

TL081, TL081A, TL081B, TL082, TL082A, TL082B TL082Y, TL084, TL084A, TL084B, TL084Y JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

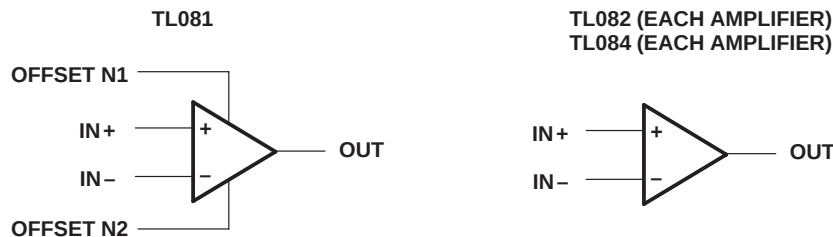
- Low Power Consumption
- Wide Common-Mode and Differential Voltage Ranges
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- Low Total Harmonic Distortion . . . 0.003% Typ
- High Input Impedance . . . JFET-Input Stage
- Latch-Up-Free Operation
- High Slew Rate . . . 13 V/ μ s Typ
- Common-Mode Input Voltage Range Includes V_{CC+}

description

The TL08x JFET-input operational amplifier family is designed to offer a wider selection than any previously developed operational amplifier family. Each of these JFET-input operational amplifiers incorporates well-matched, high-voltage JFET and bipolar transistors in a monolithic integrated circuit. The devices feature high slew rates, low input bias and offset currents, and low offset voltage temperature coefficient. Offset adjustment and external compensation options are available within the TL08x family.

The C-suffix devices are characterized for operation from 0°C to 70°C. The I-suffix devices are characterized for operation from –40°C to 85°C. The Q-suffix devices are characterized for operation from –40°C to 125°C. The M-suffix devices are characterized for operation over the full military temperature range of –55°C to 125°C.

symbols



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS
INSTRUMENTS**

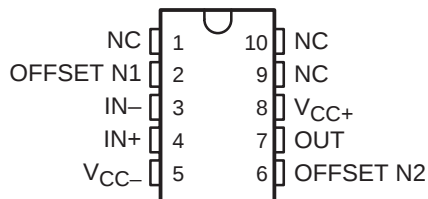
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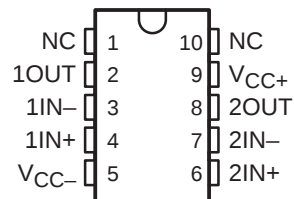
TL081, TL081A, TL081B, TL082, TL082A, TL082B TL082Y, TL084, TL084A, TL084B, TL084Y JFET-INPUT OPERATIONAL AMPLIFIERS

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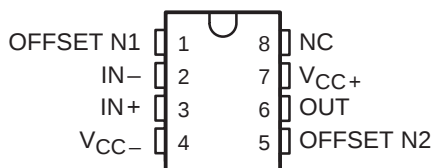
**TL081M
U PACKAGE
(TOP VIEW)**



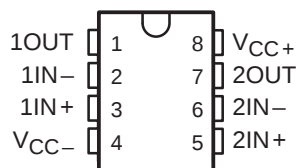
**TL082M
U PACKAGE
(TOP VIEW)**



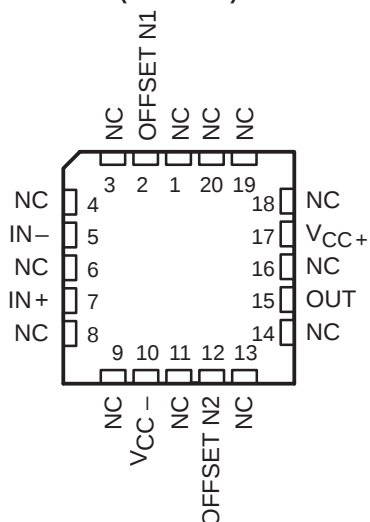
**TL081, TL081A, TL081B
D, JG, P, OR PW PACKAGE
(TOP VIEW)**



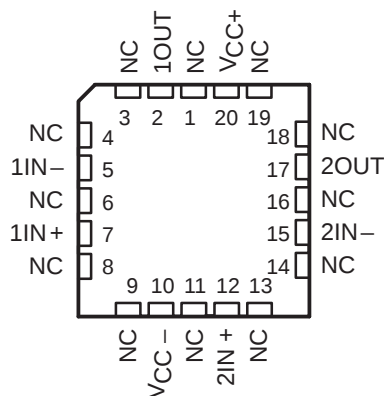
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(TOP VIEW)**



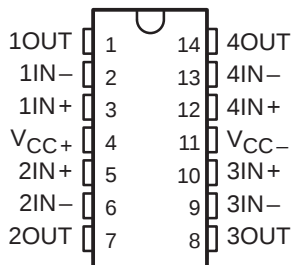
**TL081M . . . FK PACKAGE
(TOP VIEW)**



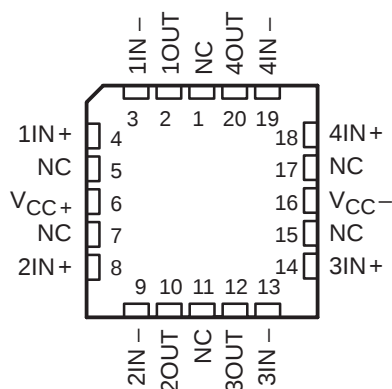
**TL082M . . . FK PACKAGE
(TOP VIEW)**



**TL084, TL084A, TL084B
D, J, N, PW, OR W PACKAGE
(TOP VIEW)**



**TL084M . . . FK PACKAGE
(TOP VIEW)**



NC – No internal connection

AVAILABLE OPTIONS

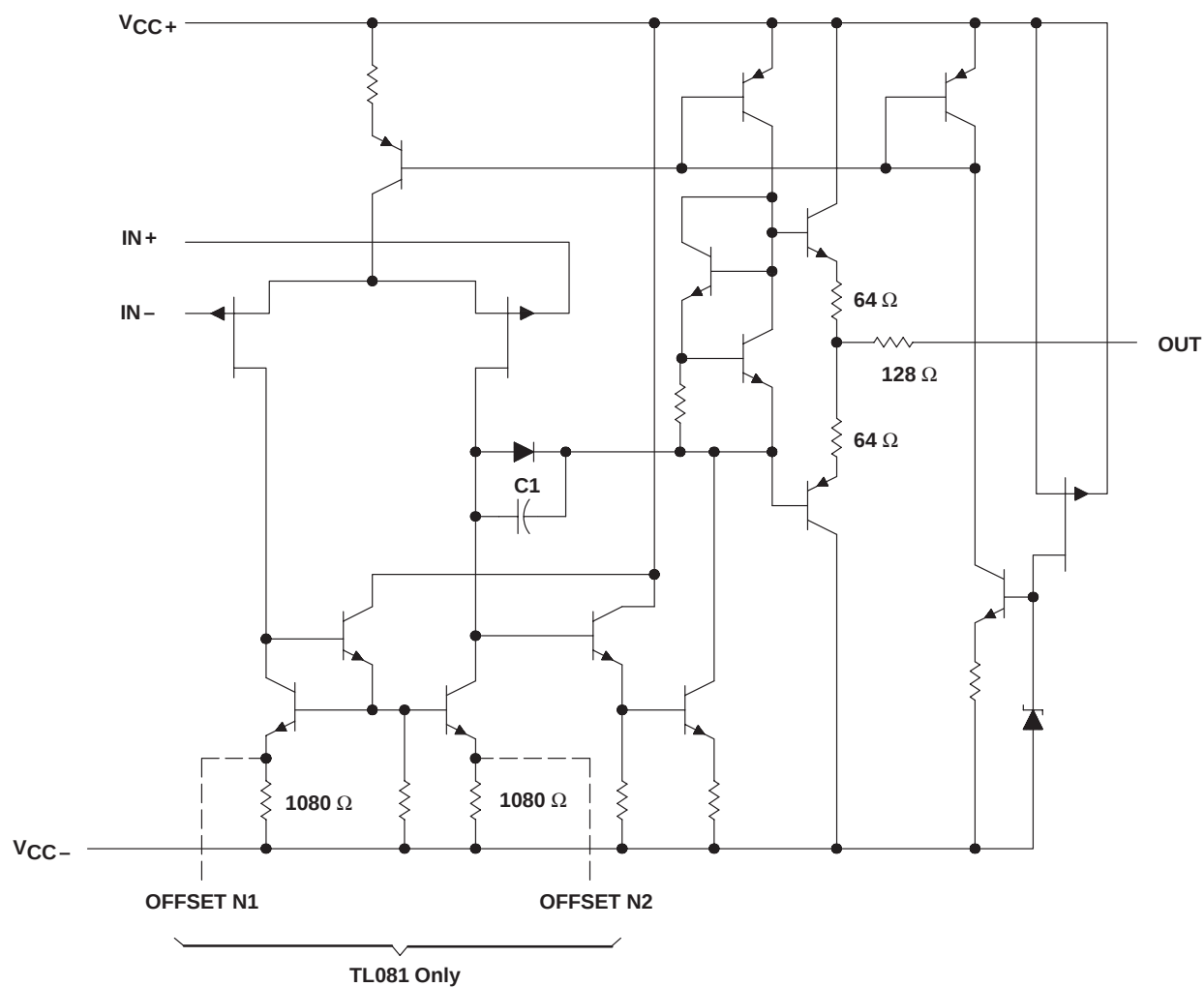
T _A	V _{IOMAX} AT 25°C	PACKAGED DEVICES										CHIP FORM (Y)
		SMALL OUTLINE (D008)	SMALL OUTLINE (D014)	CHIP CARRIER (FK)	CERAMIC DIP (J)	CERAMIC DIP (JG)	PLASTIC DIP (N)	PLASTIC DIP (P)	TSSOP (PW)	FLAT PACK (U)	FLAT PACK (W)	
0°C to 70°C	15 mV 6 mV 3 mV	TL081CD TL081ACD TL081BCD	—	—	—	—	—	TL081CP TL081ACP TL081BCP	TL081CPW	—	—	—
	15 mV 6 mV 3 mV	TL082CD TL082ACD TL082BCD	—	—	—	—	—	TL082CP TL082ACP TL082BCP	TL082CPW	—	—	TL082Y
	15 mV 6 mV 3 mV	—	TL084CD TL084ACD TL084BCD	—	—	—	TL084CN TL084ACN TL084BCN	—	TL084CPW	—	—	TL084Y
–40°C to 85°C	6 mV 6 mV 6 mV	TL081ID TL082ID TL084ID	TL084ID	—	—	—	TL084IN	TL081IP TL082IP	—	—	—	—
–40°C to 125°C	9 mV	—	TL084QD	—	—	—	—	—	—	—	—	—
–55°C to 125°C	6 mV 6 mV 9 mV	—	—	TL081MFK TL082MFK TL084MFK	TL084MJ	TL081MJG TL082MJG	—	—	—	TL081MU TL082MU	TL084MW	—

The D package is available taped and reeled. Add R suffix to the device type (e.g., TL081CDR).

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 TL082Y, TL084, TL084A, TL084B, TL084Y
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schematic (each amplifier)



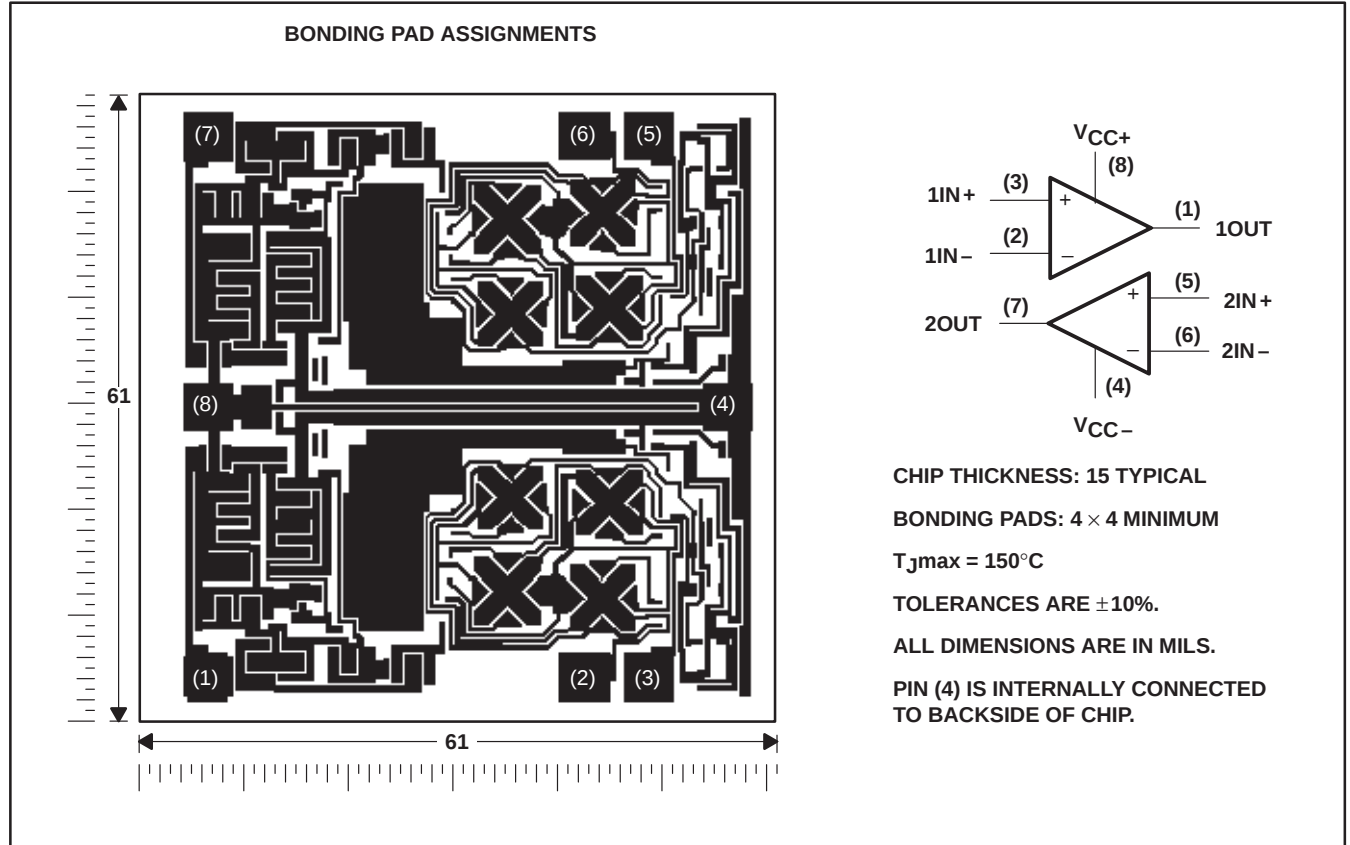
Component values shown are nominal.

