MUB	ACTIVE	CFP	U	10	1	TBD	A42	N / A for Pkg Type
TLC2262QD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262QDG4	ACTIVE	SOIC	D	8	1500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262QDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2262QDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264AID	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264AIDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264AIDR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264AIDRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TLC2264AIN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC2264AINE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC2264AIPW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264AIPWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264AIPWLE	OBsolete	TSSOP	PW	14		TBD	Call TI	Call TI
TLC2264AIPWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264AIPWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264AMFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
TLC2264AMJ	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type
TLC2264AMJB	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type
TLC2264AMWB	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
TLC2264AQD	ACTIVE	SOIC	D	14	50	TBD	CU NIPDAU	Level-1-220C-UNLIM
TLC2264AQDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264AQDR	ACTIVE	SOIC	D	14	2500	TBD	CU NIPDAU	Level-1-220C-UNLIM
TLC2264AQDRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264CD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264CDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264CDR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264CDRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264CN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC2264CNE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC2264CPW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264CPWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264CPWLE	OBsolete	TSSOP	PW	14		TBD	Call TI	Call TI
TLC2264CPWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264CPWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264ID	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264IDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264IDR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TLC2264IDRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264IN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC2264INE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC2264MFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
TLC2264MJB	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type
TLC2264MWB	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type
TLC2264QD	ACTIVE	SOIC	D	14	50	TBD	CU NIPDAU	Level-1-220C-UNLIM
TLC2264QDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC2264QDR	ACTIVE	SOIC	D	14	2500	TBD	CU NIPDAU	Level-1-220C-UNLIM
TLC2264QDRG4	ACTIVE	SOIC	D	14	1500	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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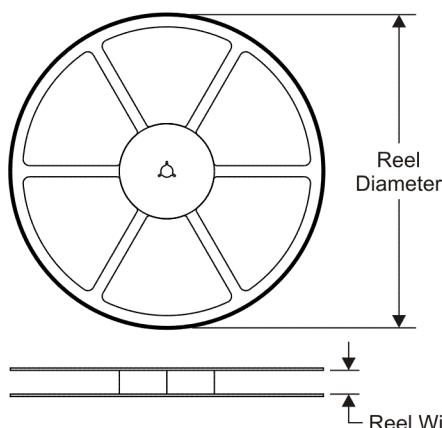
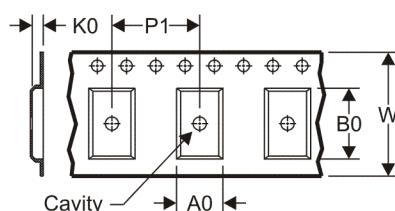
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF TLC2262, TLC2262A, TLC2262AM, TLC2262M, TLC2264, TLC2264A, TLC2264AM, TLC2264M :

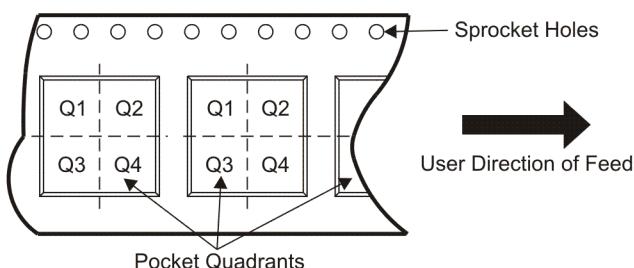
- Automotive: [TLC2264A-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

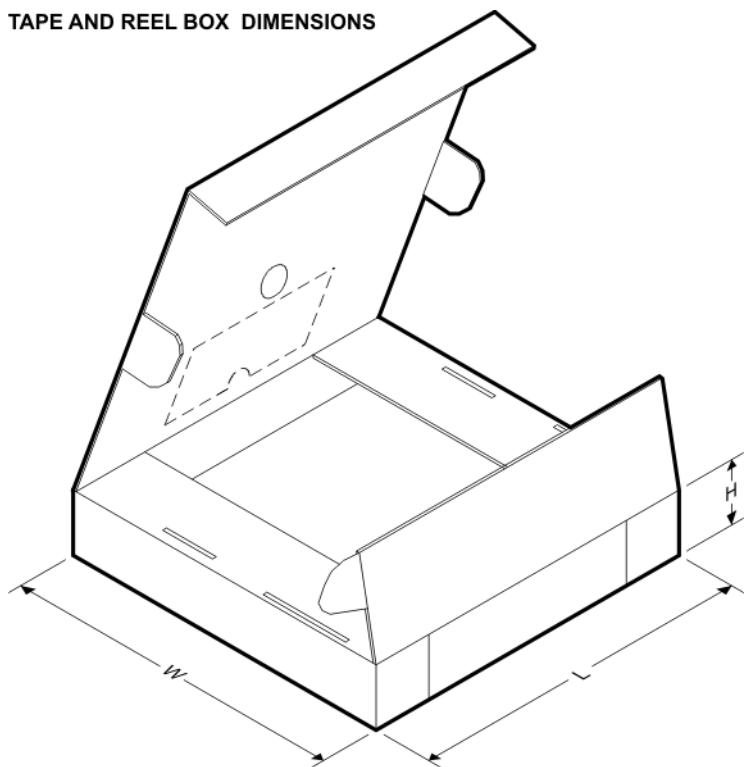
TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
TLC2262AIDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLC2262AIPWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
TLC2262CDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLC2262CPWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
TLC2262IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLC2264AIDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
TLC2264AIPWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
TLC2264AQDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
TLC2264CDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
TLC2264CPWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
TLC2264IDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
TLC2264QDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

