

TLE208x, TLE208xA, TLE208xY EXCALIBUR HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS182A – FEBRUARY 1997 – REVISED MARCH 2000

- Direct Upgrades to TL05x, TL07x, and TL08x BiFET Operational Amplifiers
- Greater Than 2× Bandwidth (10 MHz) and 3× Slew Rate (45 V/μs) Than TL08x
- On-Chip Offset Voltage Trimming for Improved DC Performance
- Wider Supply Rails Increase Dynamic Signal Range to ±19 V

description

The TLE208x series of JFET-input operational amplifiers more than double the bandwidth and triple the slew rate of the TL07x and TL08x families of BiFET operational amplifiers. The TLE208x also have wider supply-voltage rails, increasing the dynamic-signal range for BiFET circuits to ±19 V. On-chip zener trimming of offset voltage yields precision grades for greater accuracy in dc-coupled applications. The TLE208x are pin-compatible with lower performance BiFET operational amplifiers for ease in improving performance in existing designs.

BiFET operational amplifiers offer the inherently higher input impedance of the JFET-input transistors, without sacrificing the output drive associated with bipolar amplifiers. This makes these amplifiers better suited for interfacing with high-impedance sensors or very low level ac signals. They also feature inherently better ac response than bipolar or CMOS devices having comparable power consumption.

Because BiFET operational amplifiers are designed for use with dual power supplies, care must be taken to observe common-mode input-voltage limits and output voltage swing when operating from a single supply. DC biasing of the input signal is required and loads should be terminated to a virtual ground node at mid-supply. Texas Instruments TLE2426 integrated virtual ground generator is useful when operating BiFET amplifiers from single supplies.

The TLE208x are fully specified at ±15 V and ±5 V. For operation in low-voltage and/or single-supply systems, Texas Instruments LinCMOS™ families of operational amplifiers (TLC- and TLV-prefix) are recommended. When moving from BiFET to CMOS amplifiers, particular attention should be paid to slew rate and bandwidth requirements and output loading.

For BiFET circuits requiring low noise and/or tighter dc precision, the TLE207x offer the same ac response as the TLE208x with more stringent dc and noise specifications.



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TLE2081 AVAILABLE OPTIONS

T _A	V _{IO} max AT 25°C	PACKAGED DEVICES				CHIP FORM (Y)
		SMALL OUTLINE (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	
0°C to 70°C	3 mV 6 mV	TLE2081ACD TLE2081CD	—	—	TLE2081ACP TLE2081CP	— TLE2081Y
–55°C to 125°C	3 mV 6 mV	—	TLE2081AMFK TLE2081MFK	TLE2081AMJG TLE2081MJG	—	—

† The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2081ACDR).

‡ Chip forms are tested at T_A = 25°C only.

TLE2082 AVAILABLE OPTIONS

T _A	V _{IO} max AT 25°C	PACKAGED DEVICES				CHIP FORM (Y)
		SMALL OUTLINE (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	
0°C to 70°C	4 mV 7 mV	TLE2082ACD TLE2082CD	—	—	TLE2082ACP TLE2082CP	—
–40°C to 85°C	4 mV 7 mV	TLE2082AID TLE2082ID	—	—	TLE2082AIP TLE2082IP	TLE2082Y
–55°C to 125°C	4 mV 7 mV	TLE2082AMD TLE2082MD	TLE2082AMFK TLE2082MFK	TLE2082AMJG TLE2082MJG	TLE2082AMP TLE2082MP	—

† The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2082ACDR).

‡ Chip forms are tested at T_A = 25°C only.