TL081, TL081A, TL081B, TL082, TL082A, TL082B
 TL082Y, TL084, TL084A, TL084B, TL084Y
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TL082Y chip information

These chips, when properly assembled, display characteristics similar to the TL082. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.

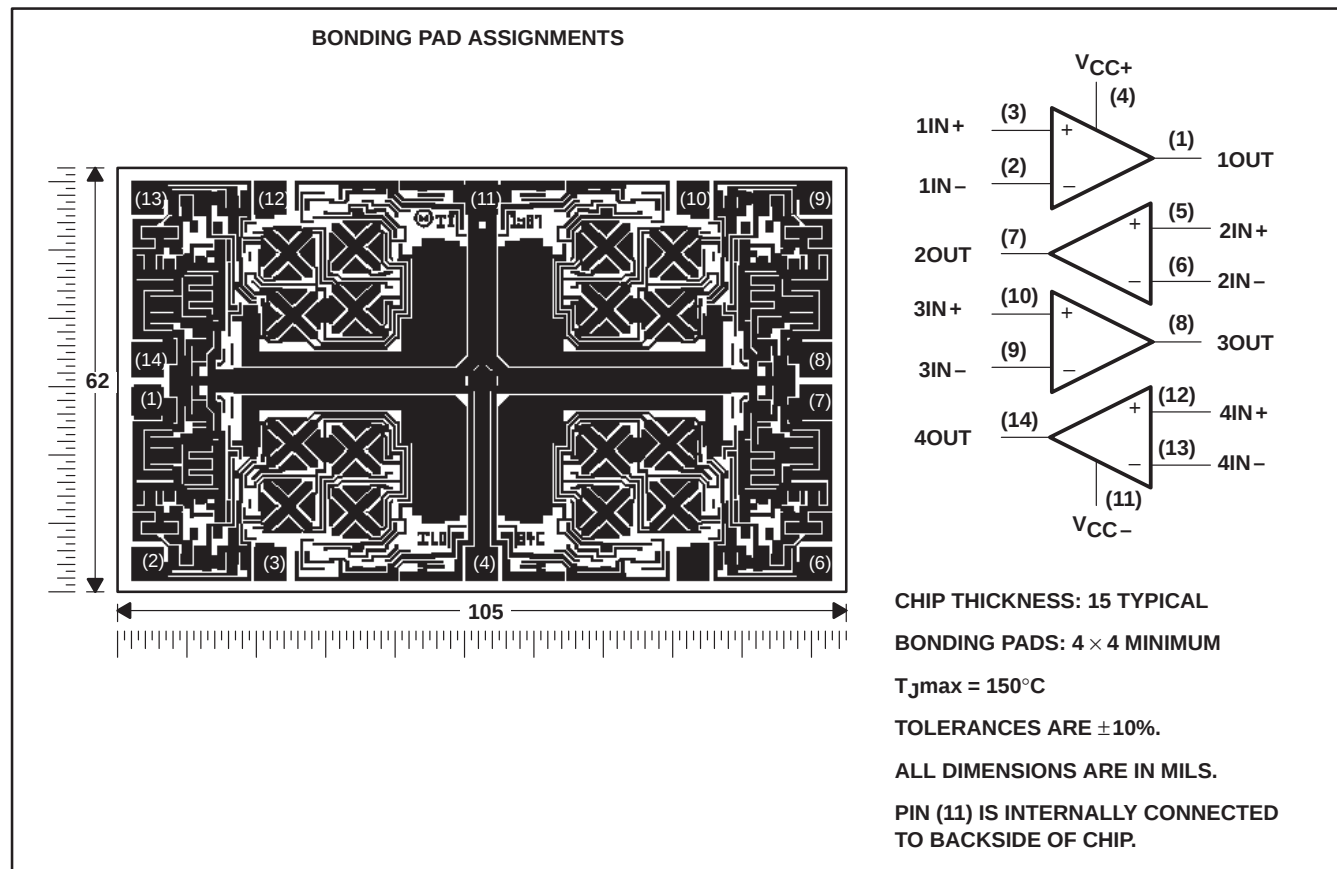


**TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL082Y, TL084, TL084A, TL084B, TL084Y
JFET-INPUT OPERATIONAL AMPLIFIERS**

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TL084Y chip information

These chips, when properly assembled, display characteristics similar to the TL084. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.



**TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL082Y, TL084, TL084A, TL084B, TL084Y
JFET-INPUT OPERATIONAL AMPLIFIERS**

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

	TL08_C TL08_AC TL08_BC	TL08_I	TL084Q	TL08_M	UNIT
Supply voltage, V_{CC+} (see Note 1)	18	18	18	18	V
Supply voltage V_{CC-} (see Note 1)	–18	–18	–18	–18	V
Differential input voltage, V_{ID} (see Note 2)	± 30	± 30	± 30	± 30	V
Input voltage, V_I (see Notes 1 and 3)	± 15	± 15	± 15	± 15	V
Duration of output short circuit (see Note 4)	unlimited	unlimited	unlimited	unlimited	
Continuous total power dissipation	See Dissipation Rating Table				
Operating free-air temperature range, T_A	0 to 70	–40 to 85	–40 to 125	–55 to 125	°C
Storage temperature range, T_{stg}	–65 to 150	–65 to 150	–65 to 150	–65 to 150	°C
Case temperature for 60 seconds, T_C	FK package			260	°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	J or JG package			300	°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	D, N, P, or PW package	260	260	260	°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. All voltage values, except differential voltages, are with respect to the midpoint between V_{CC+} and V_{CC-} .
 2. Differential voltages are at $IN+$ with respect to $IN-$.
 3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.
 4. The output may be shorted to ground or to either supply. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR	DERATE ABOVE T_A	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
D (8 pin)	680 mW	5.8 mW/°C	32°C	460 mW	373 mW	N/A
D (14 pin)	680 mW	7.6 mW/°C	60°C	604 mW	490 mW	186 mW
FK	680 mW	11.0 mW/°C	88°C	680 mW	680 mW	273 mW
J	680 mW	11.0 mW/°C	88°C	680 mW	680 mW	273 mW
JG	680 mW	8.4 mW/°C	69°C	672 mW	546 mW	210 mW
N	680 mW	9.2 mW/°C	76°C	680 mW	597 mW	N/A
P	680 mW	8.0 mW/°C	65°C	640 mW	520 mW	N/A
PW (8 pin)	525 mW	4.2 mW/°C	25°C	336 mW	N/A	N/A
PW (14 pin)	700 mW	5.6 mW/°C	25°C	448 mW	N/A	N/A
U	675 mW	5.4 mW/°C	25°C	432 mW	351 mW	135 mW
W	680 mW	8.0 mW/°C	65°C	640 mW	520 mW	200 mW

TL081, TL081A, TL081B, TL082, TL082A, TL082B
 TL082Y, TL084, TL084A, TL084B, TL084Y
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electrical characteristics, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TL081C TL082C TL084C			TL081AC TL082AC TL084AC			TL081BC TL082BC TL084BC			TL081I TL082I TL084I			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_O = 0$ $R_S = 50\ \Omega$	25°C		3	15		3	6		2	3		3	6	mV
		Full range			20			7.5			5			9	
α_{VIO} Temperature coefficient of input offset voltage	$V_O = 0$ $R_S = 50\ \Omega$	Full range		18			18			18			18		$\mu V/^\circ C$
I_{IO} Input offset current ‡	$V_O = 0$	25°C		5	200		5	100		5	100		5	100	pA
		Full range			2			2			2			10	nA
I_{IB} Input bias current ‡	$V_O = 0$	25°C		30	400		30	200		30	200		30	200	pA
		Full range			10			7			7			20	nA
V_{ICR} Common-mode input voltage range		25°C	± 11	-12 to 15		± 11	-12 to 15		± 11	-12 to 15		± 11	-12 to 15		V
V_{OM} Maximum peak output voltage swing	$R_L = 10\ k\Omega$	25°C	± 12	± 13.5		± 12	± 13.5		± 12	± 13.5		± 12	± 13.5		V
	$R_L \geq 10\ k\Omega$	Full range	± 12			± 12			± 12			± 12			
	$R_L \geq 2\ k\Omega$		± 10	± 12		± 10	± 12		± 10	± 12		± 10	± 12		
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10$ V, $R_L \geq 2\ k\Omega$	25°C	25	200		50	200		50	200		50	200		V/mV
	$V_O = \pm 10$ V, $R_L \geq 2\ k\Omega$	Full range	15			25			25			25			
B_1 Unity-gain bandwidth		25°C		3			3			3			3		MHz
r_i Input resistance		25°C		10^{12}			10^{12}			10^{12}			10^{12}		Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $V_O = 0$, $R_S = 50\ \Omega$	25°C	70	86		75	86		75	86		75	86		dB
k_{SVR} Supply voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC} = \pm 15$ V to ± 9 V, $V_O = 0$, $R_S = 50\ \Omega$	25°C	70	86		80	86		80	86		80	86		dB
I_{CC} Supply current (per amplifier)	$V_O = 0$, No load	25°C		1.4	2.8		1.4	2.8		1.4	2.8		1.4	2.8	mA
V_{O1}/V_{O2} Crosstalk attenuation	$A_{VD} = 100$	25°C		120			120			120			120		dB

† All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified. Full range for T_A is 0°C to 70°C for TL08_C, TL08_AC, TL08_BC and -40°C to 85°C for TL08_I.

‡ Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in Figure 17. Pulse techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL082Y, TL084, TL084A, TL084B, TL084Y
JFET-INPUT OPERATIONAL AMPLIFIERS

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electrical characteristics, $V_{CC\pm} = \pm 15\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS [†]	T_A	TL081M, TL082M			TL084Q, TL084M			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_O = 0, R_S = 50\ \Omega$	25°C		3	6		3	9	mV
		Full range			9			15	
α_{VIO} Temperature coefficient of input offset voltage	$V_O = 0, R_S = 50\ \Omega$	Full range		18			18		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current [‡]	$V_O = 0$	25°C		5	100		5	100	pA
		125°C			20			20	nA
I_{IB} Input bias current [‡]	$V_O = 0$	25°C		30	200		30	200	pA
		125°C			50			50	nA
V_{ICR} Common-mode input voltage range		25°C	± 11	± 12 to ± 15		± 11	± 12 to ± 15		V
V_{OM} Maximum peak output voltage swing	$R_L = 10\text{ k}\Omega$	25°C	± 12	± 13.5		± 12	± 13.5		V
	$R_L \geq 10\text{ k}\Omega$	Full range	± 12			± 12			
	$R_L \geq 2\text{ k}\Omega$		± 10	± 12		± 10	± 12		
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10\text{ V}, R_L \geq 2\text{ k}\Omega$	25°C	25	200		25	200		V/mV
	$V_O = \pm 10\text{ V}, R_L \geq 2\text{ k}\Omega$	Full range	15			15			
B_1 Unity-gain bandwidth		25°C		3			3		MHz
r_i Input resistance		25°C		10^{12}			10^{12}		Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICR\min}, V_O = 0, R_S = 50\ \Omega$	25°C	80	86		80	86		dB
k_{SVR} Supply voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC} = \pm 15\text{ V to } \pm 9\text{ V}, V_O = 0, R_S = 50\ \Omega$	25°C	80	86		80	86		dB
I_{CC} Supply current (per amplifier)	$V_O = 0, \text{ No load}$	25°C		1.4	2.8		1.4	2.8	mA
V_{O1}/V_{O2} Crosstalk attenuation	$A_{VD} = 100$	25°C		120			120		dB

[†] All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified.

[‡] Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in Figure 17. Pulse techniques must be used that maintain the junction temperatures as close to the ambient temperature as is possible.

operating characteristics, $V_{CC\pm} = \pm 15\text{ V}, T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS				MIN	TYP	MAX	UNIT
SR Slew rate at unity gain	$V_I = 10\text{ V}, R_L = 2\text{ k}\Omega, C_L = 100\text{ pF}, \text{ See Figure 1}$				8*	13		V/ μs
	$V_I = 10\text{ V}, R_L = 2\text{ k}\Omega, C_L = 100\text{ pF}, T_A = -55^\circ\text{C to } 125^\circ\text{C}, \text{ See Figure 1}$				5*			
t_r Rise time	$V_I = 20\text{ mV}, R_L = 2\text{ k}\Omega, C_L = 100\text{ pF}, \text{ See Figure 1}$					0.05		μs
Overshoot factor						20%		
V_n Equivalent input noise voltage	$R_S = 20\ \Omega$	$f = 1\text{ kHz}$				18		$\text{nV}/\sqrt{\text{Hz}}$
		$f = 10\text{ Hz to } 10\text{ kHz}$				4		μV
I_n Equivalent input noise current	$R_S = 20\ \Omega, f = 1\text{ kHz}$					0.01		$\text{pA}/\sqrt{\text{Hz}}$
THD Total harmonic distortion	$V_{I\text{rms}} = 6\text{ V}, f = 1\text{ kHz}$	$A_{VD} = 1, R_S \leq 1\text{ k}\Omega, R_L \geq 2\text{ k}\Omega,$				0.003%		

*On products compliant to MIL-PRF-38535, this parameter is not production tested.



**TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL082Y, TL084, TL084A, TL084B, TL084Y
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electrical characteristics, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS†	TL082Y, TL084Y			UNIT
			MIN	TYP	MAX	
V_{IO}	Input offset voltage	$V_O = 0$, $R_S = 50\ \Omega$		3	15	mV
αV_{IO}	Temperature coefficient of input offset voltage	$V_O = 0$, $R_S = 50\ \Omega$		18		$\mu\text{V}/^\circ\text{C}$
I_{IO}	Input offset current‡	$V_O = 0$,		5	200	pA
I_{IB}	Input bias current‡	$V_O = 0$,		30	400	pA
V_{ICR}	Common-mode input voltage range		± 11	–12 to 15		V
V_{OM}	Maximum peak output voltage swing	$R_L = 10\text{ k}\Omega$,	± 12	± 13.5		V
A_{VD}	Large-signal differential voltage amplification	$V_O = \pm 10\text{ V}$, $R_L \geq 2\text{ k}\Omega$	25	200		V/mV
B_1	Unity-gain bandwidth			3		MHz
r_i	Input resistance			10^{12}		Ω
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $V_O = 0$, $R_S = 50\ \Omega$	70 70	86 86		dB
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC} = \pm 15\text{ V}$ to $\pm 9\text{ V}$, $V_O = 0$, $R_S = 50\ \Omega$	70 70	86 86		dB
I_{CC}	Supply current (per amplifier)	$V_O = 0$, No load		1.4	2.8	mA
V_{O1}/V_{O2}	Crosstalk attenuation	$A_{VD} = 100$		120		dB

† All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified.