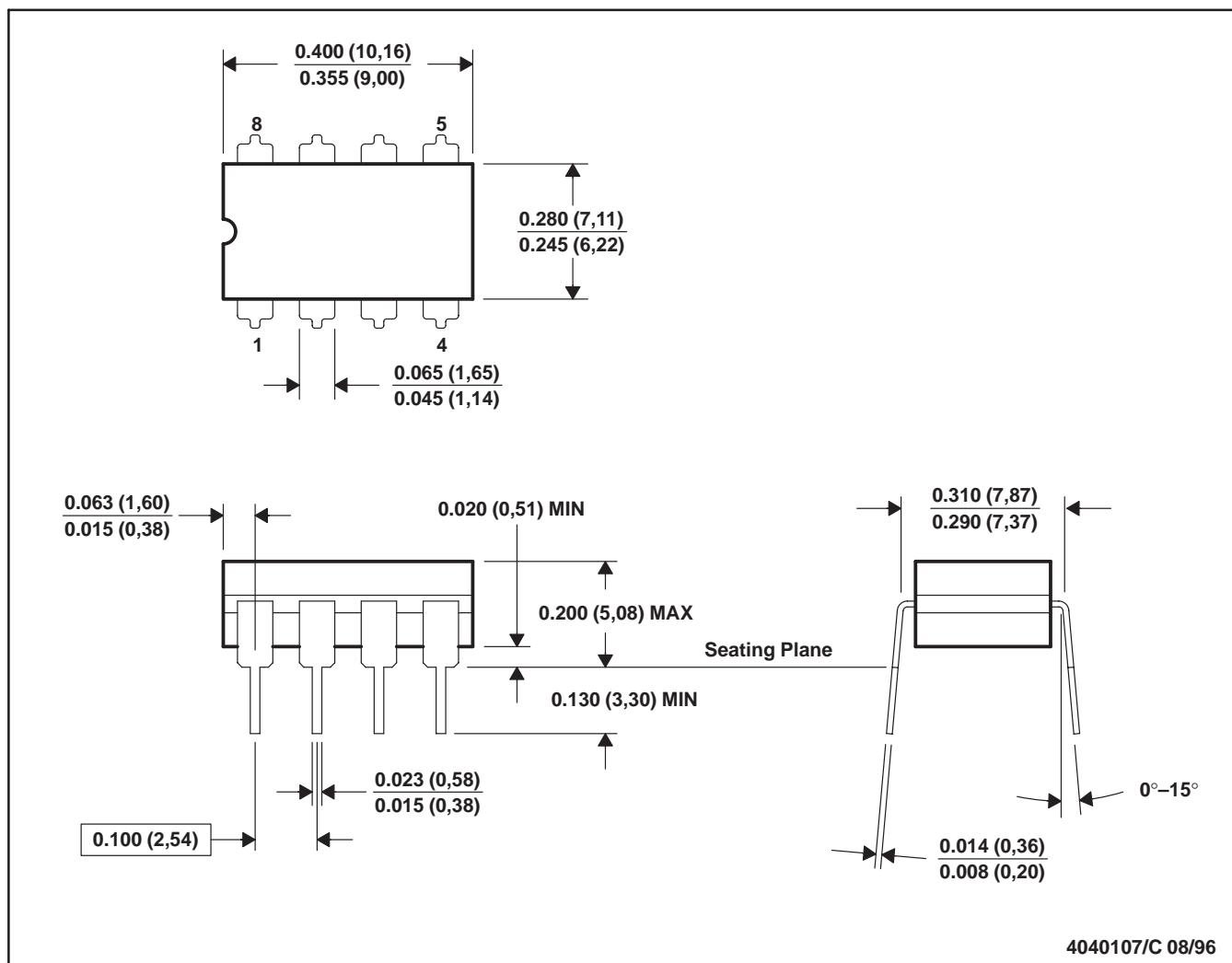
TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLC2262AIDR	SOIC	D	8	2500	340.5	338.1	20.6
TLC2262AIPWR	TSSOP	PW	8	2000	346.0	346.0	29.0
TLC2262CDR	SOIC	D	8	2500	340.5	338.1	20.6
TLC2262CPWR	TSSOP	PW	8	2000	346.0	346.0	29.0
TLC2262IDR	SOIC	D	8	2500	340.5	338.1	20.6
TLC2264AIDR	SOIC	D	14	2500	333.2	345.9	28.6
TLC2264AIPWR	TSSOP	PW	14	2000	346.0	346.0	29.0
TLC2264AQDR	SOIC	D	14	2500	346.0	346.0	33.0
TLC2264CDR	SOIC	D	14	2500	333.2	345.9	28.6
TLC2264CPWR	TSSOP	PW	14	2000	346.0	346.0	29.0
TLC2264IDR	SOIC	D	14	2500	333.2	345.9	28.6
TLC2264QDR	SOIC	D	14	2500	346.0	346.0	33.0

JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE

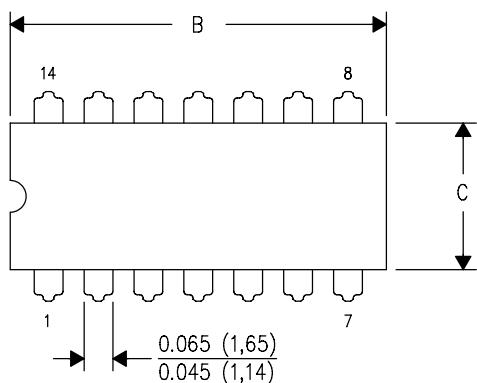


- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. This package can be hermetically sealed with a ceramic lid using glass frit.
 D. Index point is provided on cap for terminal identification.
 E. Falls within MIL STD 1835 GDIP1-T8

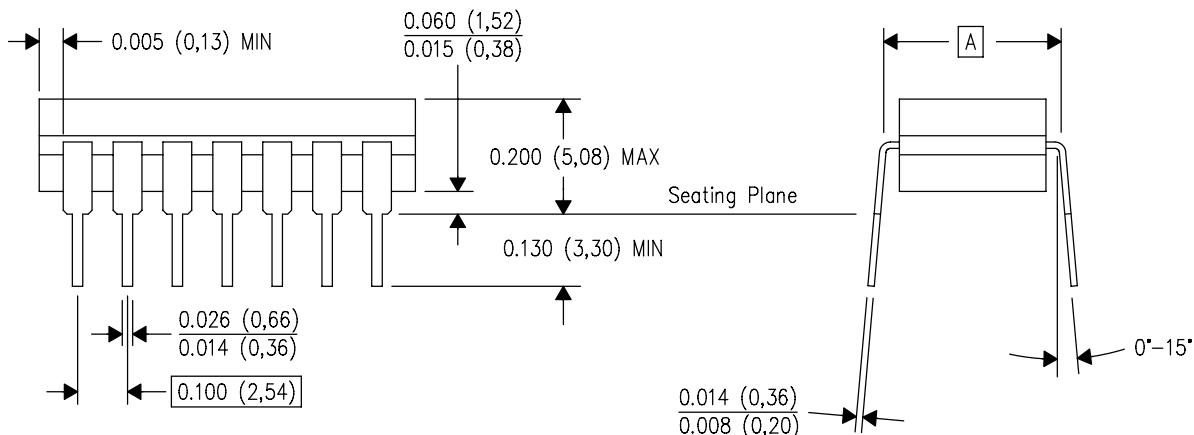
J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS **\nDIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)