TLE2084 AVAILABLE OPTIONS

T _A	V _{IO} max AT 25°C	PACKAGED DEVICES				CHIP FORM (Y)
		SMALL OUTLINE (DW)	CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)	
0°C to 70°C	4 mV 7 mV	TLE2084ACDW TLE2084CDW	—	—	TLE2084ACN TLE2084CN	— TLE2084Y
–55°C to 125°C	4 mV 7 mV	—	TLE2084AMFK TLE2084MFK	TLE2084AMJ TLE2084MJ	—	—

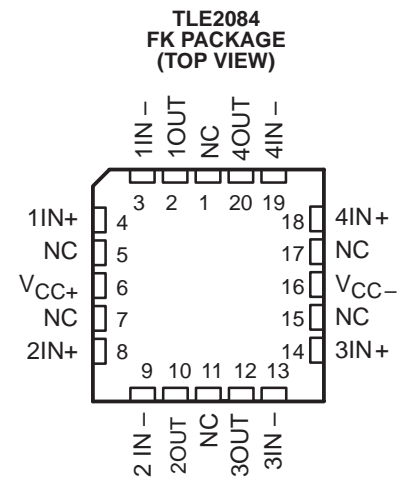
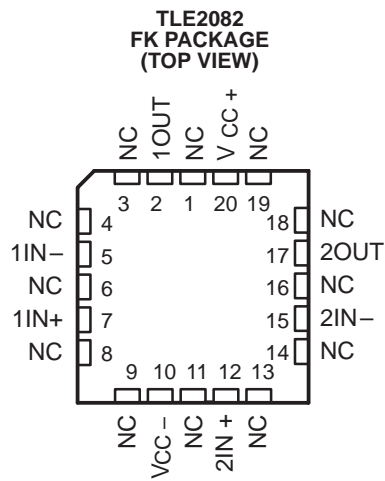
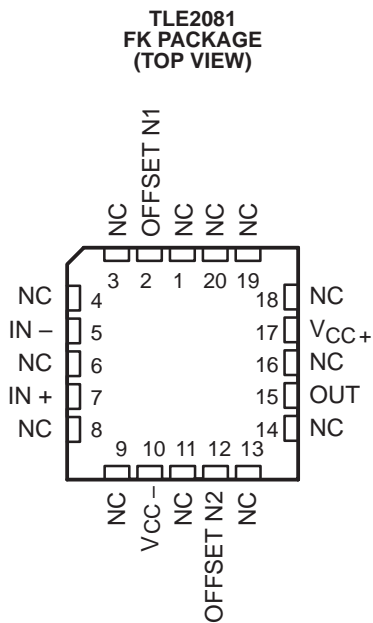
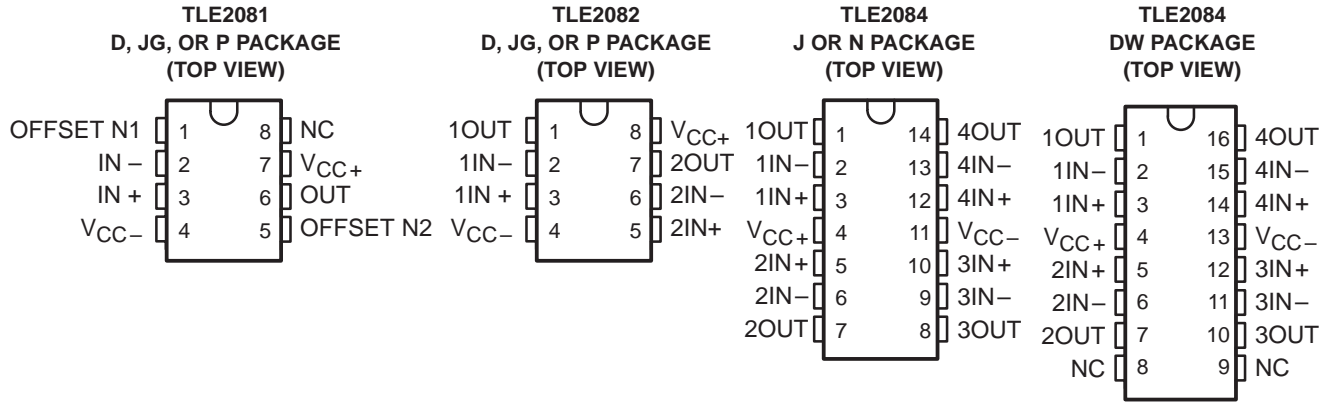
† The DW packages are available taped and reeled. Add R suffix to device type (e.g., TLE2084ACDWR).