‡ Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in Figure 17. Pulse techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	$V_I = 10\text{ V}$,	$R_L = 2\text{ k}\Omega$,	$C_L = 100\text{ pF}$,	See Figure 1	8	13		V/ μs
t_r	Rise time	$V_I = 20\text{ mV}$,	$R_L = 2\text{ k}\Omega$,	$C_L = 100\text{ pF}$,	See Figure 1	0.05			μs
	Overshoot factor					20%			
V_n	Equivalent input noise voltage	$R_S = 20\text{ }\Omega$	$f = 1\text{ kHz}$			18			nV/ $\sqrt{\text{Hz}}$
			$f = 10\text{ Hz to } 10\text{ kHz}$			4			μV
I_n	Equivalent input noise current	$R_S = 20\text{ }\Omega$,	$f = 1\text{ kHz}$			0.01			pA/ $\sqrt{\text{Hz}}$
THD	Total harmonic distortion	$V_{I\text{rms}} = 6\text{ V}$, $f = 1\text{ kHz}$	$A_{VD} = 1$,	$R_S \leq 1\text{ k}\Omega$,	$R_L \geq 2\text{ k}\Omega$,	0.003%			

PARAMETER MEASUREMENT INFORMATION

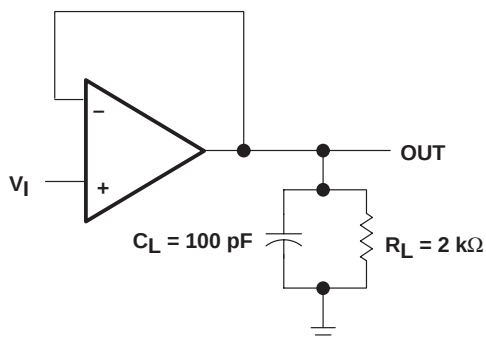


Figure 1

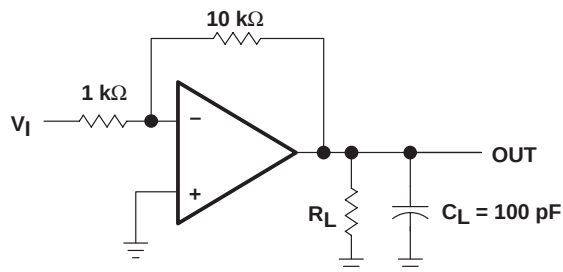


Figure 2

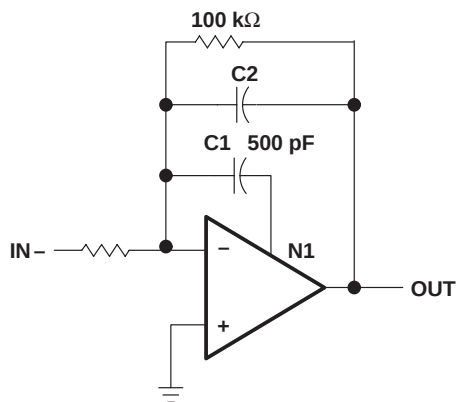


Figure 3

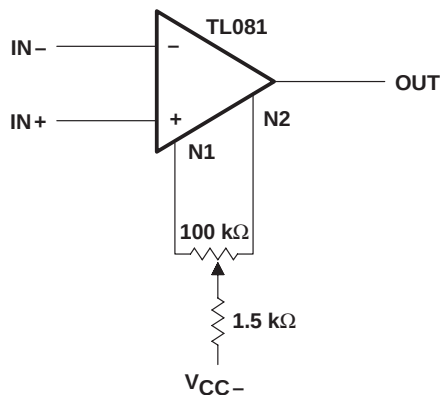


Figure 4

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
V _{OM}	Maximum peak output voltage	vs Frequency	5, 6, 7
		vs Free-air temperature	8
		vs Load resistance	9
		vs Supply voltage	10
A _{VD}	Large-signal differential voltage amplification	vs Free-air temperature	11
		vs Frequency	12
	Differential voltage amplification	vs Frequency with feed-forward compensation	13
P _D	Total power dissipation	vs Free-air temperature	14
I _{CC}	Supply current	vs Free-air temperature	15
		vs Supply voltage	16
I _{IB}	Input bias current	vs Free-air temperature	17
	Large-signal pulse response	vs Time	18
V _O	Output voltage	vs Elapsed time	19
CMRR	Common-mode rejection ratio	vs Free-air temperature	20
V _n	Equivalent input noise voltage	vs Frequency	21
THD	Total harmonic distortion	vs Frequency	22

MAXIMUM PEAK OUTPUT VOLTAGE
vs
FREQUENCY

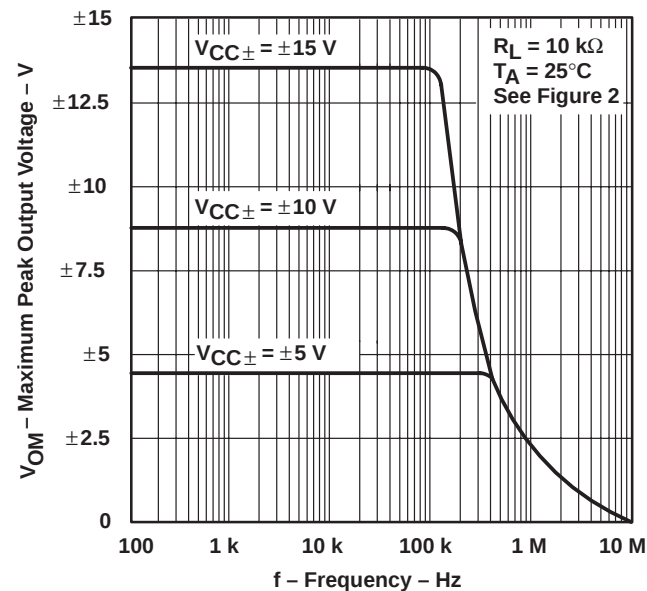


Figure 5

MAXIMUM PEAK OUTPUT VOLTAGE
vs
FREQUENCY

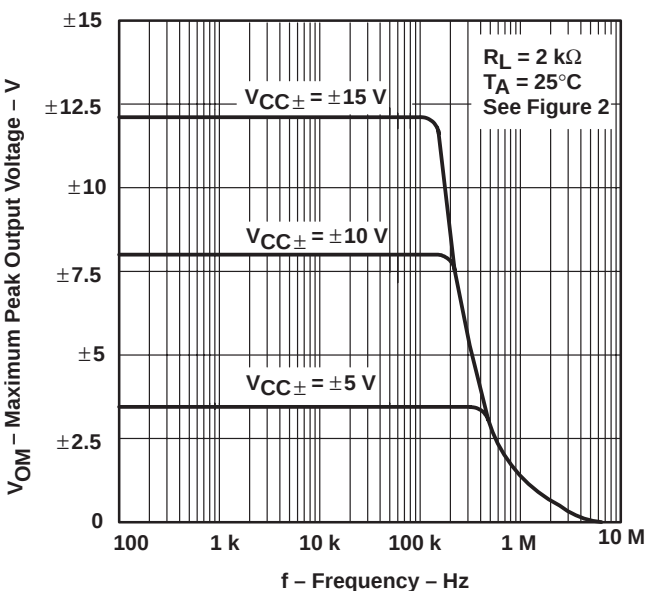


Figure 6

TYPICAL CHARACTERISTICS†

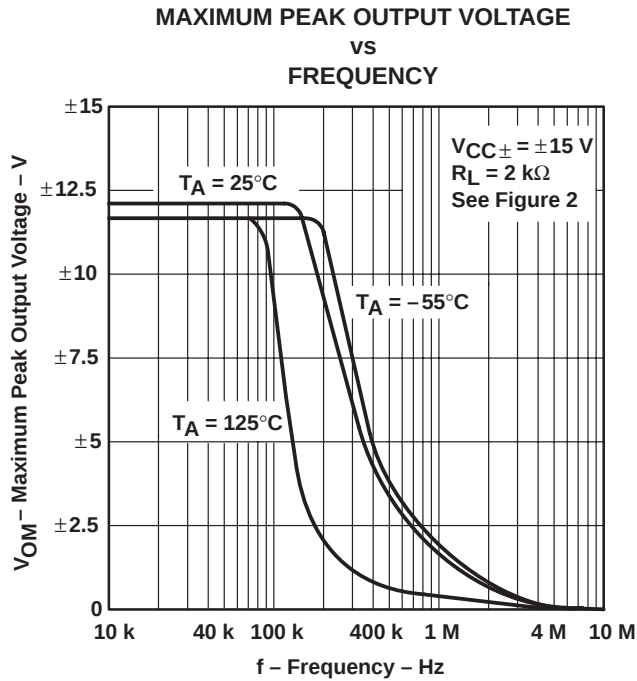


Figure 7

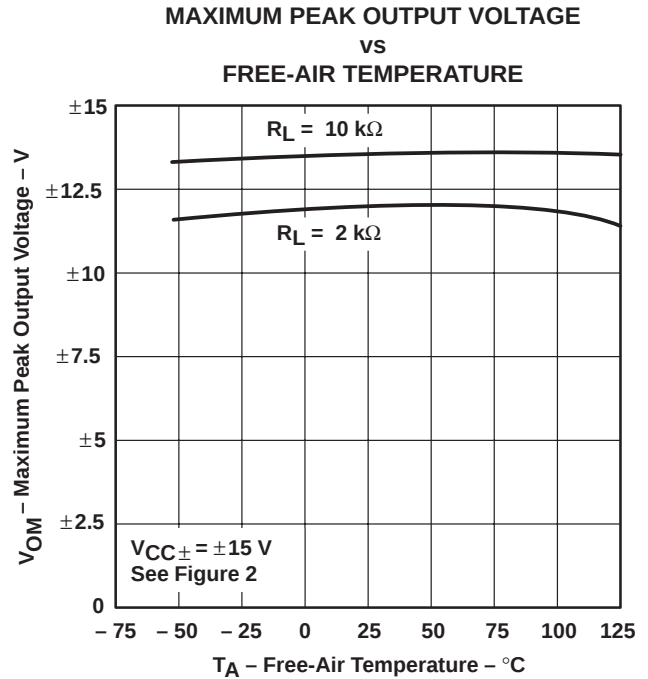


Figure 8

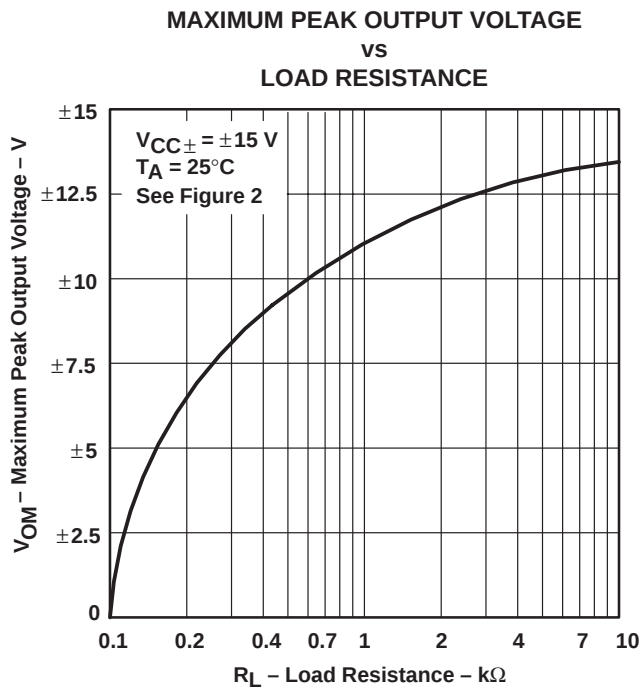


Figure 9

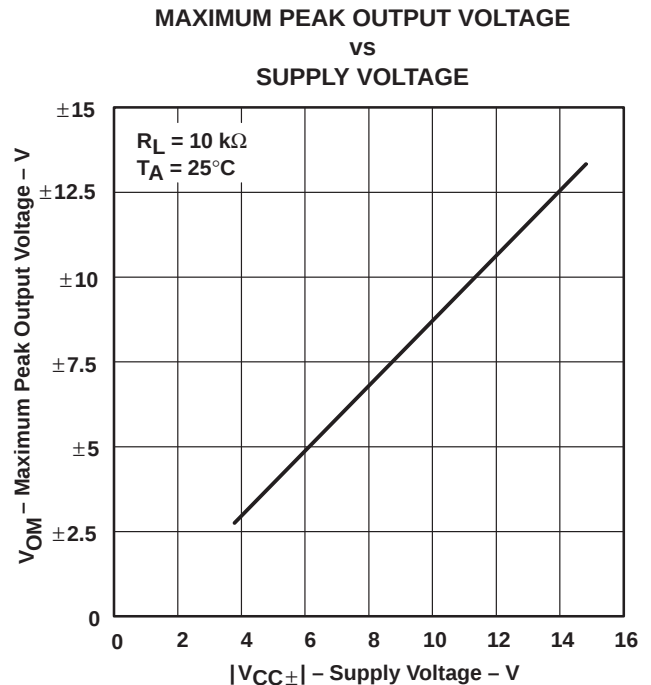


Figure 10

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

TL081, TL081A, TL081B, TL082, TL082A, TL082B
 TL082Y, TL084, TL084A, TL084B, TL084Y
 JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