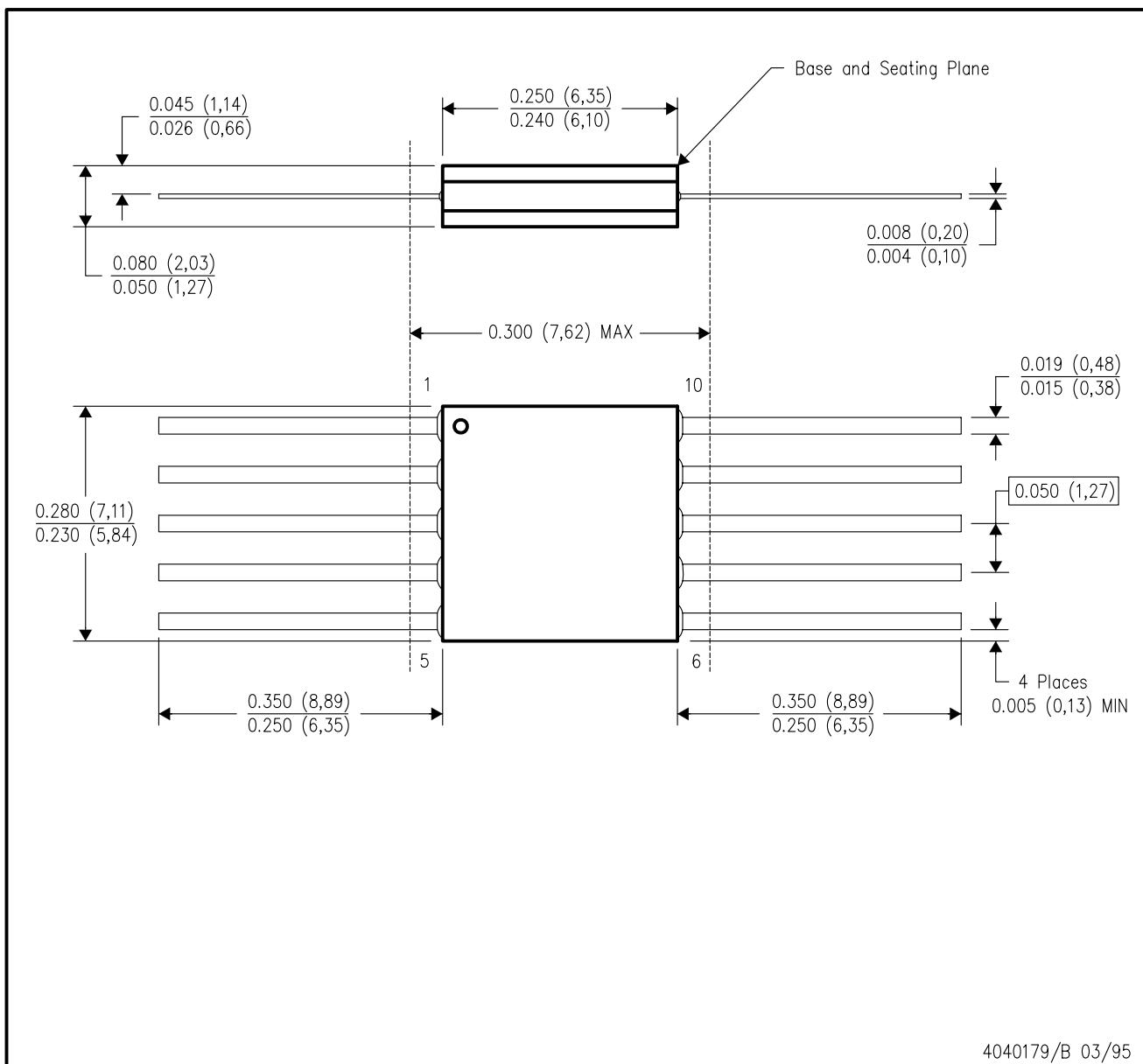


4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

U (S-GDFP-F10)

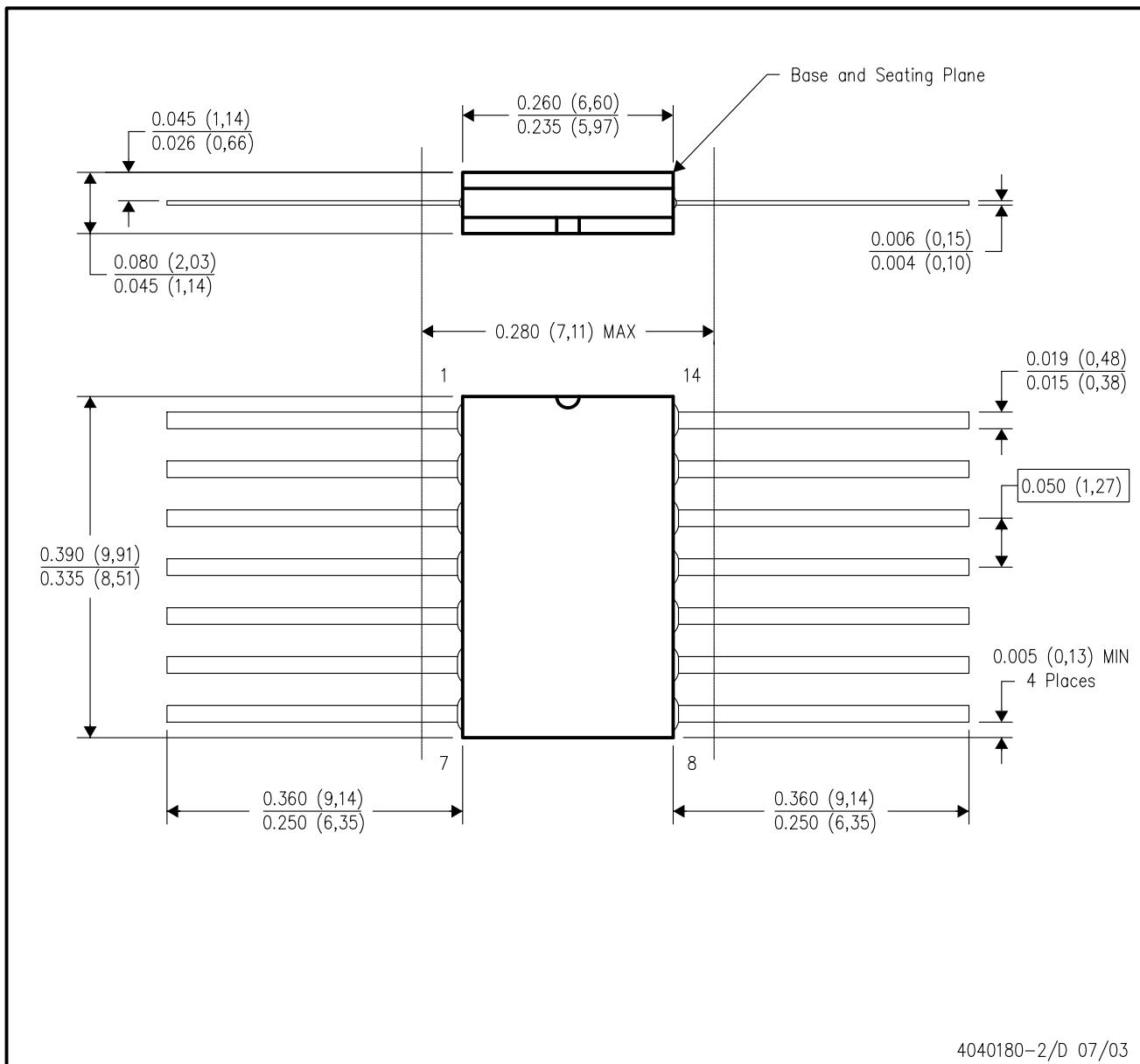
CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only.
 - Falls within MIL STD 1835 GDFP1-F10 and JEDEC MO-092AA