‡ Chip forms are tested at T_A = 25°C only.



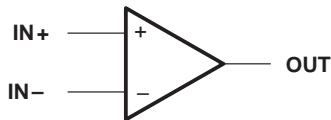
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NC – No internal connection

symbol

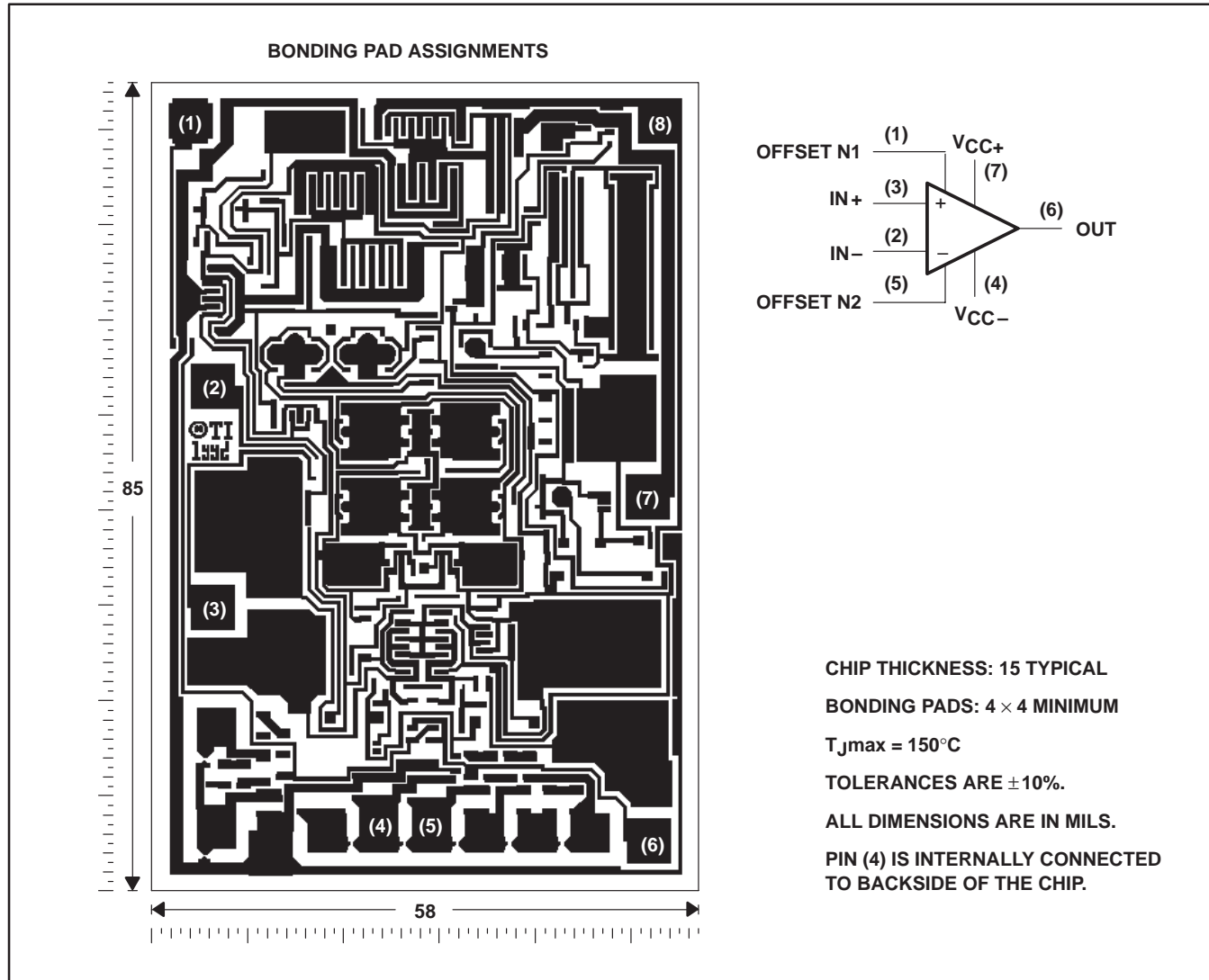


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TLE2081Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2081. 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.