TYPICAL CHARACTERISTICS†

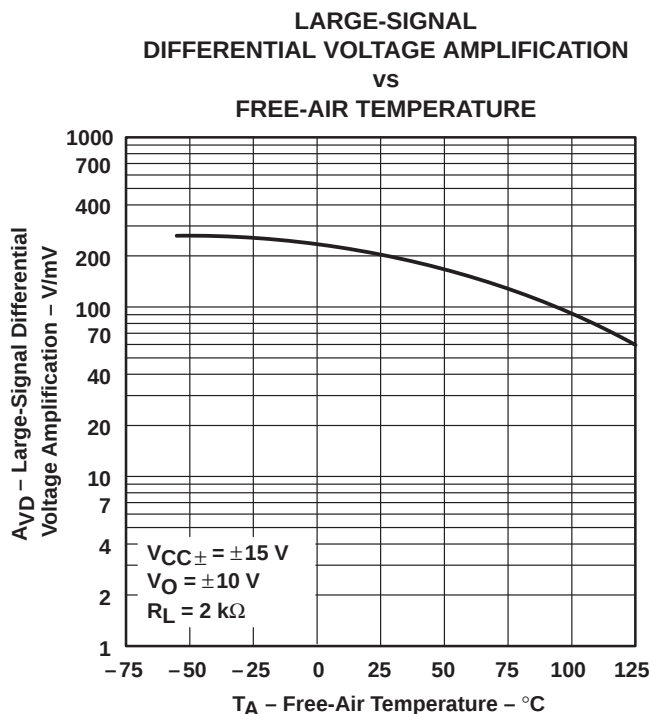


Figure 11

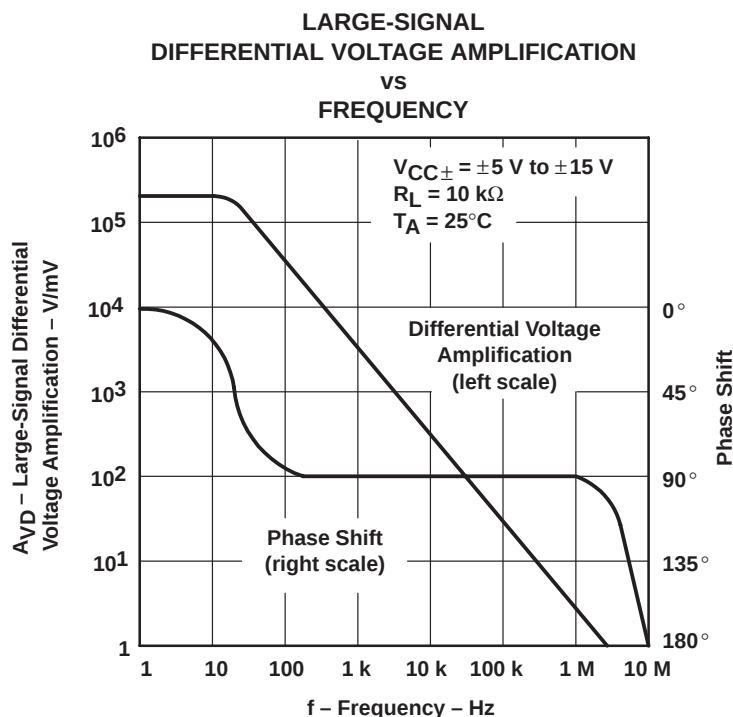


Figure 12

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

TYPICAL CHARACTERISTICS†

DIFFERENTIAL VOLTAGE AMPLIFICATION
 vs
 FREQUENCY WITH FEED-FORWARD COMPENSATION

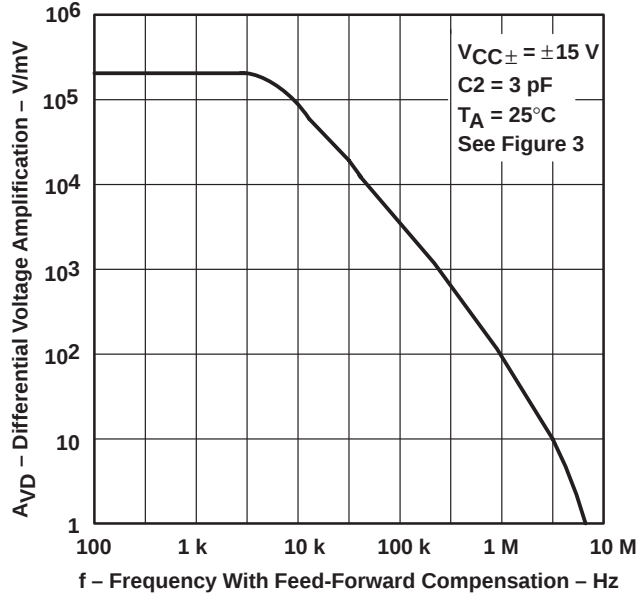


Figure 13

TOTAL POWER DISSIPATION
 vs
 FREE-AIR TEMPERATURE

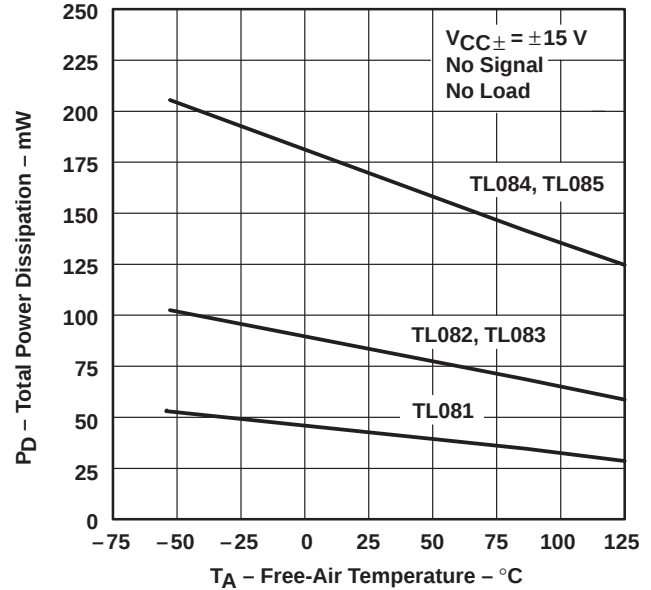


Figure 14

SUPPLY CURRENT PER AMPLIFIER
 vs
 FREE-AIR TEMPERATURE

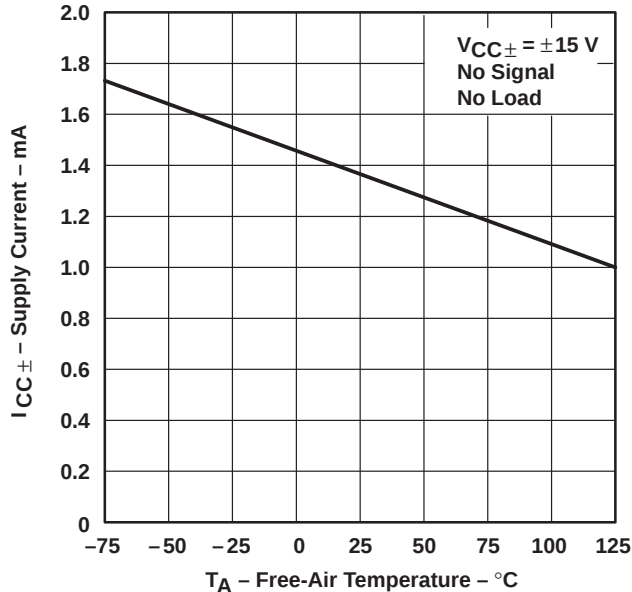


Figure 15

SUPPLY CURRENT
 vs
 SUPPLY VOLTAGE

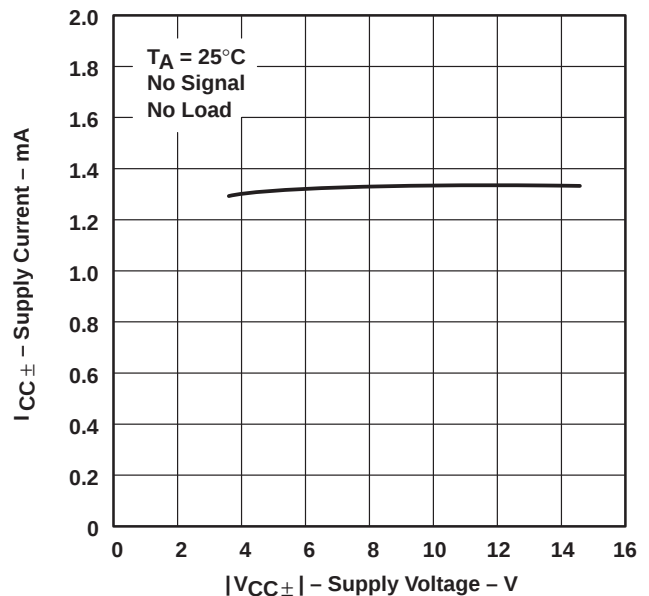


Figure 16

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

TYPICAL CHARACTERISTICS†

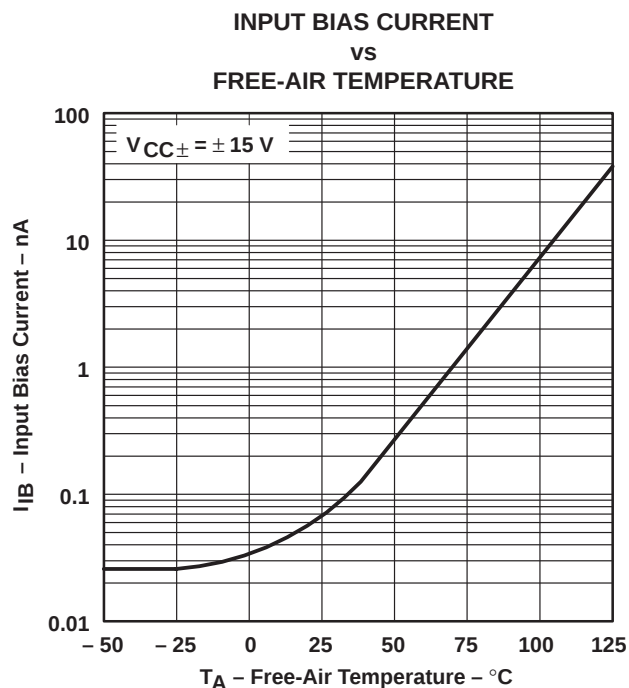


Figure 17

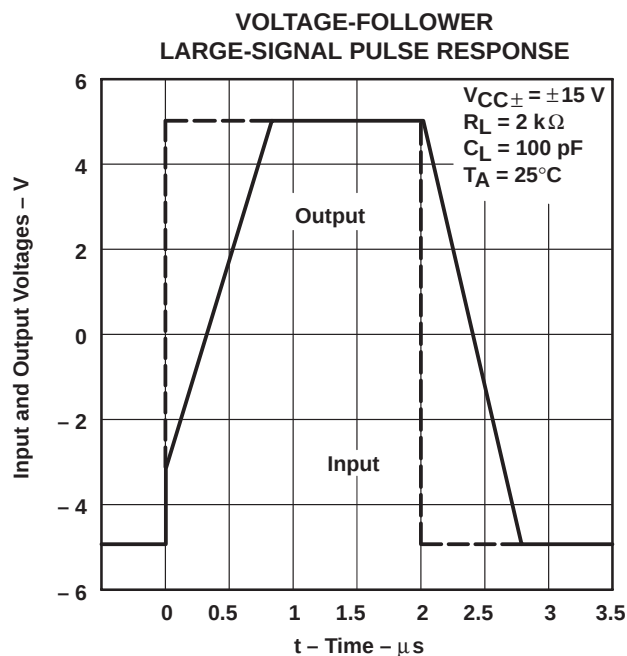


Figure 18

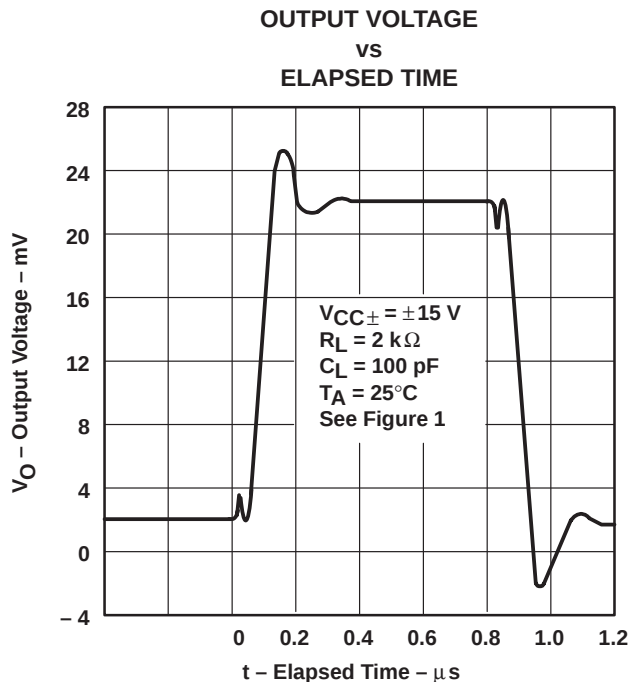


Figure 19

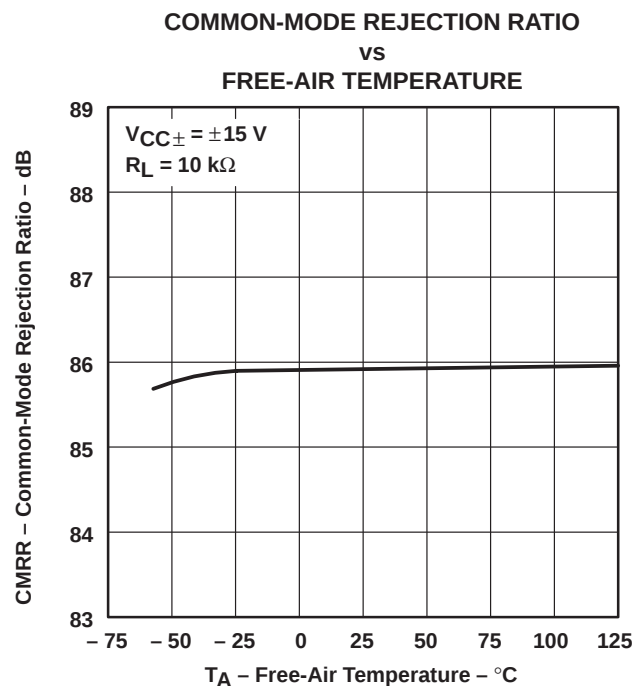


Figure 20

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

TYPICAL CHARACTERISTICS†