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK

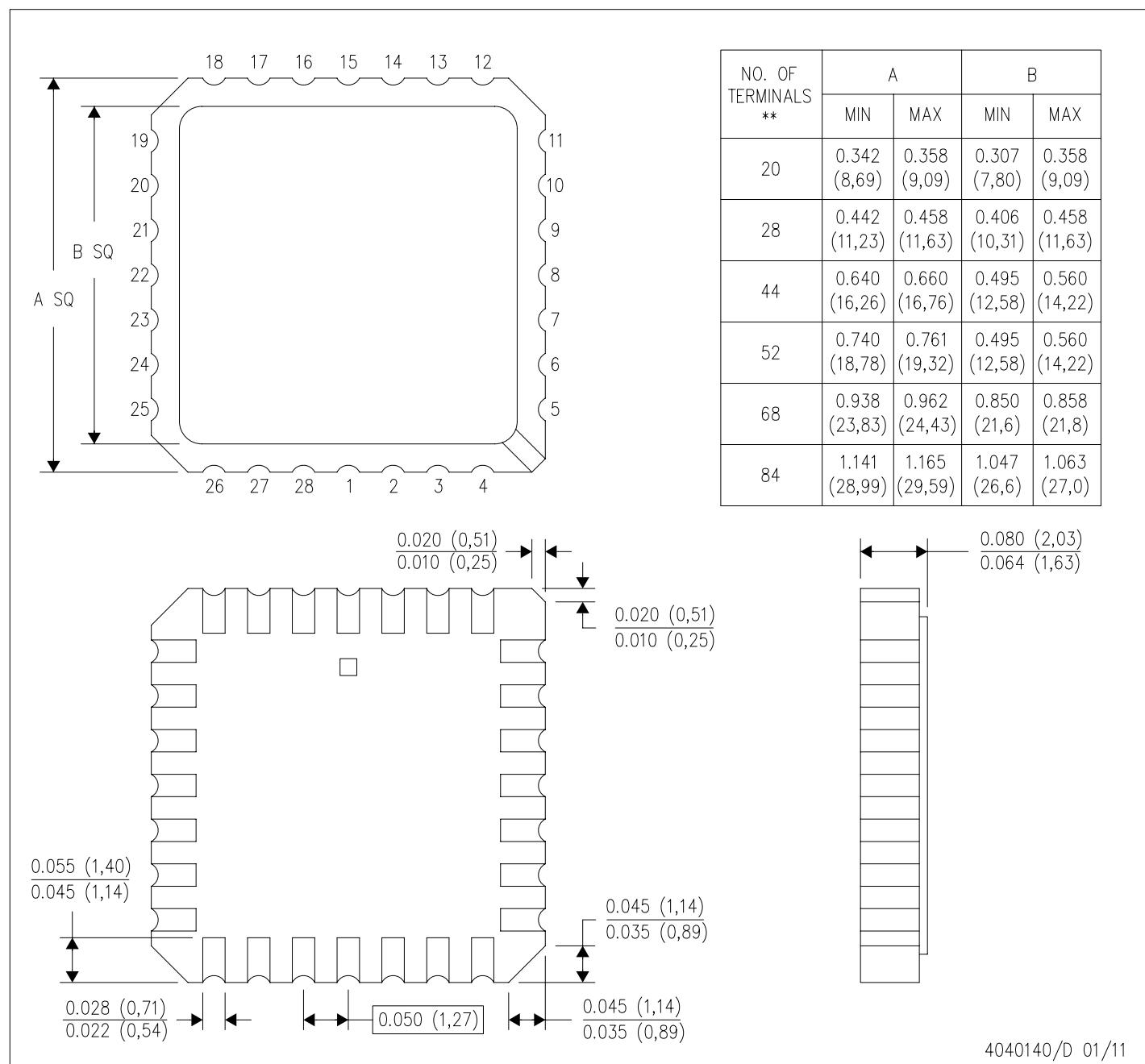


- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only.
 - Falls within MIL-STD 1835 GDFP1-F14 and JEDEC MO-092AB

FK (S-CQCC-N**)

28 TERMINAL SHOWN

LEADLESS CERAMIC CHIP CARRIER

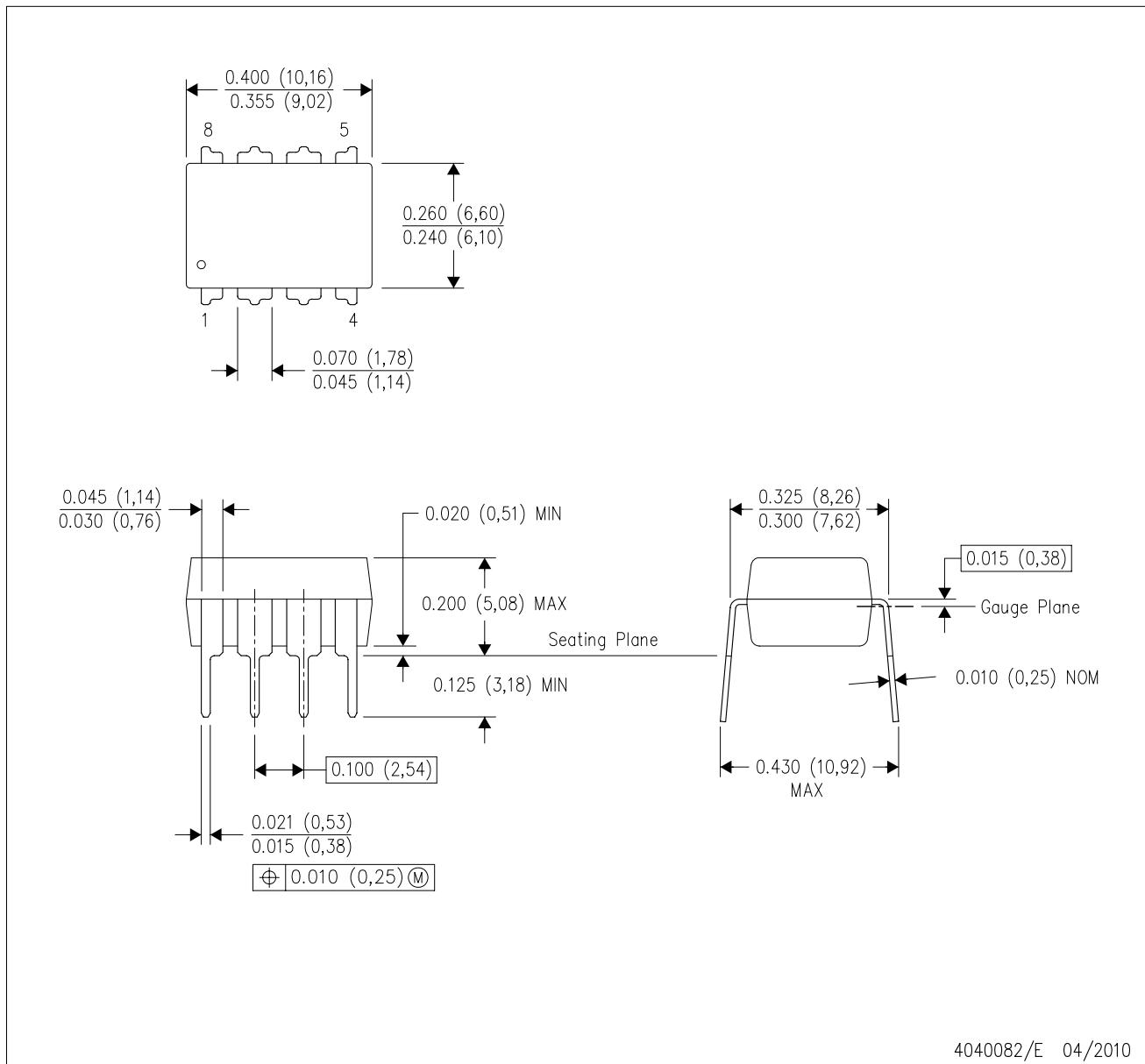


- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - Falls within JEDEC MS-004