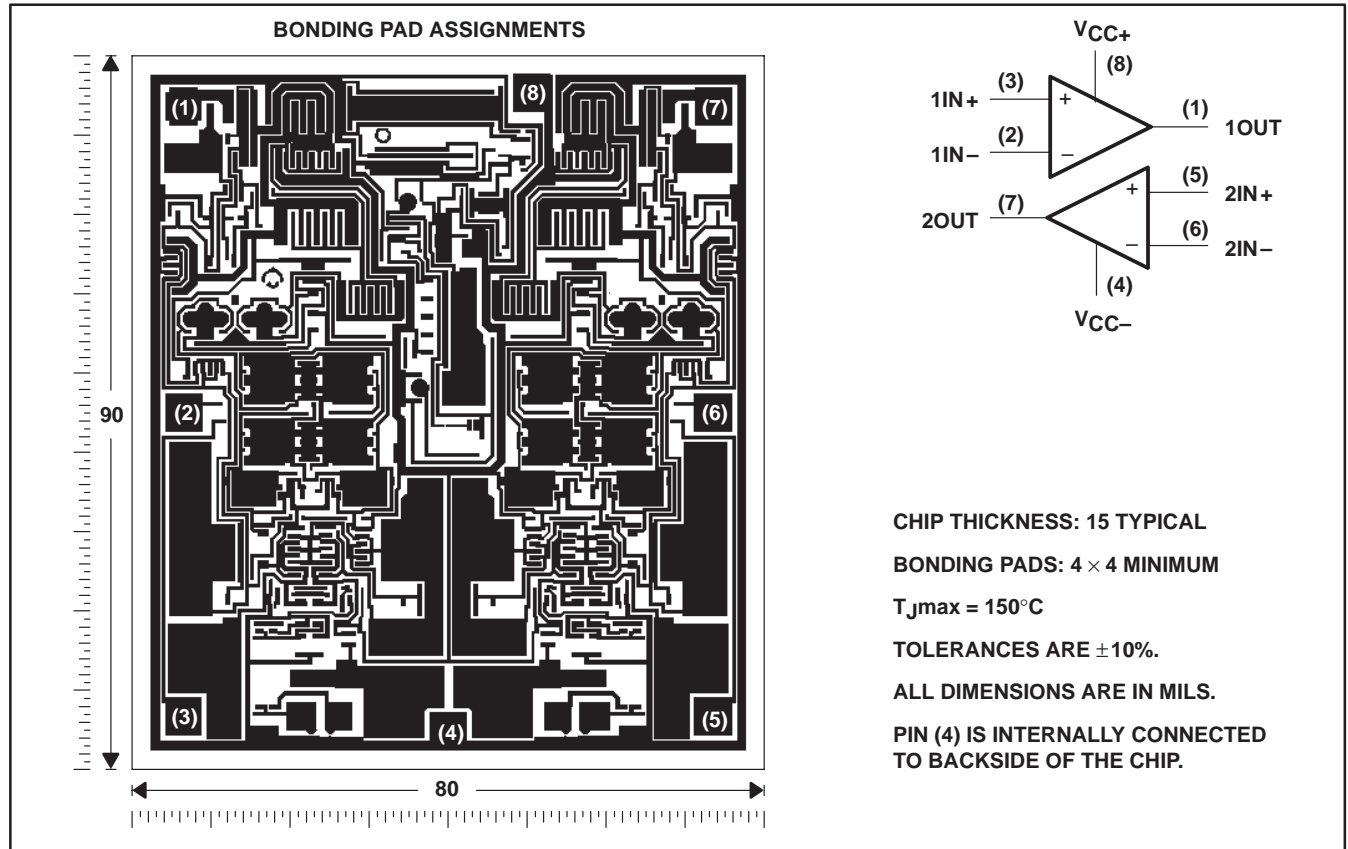


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TLE2082Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2082. 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.