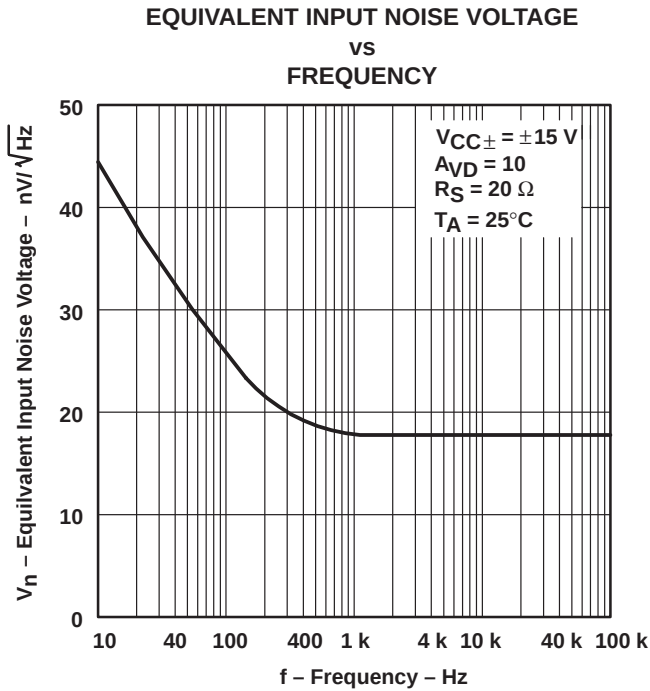


Figure 21

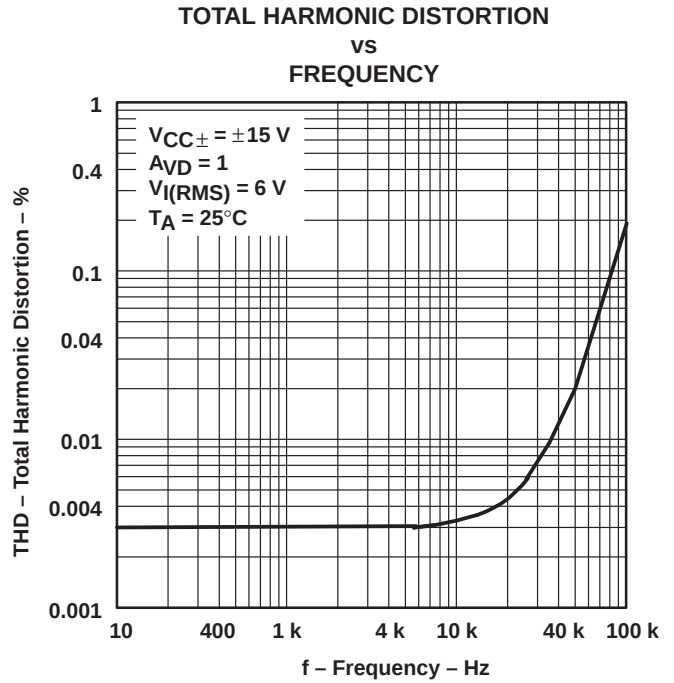


Figure 22

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

APPLICATION INFORMATION

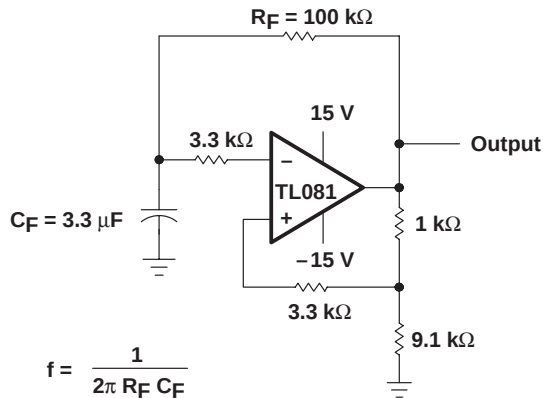


Figure 23

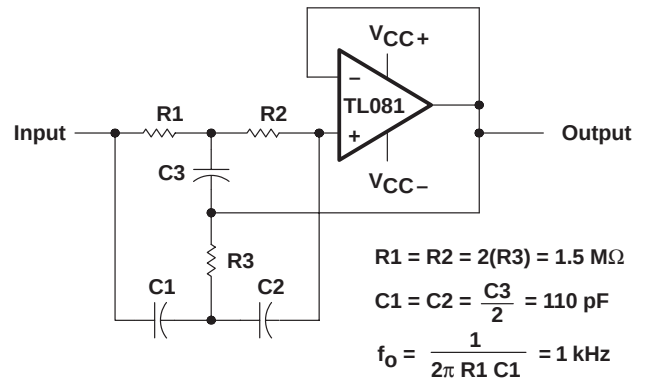


Figure 24

TL081, TL081A, TL081B, TL082, TL082A, TL082B
 TL082Y, TL084, TL084A, TL084B, TL084Y
JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

APPLICATION INFORMATION

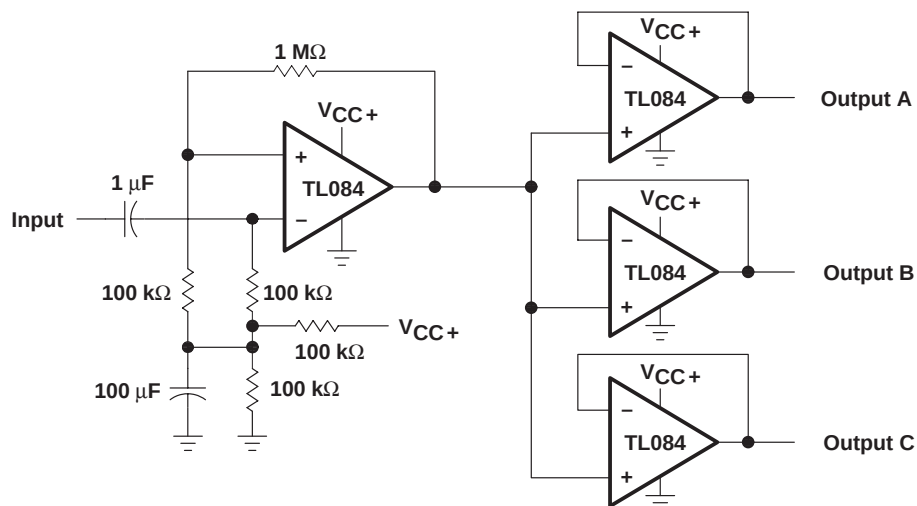
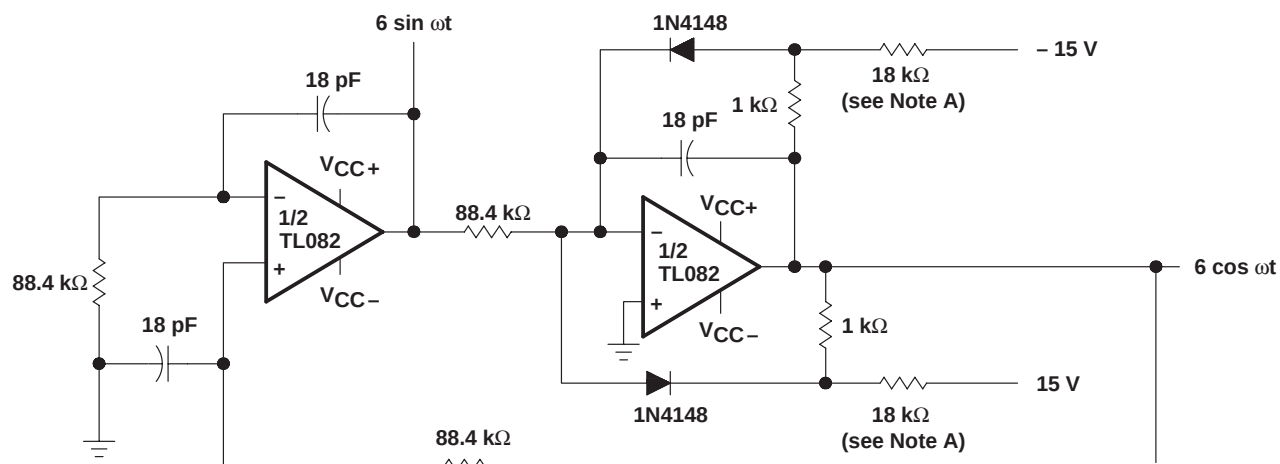


Figure 25. Audio-Distribution Amplifier



NOTE A: These resistor values may be adjusted for a symmetrical output.

Figure 26. 100-KHz Quadrature Oscillator

APPLICATION INFORMATION

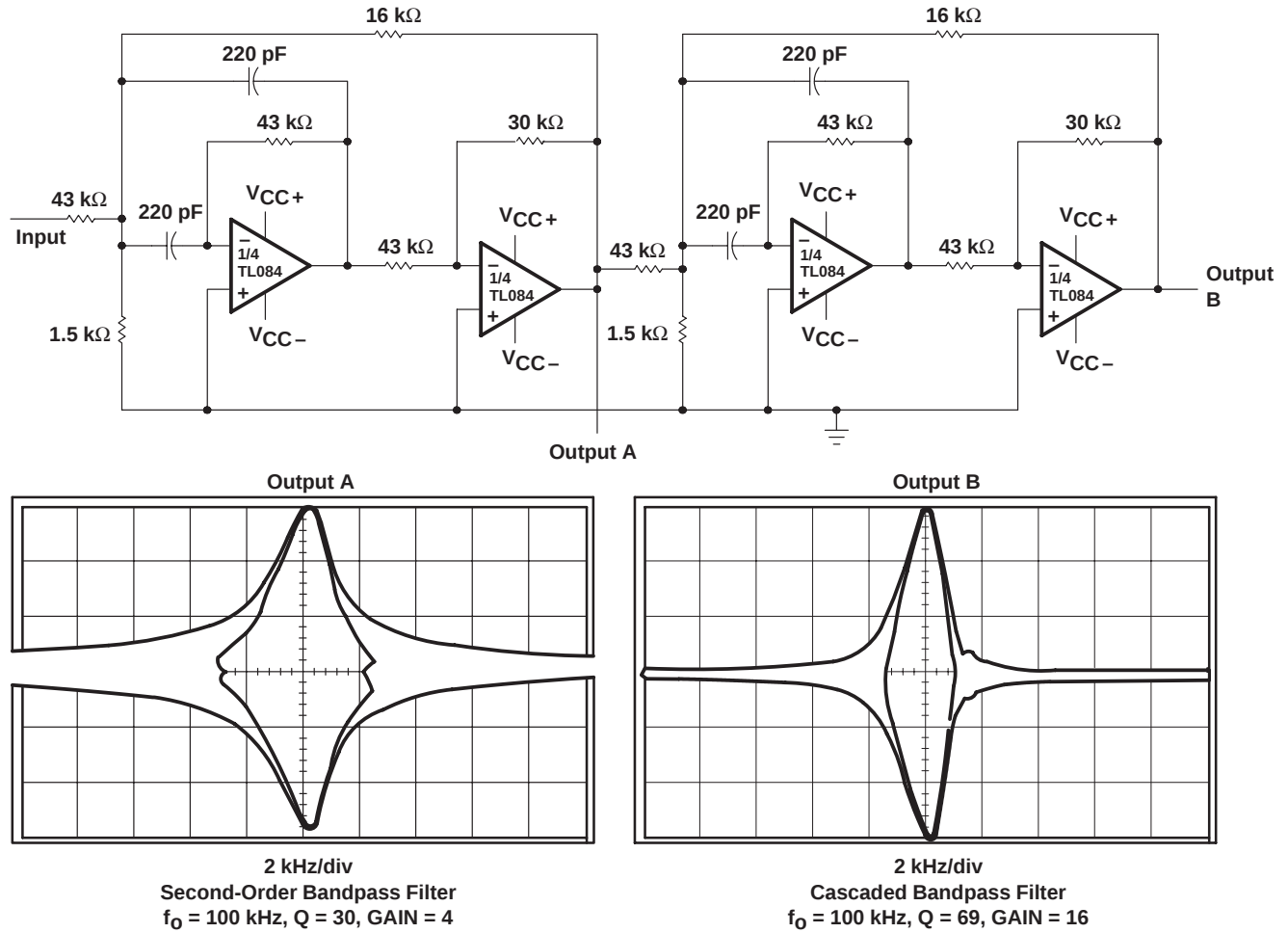


Figure 27. Positive-Feedback Bandpass Filter

TL081, TL081A, TL081B, TL082, TL082A, TL082B
 TL082Y, TL084, TL084A, TL084B, TL084Y
 JFET-INPUT OPERATIONAL AMPLIFIERS

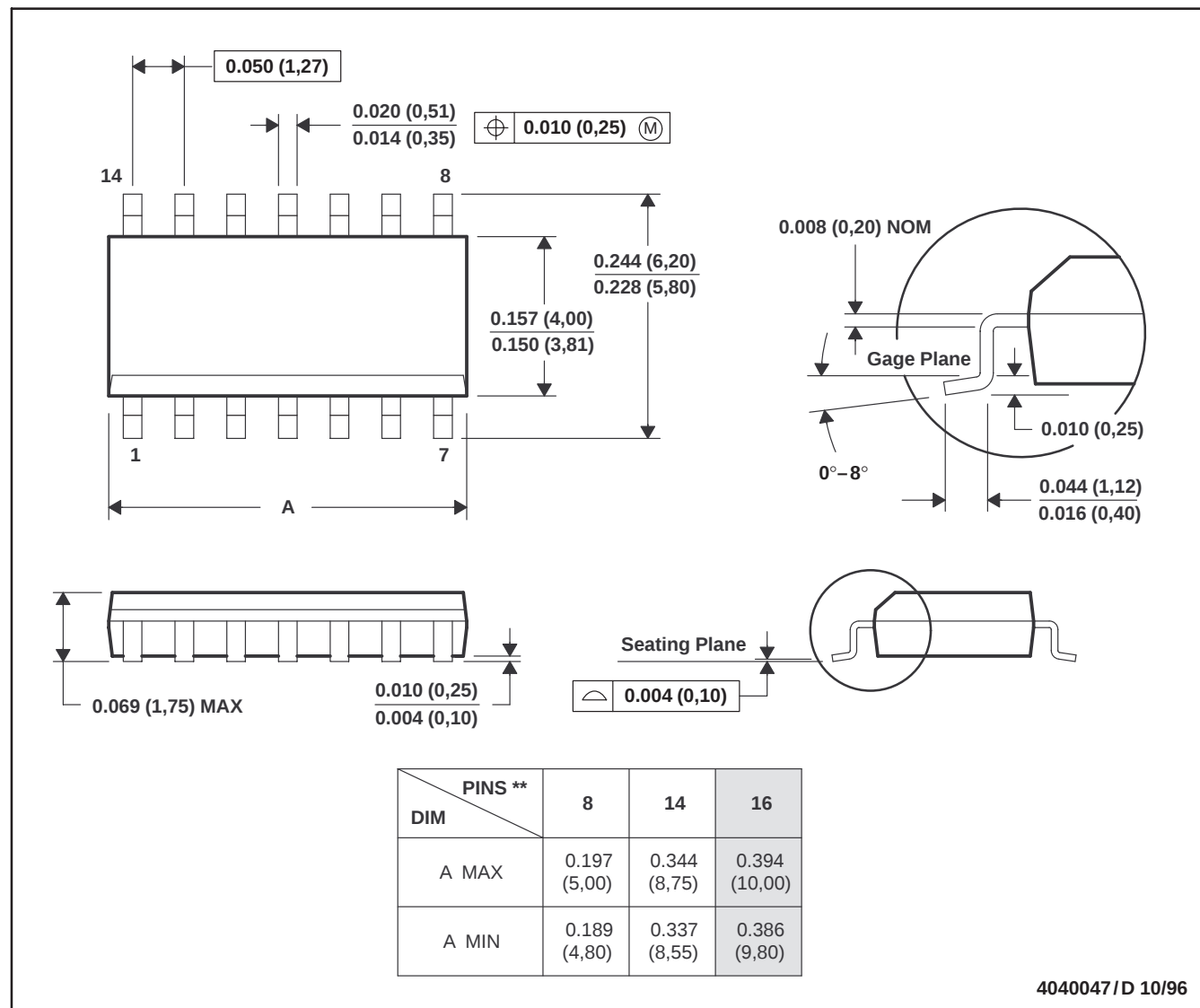
SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