MECHANICAL DATA

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



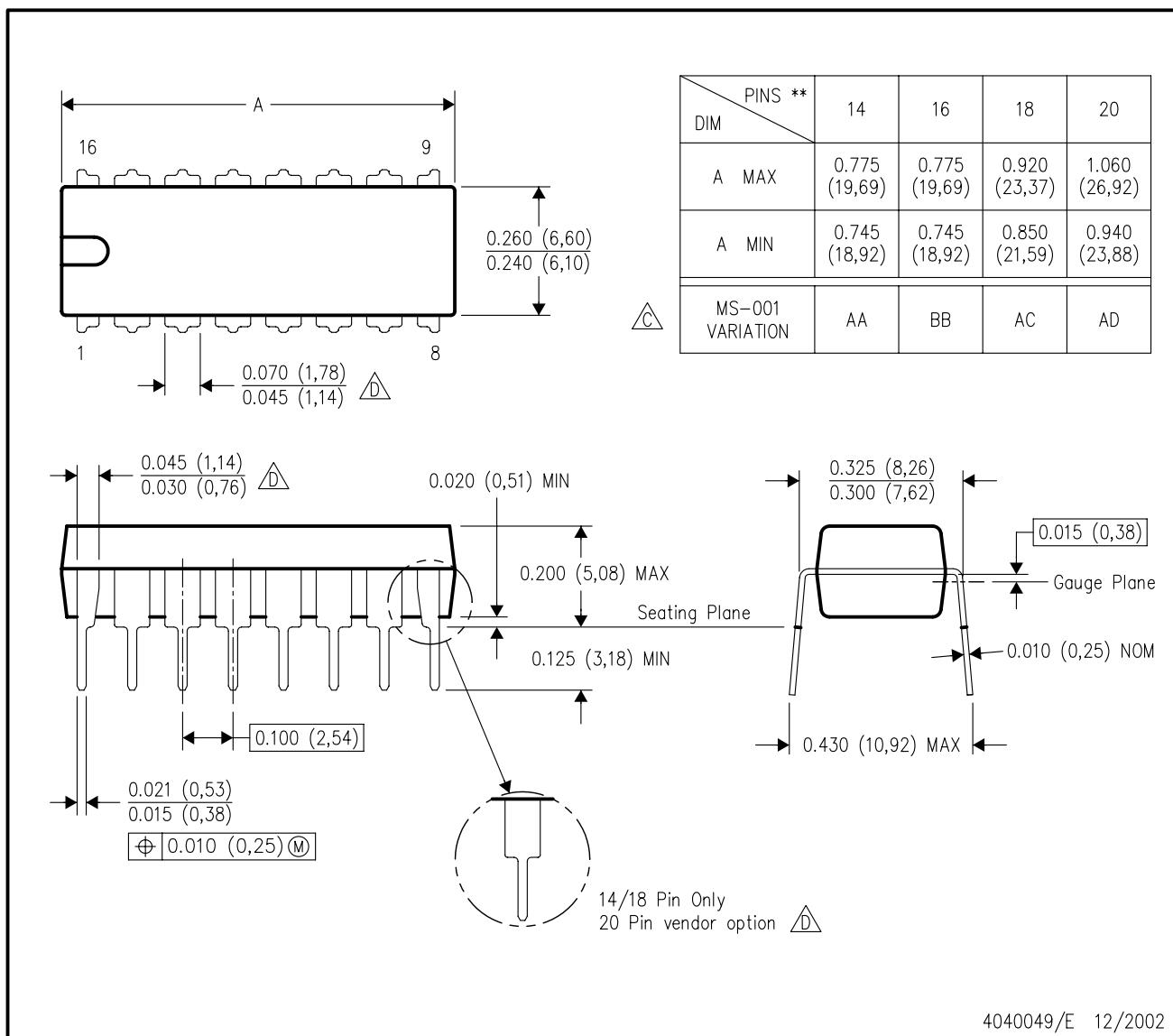
4040082/E 04/2010

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

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



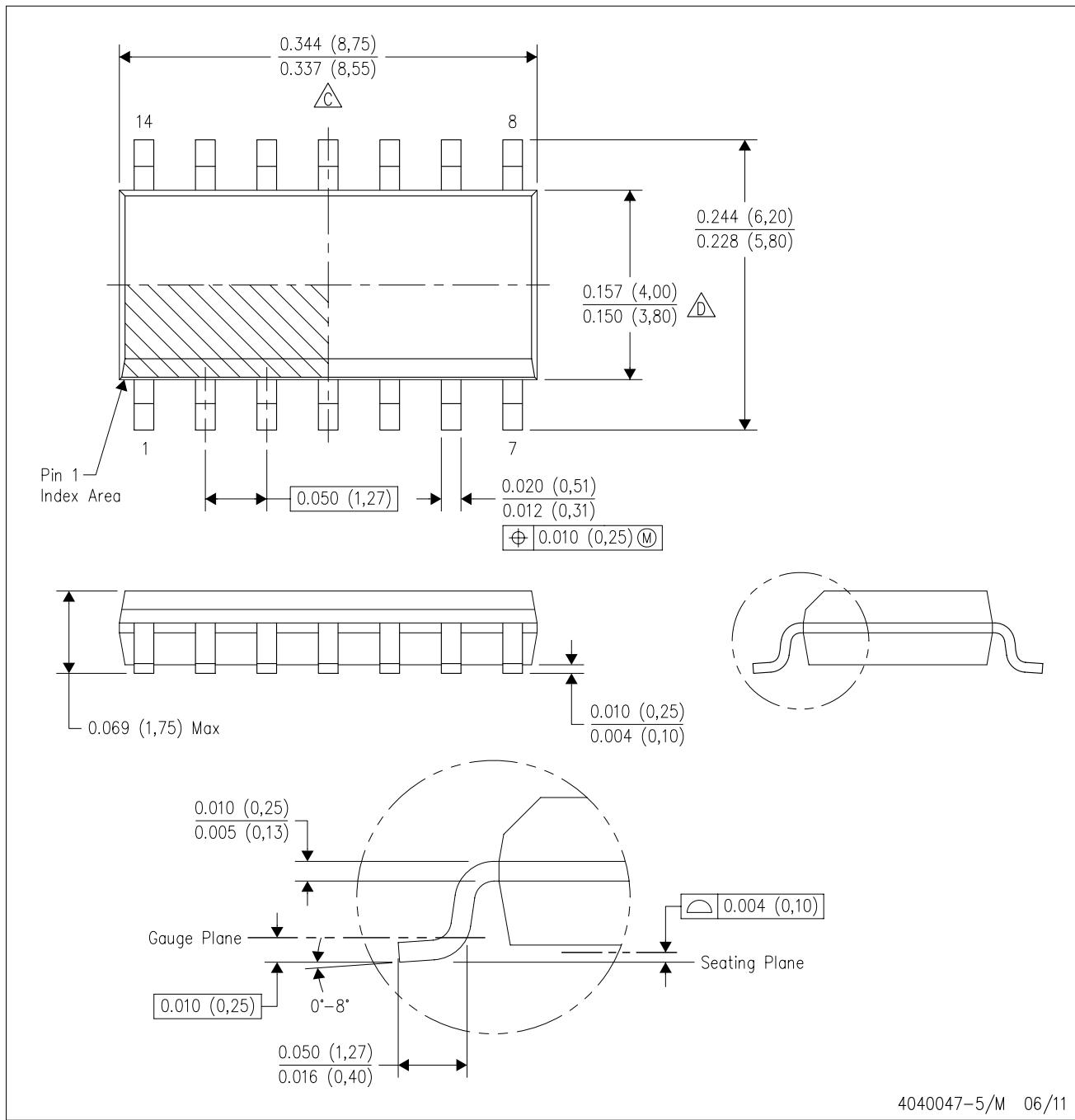
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