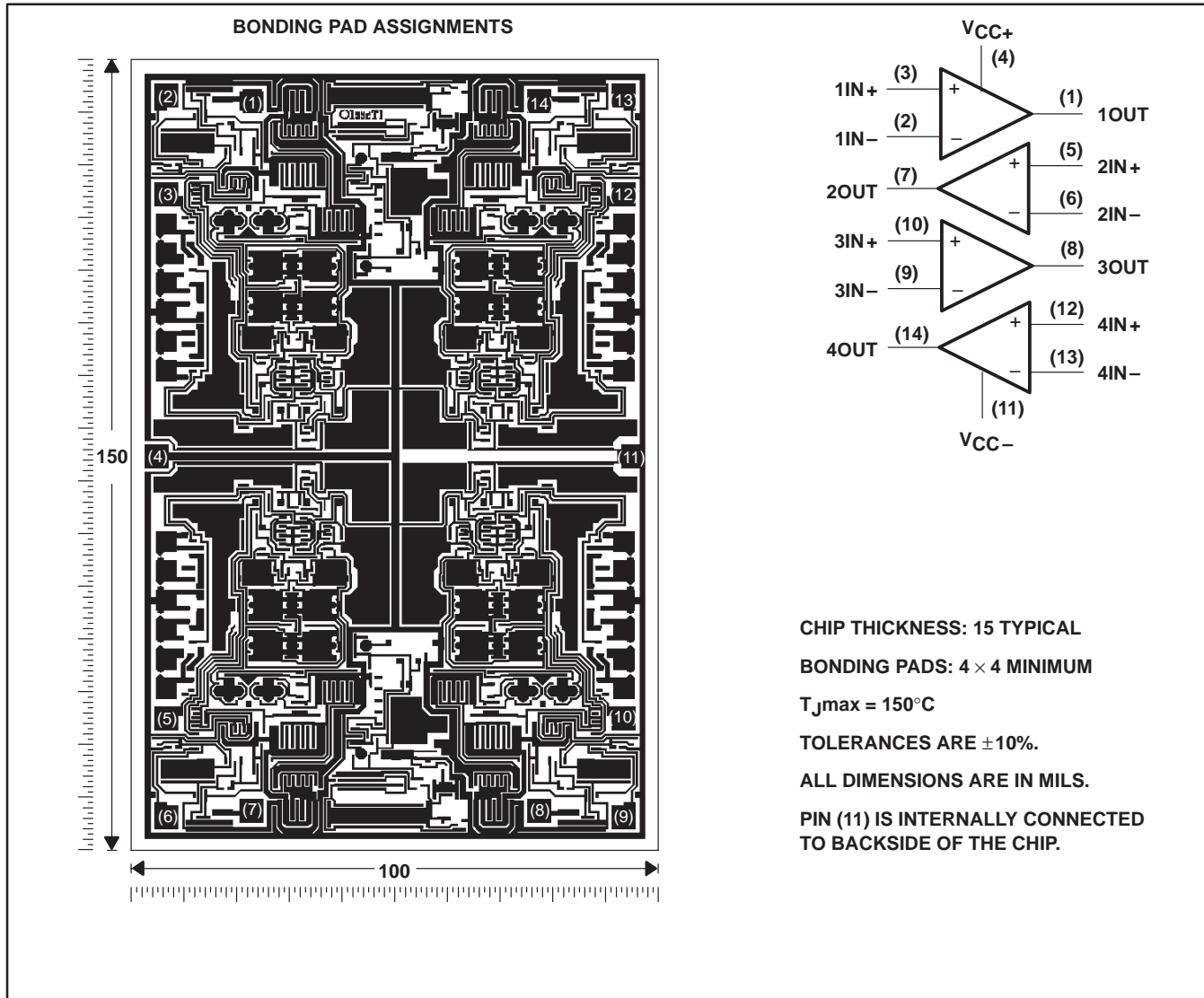


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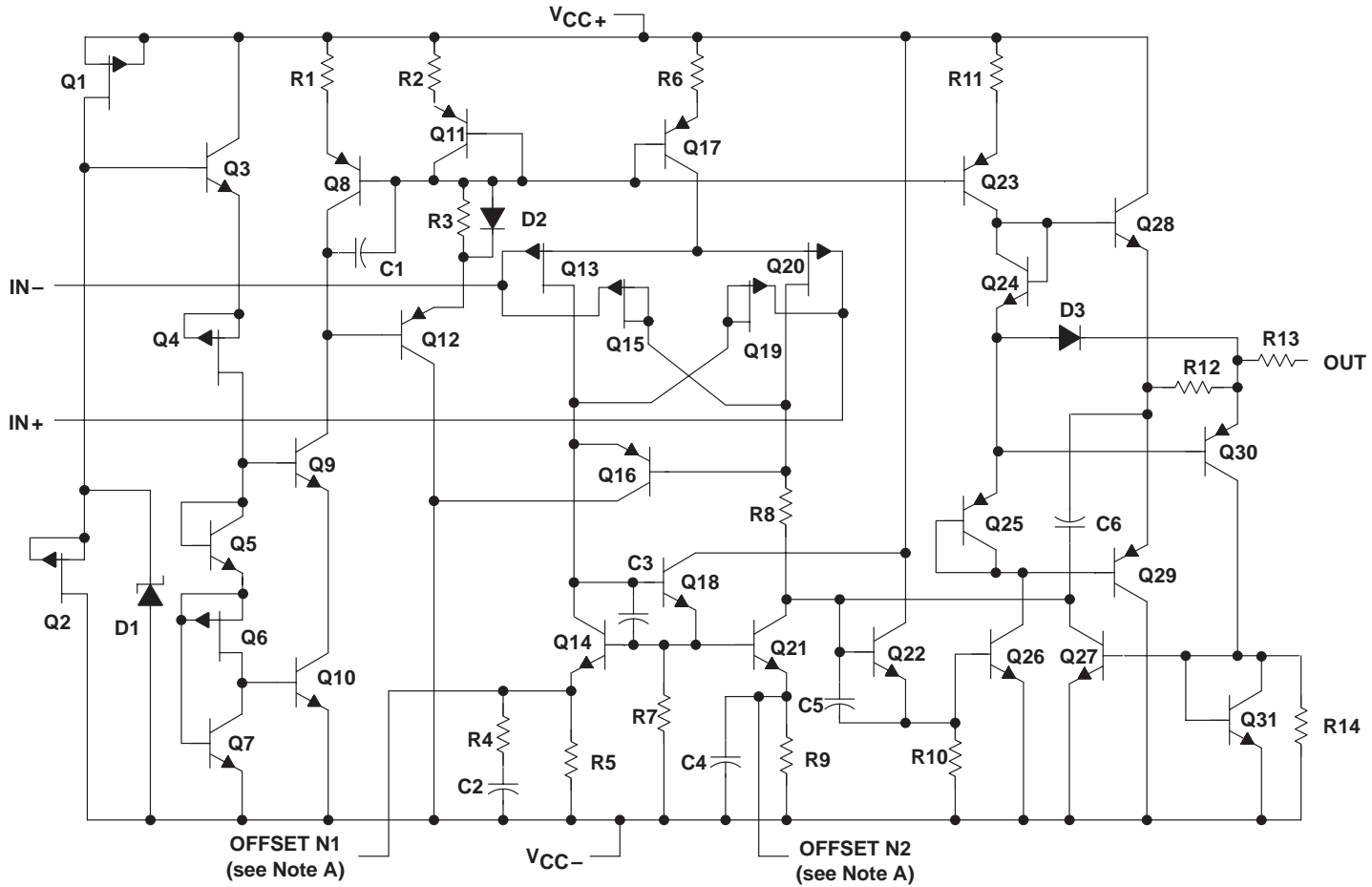
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TLE2084Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2084. 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.



equivalent schematic (each channel)



NOTE A: OFFSET N1 AND OFFSET N2 are only available on the TLE2081x devices.