MECHANICAL DATA

D (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



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

TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL082Y, TL084, TL084A, TL084B, TL084Y
JFET-INPUT OPERATIONAL AMPLIFIERS

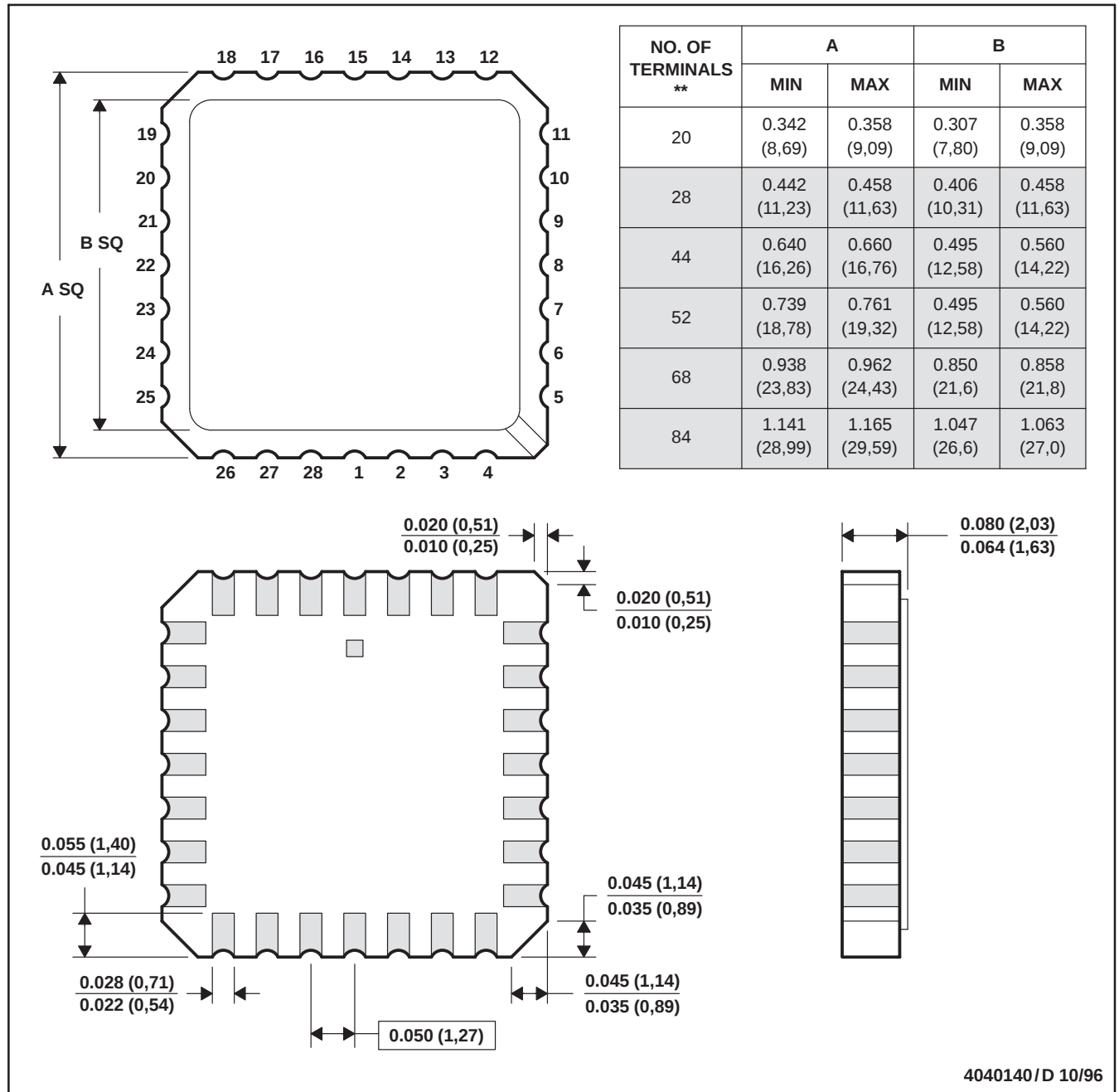
SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

MECHANICAL DATA

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- 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 metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MS-004

TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL082Y, TL084, TL084A, TL084B, TL084Y
JFET-INPUT OPERATIONAL AMPLIFIERS

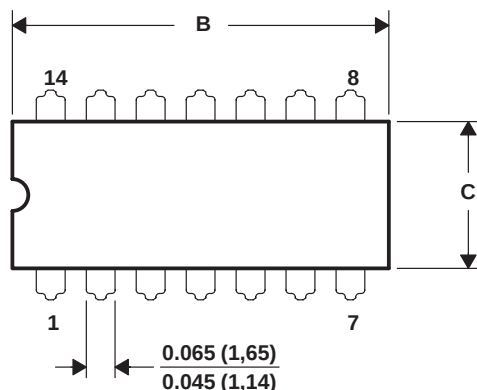
SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

MECHANICAL DATA

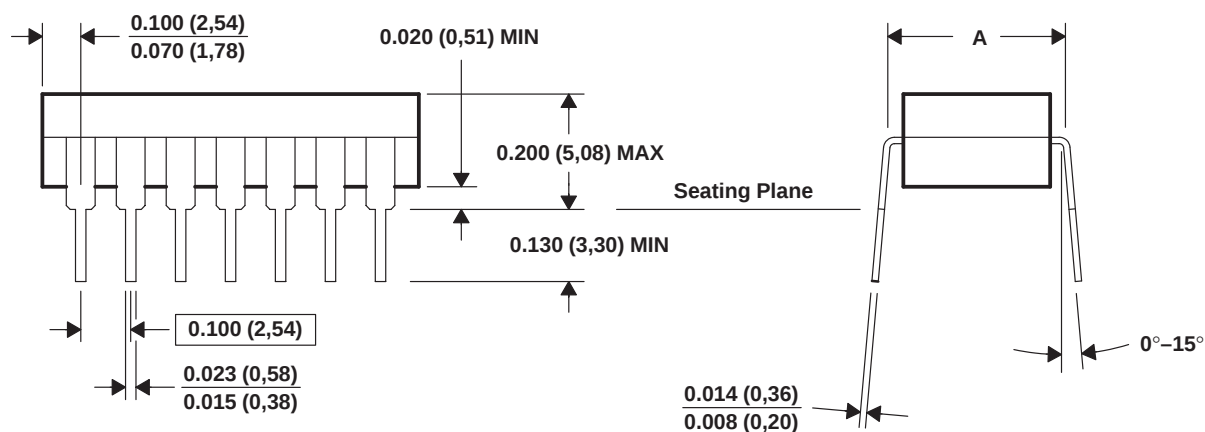
J (R-GDIP-T**)

14 PIN SHOWN

CERAMIC DUAL-IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A MAX	0.310 (7,87)	0.310 (7,87)	0.310 (7,87)	0.310 (7,87)
A MIN	0.290 (7,37)	0.290 (7,37)	0.290 (7,37)	0.290 (7,37)
B MAX	0.785 (19,94)	0.785 (19,94)	0.910 (23,10)	0.975 (24,77)
B MIN	0.755 (19,18)	0.755 (19,18)	—	0.930 (23,62)
C MAX	0.300 (7,62)	0.300 (7,62)	0.300 (7,62)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.245 (6,22)	0.245 (6,22)



4040083/D 08/98

- 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 only on press ceramic glass frit seal only.
E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18, GDIP1-T20, and GDIP1-T22.

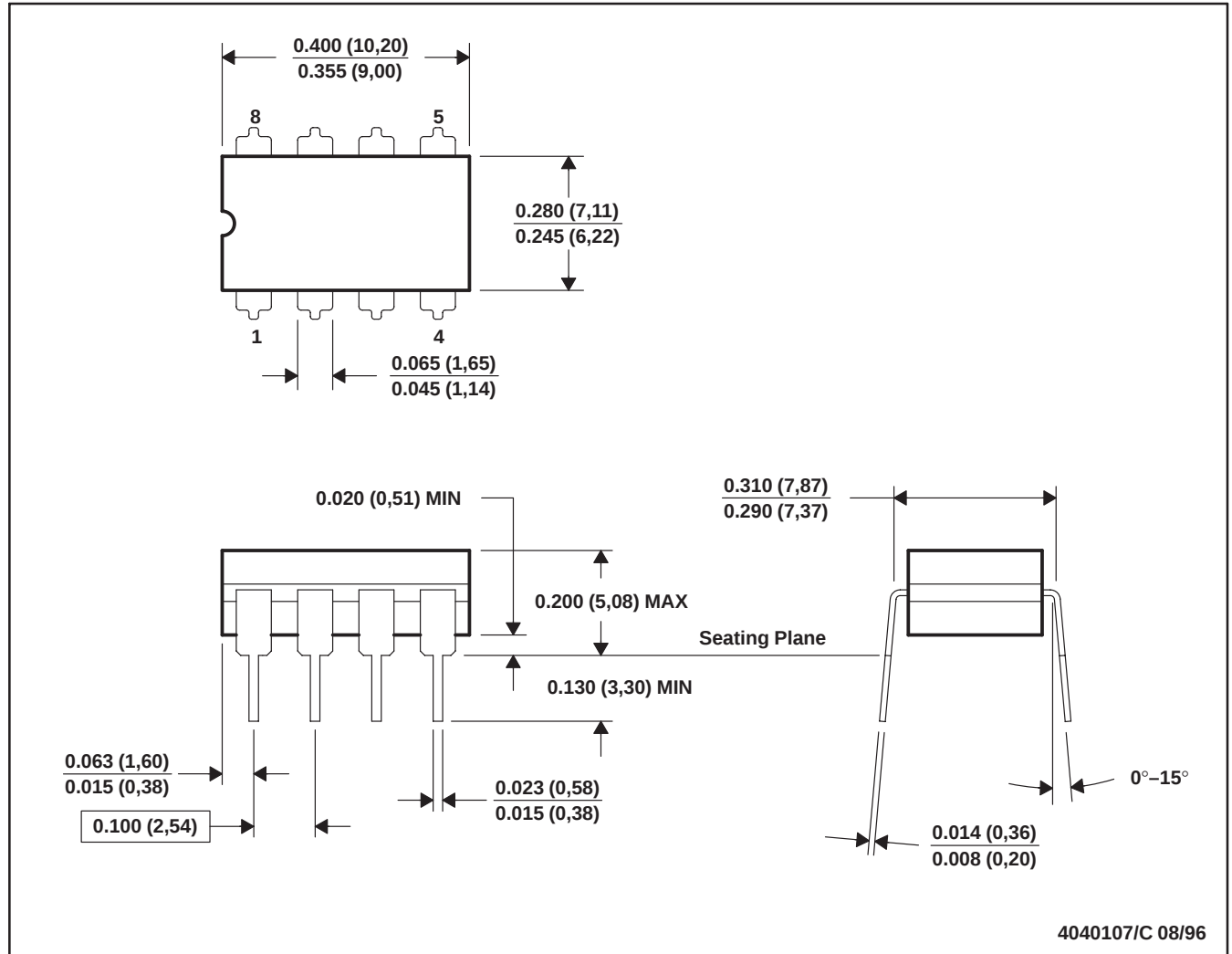
TL081, TL081A, TL081B, TL082, TL082A, TL082B
 TL082Y, TL084, TL084A, TL084B, TL084Y
 JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

MECHANICAL DATA

JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE PACKAGE



- 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 only on press ceramic glass frit seal only.
 E. Falls within MIL-STD-1835 GDIP1-T8

TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL082Y, TL084, TL084A, TL084B, TL084Y
JFET-INPUT OPERATIONAL AMPLIFIERS

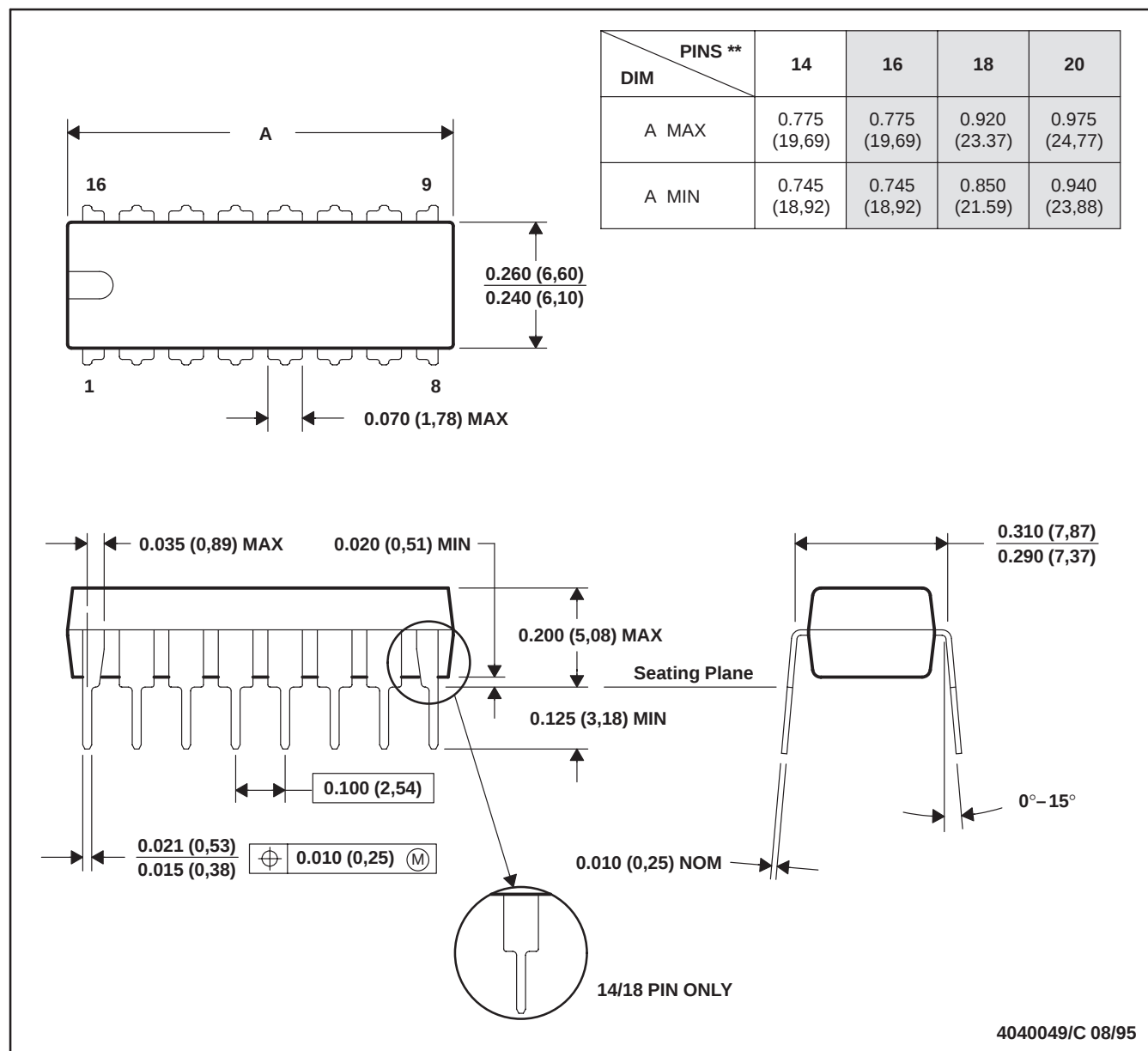
SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

MECHANICAL DATA

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PIN SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Falls within JEDEC MS-001 (20 pin package is shorter than MS-001.)