$\triangle C$ Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).

$\triangle D$ The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters).

B. This drawing is subject to change without notice.

C Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.

D Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.

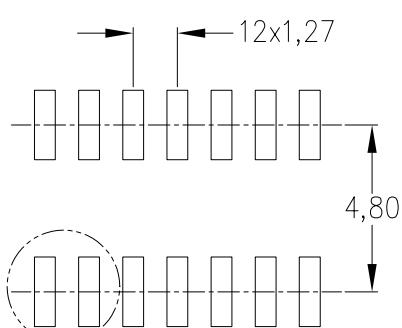
E. Reference JEDEC MS-012 variation AB.

LAND PATTERN DATA

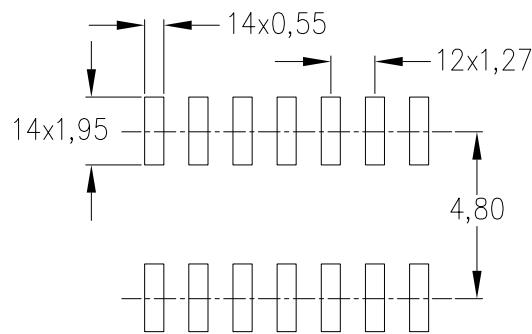
D (R-PDSO-G14)

PLASTIC SMALL OUTLINE

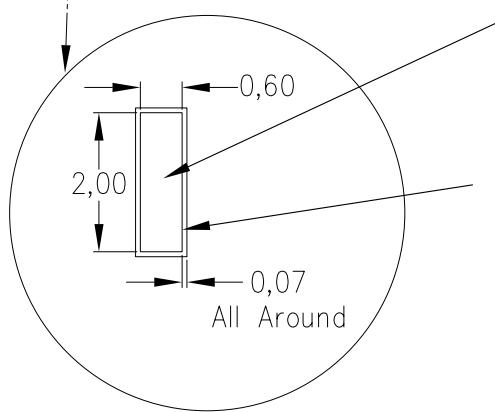
Example Board Layout
(Note C)



Stencil Openings
(Note D)



Example
Non Soldermask Defined Pad



Example
Pad Geometry
(See Note C)

Example
Solder Mask Opening
(See Note E)

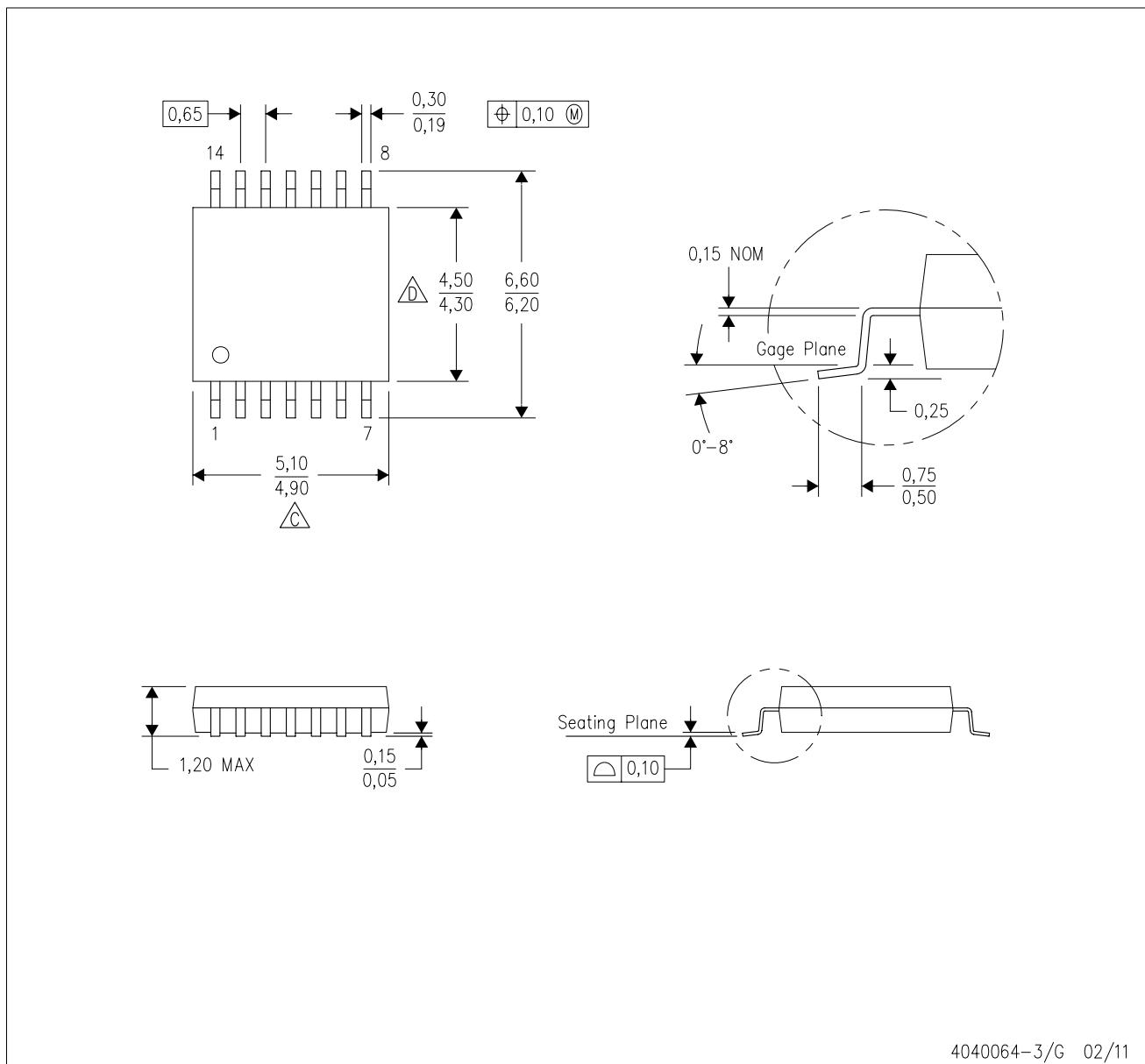
4211283-3/C 02/11

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

MECHANICAL DATA

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040064-3/G 02/11

NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.

B. This drawing is subject to change without notice.

C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.

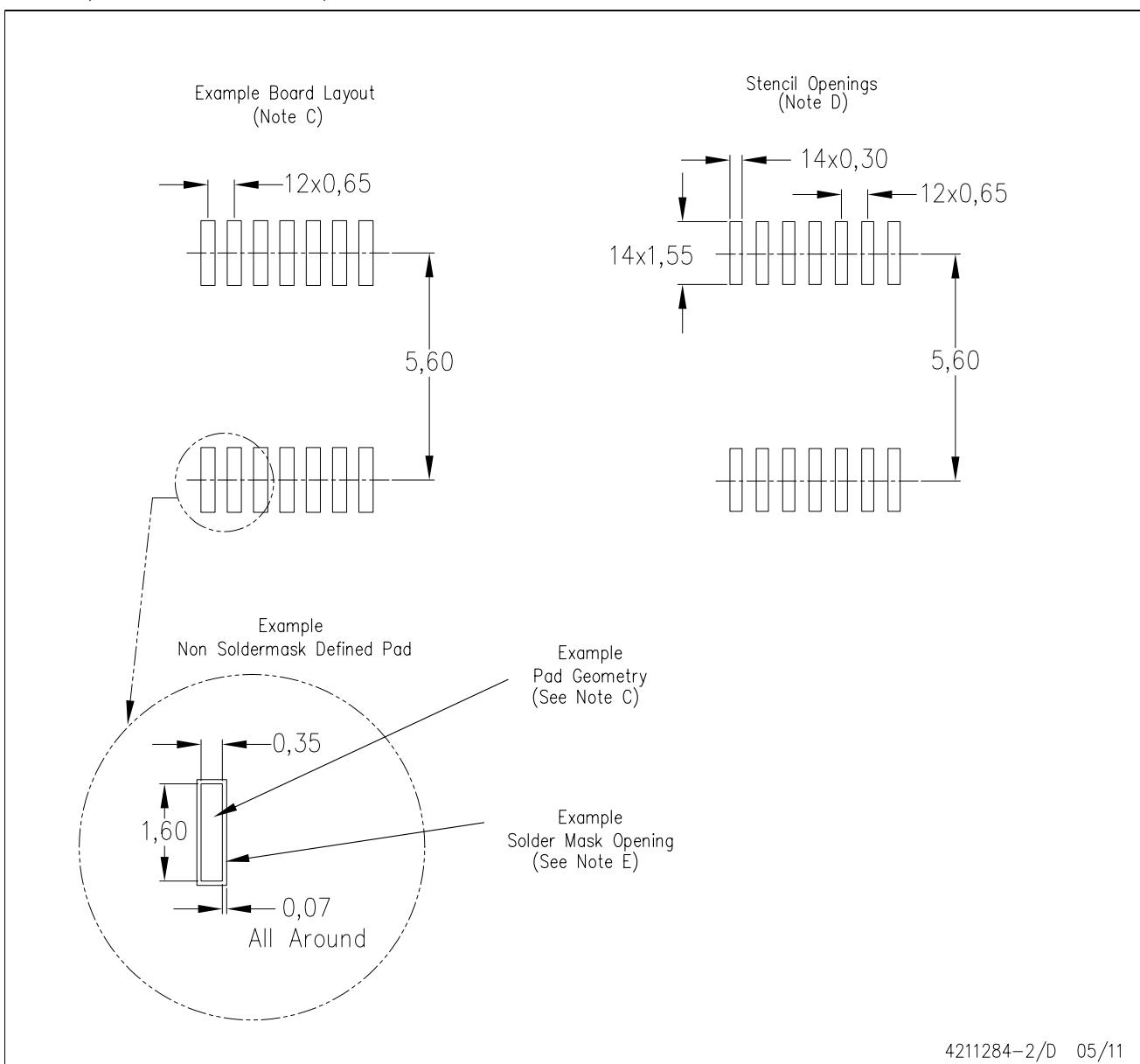
D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.

E. Falls within JEDEC MO-153

LAND PATTERN DATA

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE

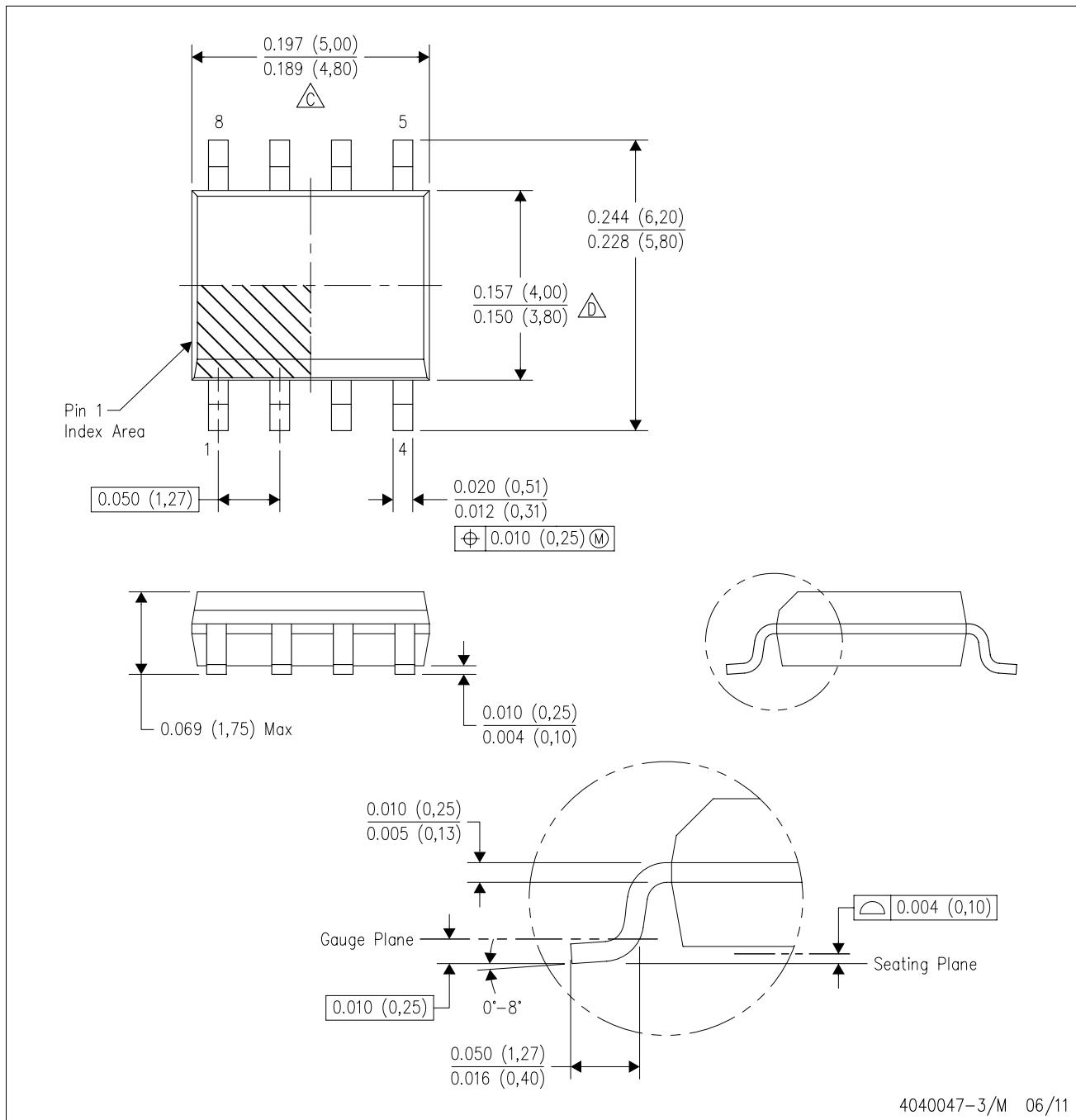


4211284-2/D 05/11

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters).