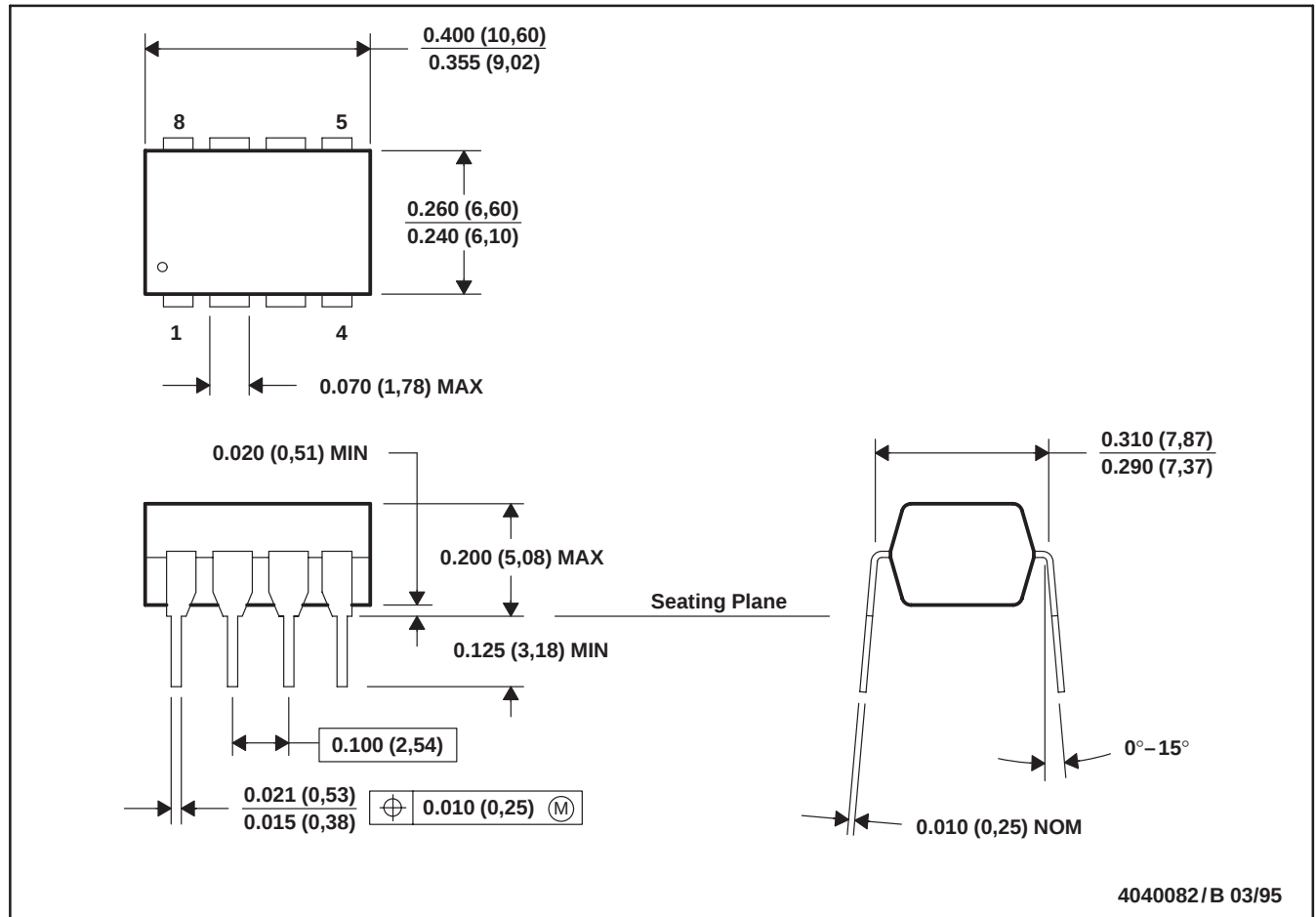
TL081, TL081A, TL081B, TL082, TL082A, TL082B
 TL082Y, TL084, TL084A, TL084B, TL084Y
 JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

MECHANICAL DATA

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



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

TL081, TL081A, TL081B, TL082, TL082A, TL082B
TL082Y, TL084, TL084A, TL084B, TL084Y
JFET-INPUT OPERATIONAL AMPLIFIERS

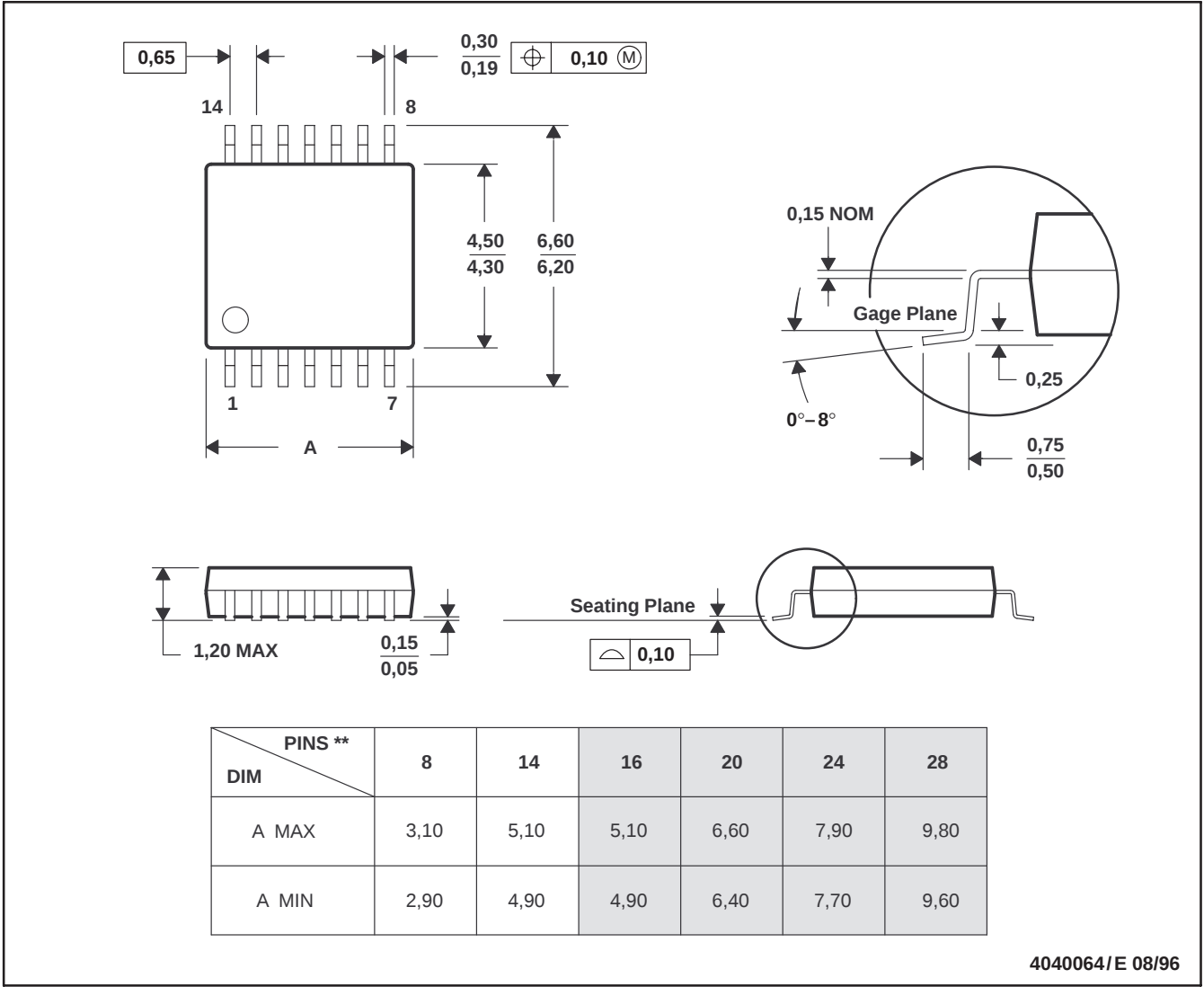
SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

MECHANICAL DATA

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



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

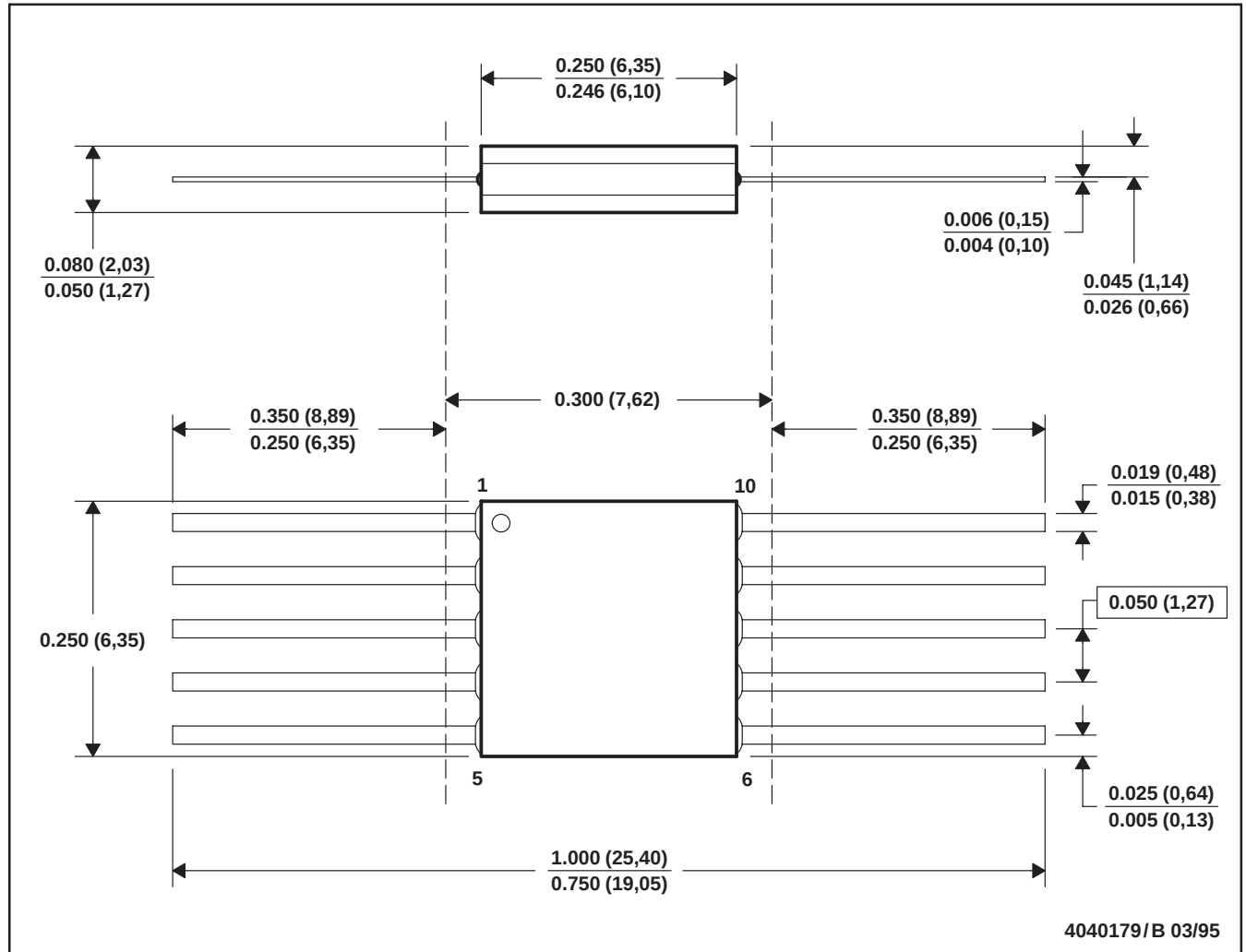
TL081, TL081A, TL081B, TL082, TL082A, TL082B
 TL082Y, TL084, TL084A, TL084B, TL084Y
 JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

MECHANICAL DATA

U (S-GDFP-F10)

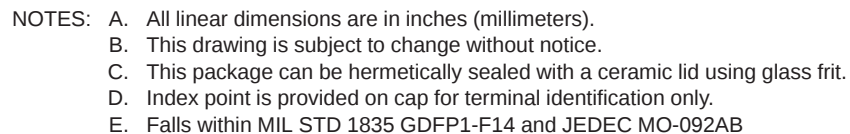
CERAMIC DUAL FLATPACK



- 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 only.
 E. Falls within MIL STD 1835 GDFP1-F10 and JEDEC MO-092AA

SLOS081E – FEBRUARY 1977 – REVISED FEBRUARY 1999

CERAMIC DUAL FLATPACK



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TL081, JFET-Input General-Purpose Operational AmplifierDEVICE STATUS: **ACTIVE**

PARAMETER NAME	TL081
Vs (max) (V)	36
Vs (min) (V)	7
IQ per channel (max) (mA)	2.8
IQ per channel (typ) (mA)	1.4
GBW (typ) (MHz)	3
Slew Rate (typ) (V/us)	13
VIO (Full Range) (max) (mV)	20
VIO (25 deg C) (max) (mV)	15
IIB (max) (pA)	400
CMRR (min) (dB)	70
Vn at 1kHz (typ) (nV/rtHz)	18
Number of Channels	1
Spec'd at Vs (V)	+/-15
Open Loop Gain (min) (dB)	88
Offset Drift (typ) (uV/C)	18

FEATURES[Back to Top](#)

- Low Power Consumption
- Wide Common-Mode and Differential Voltage Ranges
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- Low Total Harmonic Distortion...0.003% Typ
- High Input Impedance...JFET-Input Stage
- Latch-Up-Free Operation
- High Slew Rate...13 V/us Typ
- Common-Mode Input Voltage Range Includes V_{CC+}

DESCRIPTION[Back to Top](#)

The TL08x JFET-input operational amplifier family is designed to offer a wider selection than any previously developed operational amplifier family. Each of these JFET-input operational amplifiers incorporates well-matched, high-voltage JFET and bipolar transistors in a monolithic integrated circuit. The devices

feature high slew rates, low input bias and offset currents, and low offset voltage temperature coefficient. Offset adjustment and external compensation options are available within the TL08x family.