B. This drawing is subject to change without notice.

△C Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0.15) each side.

△D Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0.43) each side.

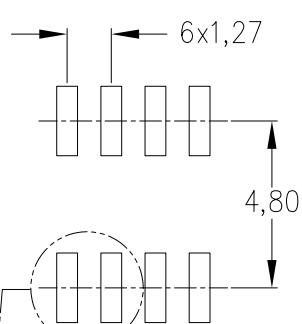
E. Reference JEDEC MS-012 variation AA.

LAND PATTERN DATA

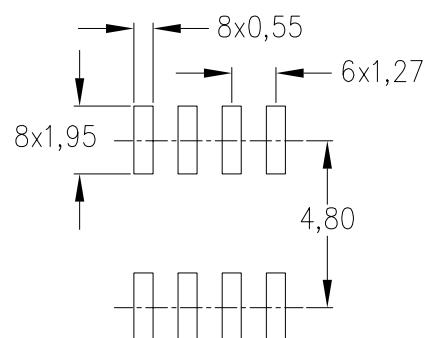
D (R-PDSO-G8)

PLASTIC SMALL OUTLINE

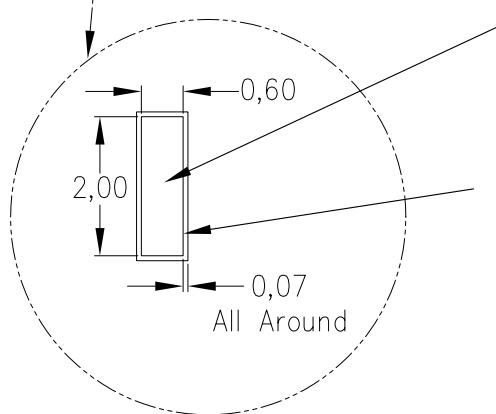
Example Board Layout
(Note C)



Stencil Openings
(Note D)



Example
Non Soldermask Defined Pad



Example
Pad Geometry
(See Note C)

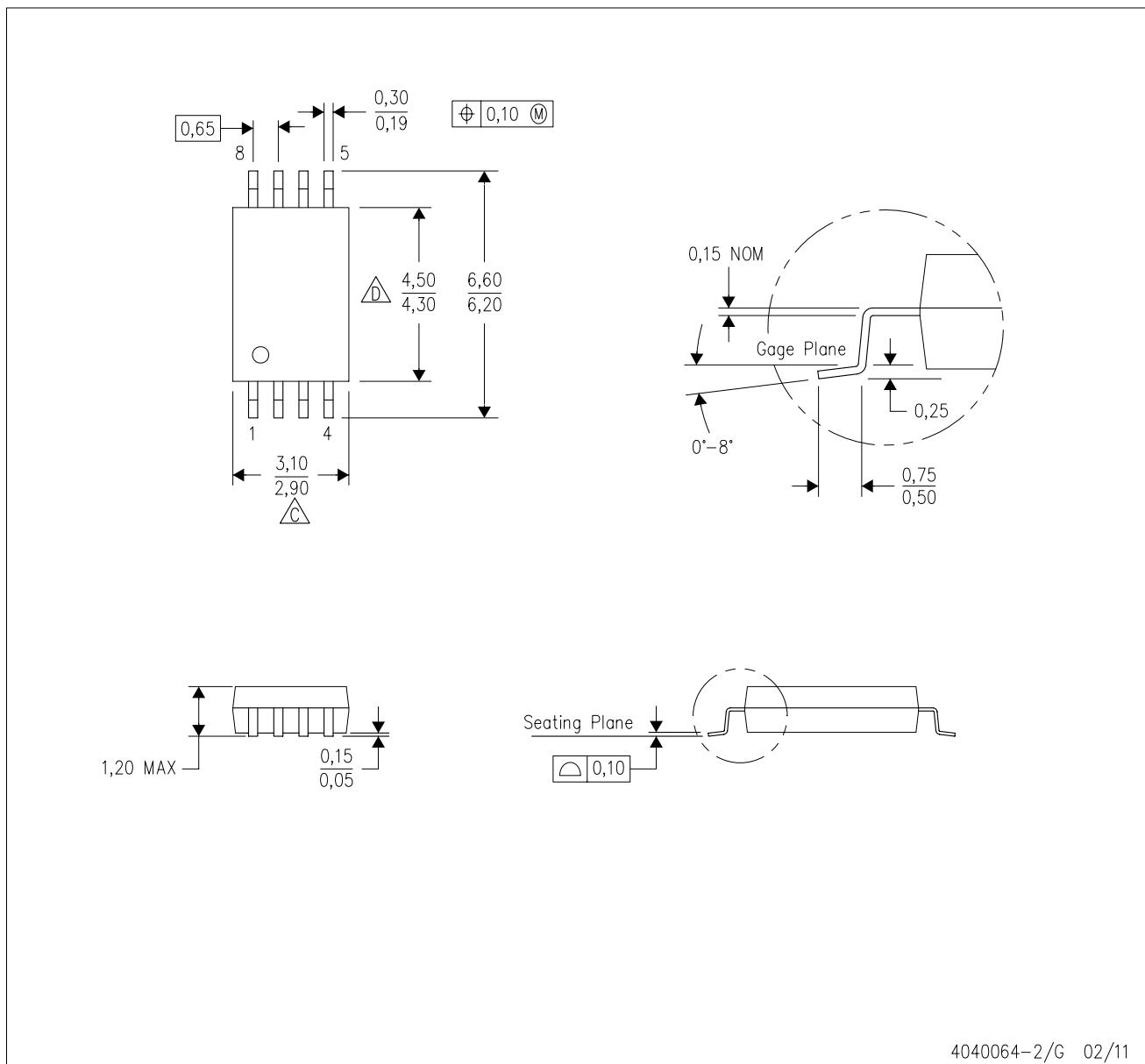
Example
Solder Mask Opening
(See Note E)

4211283-2/C 02/11

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G8)

PLASTIC SMALL OUTLINE



4040064-2/G 02/11

NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.

B. This drawing is subject to change without notice.

C Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.

D Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.

E. Falls within JEDEC MO-153

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