The C-suffix devices are characterized for operation from 0°C to 70°C. The I-suffix devices are characterized for operation from -40°C to 85°C. The Q-suffix devices are characterized for operation from -40°C to 125°C. The M-suffix devices are characterized for operation over the full military temperature range of -55°C to 125°C.

TECHNICAL DOCUMENTS

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To view the following documents, [Acrobat Reader 3.x](#) is required.

To download a document to your hard drive, right-click on the link and choose 'Save'.

DATASHEET

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Full datasheet in Acrobat PDF: [slos081e.pdf](#) (463 KB) (Updated: 02/22/1999)

Full datasheet in Zipped PostScript: [slos081e.psz](#) (408 KB)

APPLICATION NOTES

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View Application Reports for [Signal Amplifiers \(Less than equal to 100MHz\)](#)

- [Analog Applications Journal May 2000](#) (SLYT015 - Updated: 04/20/2000)
- [Analog Applications Journal, September 1999 edition](#) (SLYT005 - Updated: 07/15/1999)
- [Analysis Of The Sallen-Key Architecture](#) (SLOA024A - Updated: 07/27/1999)
- [Stability Analysis Of Voltage-Feedback Op Amps, Including Compensation Technique](#) (SLOA020 - Updated: 07/14/1999)

USER MANUALS

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- [Universal Op Amp Single, Dual, Quad \(SOIC\) Evaluation Module With Shutdown](#) (SLOU061, 1160 KB - Updated: 10/22/1999)
- [Universal Operational Amplifier EVM](#) (SLVU006A, 387 KB - Updated: 03/22/1999)
- [Universal Operational Amplifier Evaluation Module Selection Guide](#) (SLOU060A, 16 KB - Updated: 09/28/2000)
- [Universal Operational Amplifier Single, Dual, Quad \(MSOP/TSSOP\)](#) (SLOU055, 1196 KB - Updated: 10/22/1999)
- [Universal Operational Amplifier Single, Dual, Quad \(PDIP\)](#) (SLOU062, 1211 KB - Updated: 10/22/1999)

SAMPLES

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ORDERABLE DEVICE	PACKAGE	PINS	TEMP (°C)	STATUS	DSCC NUMBER	SAMPLES
TL081CP	<u>P</u>	8	0 TO 70	ACTIVE		Request Samples

PRICING / AVAILABILITY

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ORDERABLE DEVICE	PACKAGE	PINS	TEMP (°C)	STATUS	BUDGETARY PRICE US\$/UNIT QTY=1000+	PACK QTY	DSCC NUMBER	PRICING/AVAILABILITY
TL081CD	<u>D</u>	8	0 TO 70	ACTIVE	0.35	75		Check stock or order
TL081CDR	<u>D</u>	8	0 TO 70	ACTIVE	0.38	2500		Check stock or order
TL081CP	<u>P</u>	8	0 TO 70	ACTIVE	0.35	50		Check stock or order
TL081CPS	<u>PS</u>	8	0 TO 70	OBSOLETE				
TL081CPWLE	<u>PW</u>	8	0 TO 70	OBSOLETE				
TL081ID	<u>D</u>	8	-40 TO 85	ACTIVE	0.59	75		Check stock or order

TL081IDR	<u>D</u>	8	-40 TO 85	ACTIVE	0.59	2500		Check stock or order
TL081IP	<u>P</u>	8	-40 TO 85	ACTIVE	0.59	50		Check stock or order
TL081MFKB	<u>FK</u>	20	-55 TO 125	ACTIVE	9.67	165		Check stock or order
TL081MJG	<u>JG</u>	8	-55 TO 125	ACTIVE	2.86	1		Check stock or order
TL081MJGB	<u>JG</u>	8	-55 TO 125	ACTIVE	3.36	1		Check stock or order

DEVELOPMENT TOOLS

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Tool Part Number	Tool Title	Tool Type
UNIV-OPAMP-1B	Universal EVM for Single/Dual OpAmps without Shutdown in MSOP/SOIC/SOT-23 packages	Evaluation Modules (EVM)
UNIV-OPAMP-2B	Universal EVM for Single/Dual OpAmps with Shutdown in MSOP/SOIC/SOT-23 packages	Evaluation Modules (EVM)
UNIV-OPAMP-3B	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in MSOP/TSSOP packages	Evaluation Modules (EVM)
UNIV-OPAMP-4B	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in SOIC packages	Evaluation Modules (EVM)
UNIV-OPAMP-5B	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in PDIP packages	Evaluation Modules (EVM)

Table Data Updated on: 11/26/2000

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TL082, Dual JFET-Input General-Purpose Operational Amplifier

DEVICE STATUS: **ACTIVE**

PARAMETER NAME	TL082
Vs (max) (V)	36
Vs (min) (V)	7
IQ per channel (max) (mA)	2.8
IQ per channel (typ) (mA)	1.4
GBW (typ) (MHz)	3
Slew Rate (typ) (V/us)	13
VIO (Full Range) (max) (mV)	20
VIO (25 deg C) (max) (mV)	15
IIB (max) (pA)	400
CMRR (min) (dB)	70
Vn at 1kHz (typ) (nV/rtHz)	18
Number of Channels	2
Spec'd at Vs (V)	+/-15
Open Loop Gain (min) (dB)	88
Offset Drift (typ) (uV/C)	18

FEATURES

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- Low Power Consumption
- Wide Common-Mode and Differential Voltage Ranges
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- Low Total Harmonic Distortion...0.003% Typ
- High Input Impedance...JFET-Input Stage
- Latch-Up-Free Operation
- High Slew Rate...13 V/us Typ
- Common-Mode Input Voltage Range Includes V_{CC}+

DESCRIPTION

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The TL08x JFET-input operational amplifier family is designed to offer a wider selection than any previously developed operational amplifier family. Each of these JFET-input operational amplifiers incorporates

well-matched, high-voltage JFET and bipolar transistors in a monolithic integrated circuit. The devices feature high slew rates, low input bias and offset currents, and low offset voltage temperature coefficient. Offset adjustment and external compensation options are available within the TL08x family.

The C-suffix devices are characterized for operation from 0°C to 70°C. The I-suffix devices are characterized for operation from -40°C to 85°C. The Q-suffix devices are characterized for operation from -40°C to 125°C. The M-suffix devices are characterized for operation over the full military temperature range of -55°C to 125°C.

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DATASHEET

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- [Analog Applications Journal, September 1999 edition](#) (SLYT005 - Updated: 07/15/1999)
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- [Stability Analysis Of Voltage-Feedback Op Amps, Including Compensation Technique](#) (SLOA020 - Updated: 07/14/1999)

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- [Universal Op Amp Single, Dual, Quad \(SOIC\) Evaluation Module With Shutdown](#) (SLOU061, 1160 KB - Updated: 10/22/1999)
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- [Universal Operational Amplifier Single, Dual, Quad \(PDIP\)](#) (SLOU062, 1211 KB - Updated: 10/22/1999)

SAMPLES

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ORDERABLE DEVICE	PACKAGE	PINS	TEMP (°C)	STATUS	DSCC NUMBER	SAMPLES
TL082CD	<u>D</u>	8	0 TO 70	ACTIVE		Request Samples
TL082CP	<u>P</u>	8	0 TO 70	ACTIVE		Request Samples
TL082CPWLE	<u>PW</u>	8	0 TO 70	OBSOLETE		
TL082ID	<u>D</u>	8	-40 TO 85	ACTIVE		Request Samples
TL082IP	<u>P</u>	8	-40 TO 85	ACTIVE		Request Samples

PRICING / AVAILABILITY

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ORDERABLE DEVICE	PACKAGE	PINS	TEMP (°C)	STATUS	BUDGETARY PRICE US\$/UNIT QTY=1000+	PACK QTY	DSCC NUMBER	PRICING/AVAILABILITY
TL082CD	<u>D</u>	8	0 TO 70	ACTIVE	0.38	75		Check stock or order
TL082CDR	<u>D</u>	8	0 TO 70	ACTIVE	0.42	2500		Check stock or order
TL082CJG	<u>JG</u>	8	0 TO 70	OBSOLETE				

TL082CP	<u>P</u>	8	0 TO 70	ACTIVE	0.38	50		Check stock or order
TL082CPS	<u>PS</u>	8	0 TO 70	OBSOLETE				
TL082CPSR	<u>PS</u>	8	0 TO 70	ACTIVE	0.47	2000		Check stock or order
TL082CPWLE	<u>PW</u>	8	0 TO 70	OBSOLETE				
TL082CPWR	<u>PW</u>	8	0 TO 70	ACTIVE	0.38	2000		Check stock or order
TL082ID	<u>D</u>	8	-40 TO 85	ACTIVE	0.59	75		Check stock or order
TL082IDR	<u>D</u>	8	-40 TO 85	ACTIVE	0.62	2500		Check stock or order
TL082IJG	<u>JG</u>	8	-40 TO 85	OBSOLETE				
TL082IP	<u>P</u>	8	-40 TO 85	ACTIVE	0.59	50		Check stock or order
TL082MFK	<u>FK</u>	20	-55 TO 125	OBSOLETE				
TL082MFKB	<u>FK</u>	20	-55 TO 125	ACTIVE	10.65	165	5962-9851501Q2A	Check stock or order
TL082MJG	<u>JG</u>	8	-55 TO 125	ACTIVE	2.86	1		Check stock or order
TL082MJGB	<u>JG</u>	8	-55 TO 125	ACTIVE	3.72	1	5962-9851501QPA	Check stock or order

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Tool Part Number	Tool Title	Tool Type
UNIV-OPAMP-1B	Universal EVM for Single/Dual OpAmps without Shutdown in MSOP/SOIC/SOT-23 packages	Evaluation Modules (EVM)
UNIV-OPAMP-2B	Universal EVM for Single/Dual OpAmps with Shutdown in MSOP/SOIC/SOT-23 packages	Evaluation Modules (EVM)
UNIV-OPAMP-3B	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in MSOP/TSSOP packages	Evaluation Modules (EVM)
UNIV-OPAMP-4B	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in SOIC packages	Evaluation Modules (EVM)
UNIV-OPAMP-5B	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in PDIP packages	Evaluation Modules (EVM)

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TL084, Quad JFET-Input General-Purpose Operational Amplifier
DEVICE STATUS: **ACTIVE**

PARAMETER NAME	TL084
Vs (max) (V)	36
Vs (min) (V)	7
IQ per channel (max) (mA)	2.8
IQ per channel (typ) (mA)	1.4
GBW (typ) (MHz)	3
Slew Rate (typ) (V/us)	13
VIO (Full Range) (max) (mV)	20
VIO (25 deg C) (max) (mV)	15
IIB (max) (pA)	400
CMRR (min) (dB)	70
Vn at 1kHz (typ) (nV/rtHz)	18
Number of Channels	4
Spec'd at Vs (V)	+/-15
Open Loop Gain (min) (dB)	88
Offset Drift (typ) (uV/C)	18

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- Low Power Consumption
- Wide Common-Mode and Differential Voltage Ranges
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- Low Total Harmonic Distortion...0.003% Typ
- High Input Impedance...JFET-Input Stage
- Latch-Up-Free Operation
- High Slew Rate...13 V/us Typ
- Common-Mode Input Voltage Range Includes V_{CC}+

DESCRIPTION

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TL084CD	<u>D</u>	14	0 TO 70	ACTIVE		Request Samples
TL084CN	<u>N</u>	14	0 TO 70	ACTIVE		Request Samples
TL084ID	<u>D</u>	14	-40 TO 85	ACTIVE		Request Samples
TL084IN	<u>N</u>	14	-40 TO 85	ACTIVE		Request Samples

PRICING / AVAILABILITY

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TL084CD	<u>D</u>	14	0 TO 70	ACTIVE	0.50	50		Check stock or order
TL084CDR	<u>D</u>	14	0 TO 70	ACTIVE	0.53	2500		Check stock or order
TL084CJ	<u>J</u>	14	0 TO 70	OBSOLETE				
TL084CN	<u>N</u>	14	0 TO 70	ACTIVE	0.50	25		Check stock or order

TL084CNSLE	<u>NS</u>	14	0 TO 70	OBSOLETE				
TL084CNSR	<u>NS</u>	14	0 TO 70	ACTIVE	0.59	2000		Check stock or order
TL084CPWLE	<u>PW</u>	14	0 TO 70	OBSOLETE				
TL084CPWR	<u>PW</u>	14	0 TO 70	ACTIVE	0.50	2000		Check stock or order
TL084ID	<u>D</u>	14	-40 TO 85	ACTIVE	0.67	50		Check stock or order
TL084IDR	<u>D</u>	14	-40 TO 85	ACTIVE	0.70	2500		Check stock or order
TL084IJ	<u>J</u>	14	-40 TO 85	OBSOLETE				
TL084IN	<u>N</u>	14	-40 TO 85	ACTIVE	0.67	25		Check stock or order
TL084MFKB	<u>FK</u>	20	-55 TO 125	ACTIVE	12.36	1		Check stock or order
TL084MJ	<u>J</u>	14	-55 TO 125	ACTIVE	4.00	1		Check stock or order
TL084MJB	<u>J</u>	14	-55 TO 125	ACTIVE	4.49	1		Check stock or order
TL084QD	<u>D</u>	14	-40 TO 125	ACTIVE	0.70	50		Check stock or order
TL084QDR	<u>D</u>	14	-40 TO 125	ACTIVE	0.74	2500		Check stock or order

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