ACTUAL DEVICE COMPONENT COUNT			
COMPONENT	TLE2081	TLE2082	TLE2084
Transistors	33	57	114
Resistors	25	37	74
Diodes	8	5	10
Capacitors	6	11	22

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

Supply voltage, V_{CC+} (see Note 1)	19 V
Supply voltage, V_{CC-} (see Note 1)	-19 V
Differential input voltage range, V_{ID} (see Note 2)	V_{CC+} to V_{CC-}
Input voltage range, V_I (any input)	V_{CC+} to V_{CC-}
Input current, I_I (each input)	±1 mA
Output current, I_O (each output)	±80 mA
Total current into V_{CC+}	160 mA
Total current out of V_{CC-}	160 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 85°C
M suffix	-55°C to 125°C
Storage temperature range	-65°C to 150°C
Case temperature for 60 seconds: FK package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: DW or N package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package	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_{CC+} and V_{CC-} .

2. Differential voltages are at $IN+$ with respect to $IN-$.

3. The output can be shorted to either supply. Temperatures and/or supply voltages must be limited to ensure that the maximum dissipation rate is not exceeded.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$	$T_A = 85^\circ\text{C}$	$T_A = 125^\circ\text{C}$
	POWER RATING		POWER RATING	POWER RATING	POWER RATING
D	725 mW	5.8 mW/°C	464 mW	377 mW	145 mW
DW	1025 mW	8.2 mW/°C	656 mW	533 mW	205 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	344 mW	200 mW

recommended operating conditions

		C SUFFIX		I SUFFIX		M SUFFIX		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
Supply voltage, $V_{CC\pm}$		±2.25	±19	±2.25	±19	±2.25	±19	V
Common-mode input voltage, V_{IC}	$V_{CC\pm} = \pm 5\text{ V}$	-0.9	5	-0.8	5	-0.8	5	V
	$V_{CC\pm} = \pm 15\text{ V}$	-10.9	15	-10.8	15	-10.8	15	
Operating free-air temperature, T_A		0	70	-40	85	-55	125	°C



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TLE2081C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2081C			TLE2081AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0,$ $R_S = 50 \Omega$	$V_O = 0,$	25°C	0.34	6	0.3	3	mV	
			Full range	8			5		
α_{VIO} Temperature coefficient of input offset voltage			Full range	3.2	29	3.2	29	$\mu V/^\circ C$	
I_{IO} Input offset current	$V_{IC} = 0,$ See Figure 4	$V_O = 0,$	25°C	5	100	5	100	nA	
			Full range	1.4			1.4		
I_{IB} Input bias current			25°C	15	175	15	175	nA	
			Full range	5			5		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$		25°C	5 to -1	5 to -1.9	5 to -1	5 to -1.9	V	
			Full range	5 to -0.9		5 to -0.9			
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200 \mu A$		25°C	3.8	4.1	3.8	4.1	V	
			Full range	3.7			3.7		
	$I_O = -2$ mA		25°C	3.5	3.9	3.5	3.9		
			Full range	3.4			3.4		
	$I_O = -20$ mA		25°C	1.5	2.3	1.5	2.3		
			Full range	1.5			1.5		
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200 \mu A$		25°C	-3.5	-4.2	-3.5	-4.2	V	
			Full range	-3.4			-3.4		
	$I_O = 2$ mA		25°C	-3.7	-4.1	-3.7	-4.1		
			Full range	-3.6			-3.6		
	$I_O = 20$ mA		25°C	-1.5	-2.4	-1.5	-2.4		
			Full range	-1.5			-1.5		
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 2.3$ V	$R_L = 600 \Omega$	25°C	80	91	80	91	dB	
			Full range	79			79		
		$R_L = 2$ k Ω		25°C	90	100	90		100
				Full range	89				89
		$R_L = 10$ k Ω		25°C	95	106	95		106
				Full range	94				94
r_i Input resistance	$V_{IC} = 0$		25°C	10 ¹²		10 ¹²		Ω	
c_i Input capacitance	$V_{IC} = 0,$ See Figure 5	Common mode	25°C	11		11		pF	
		Differential	25°C	2.5		2.5			
z_o Open-loop output impedance	$f = 1$ MHz		25°C	80		80		Ω	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin},$ $V_O = 0,$ $R_S = 50 \Omega$		25°C	70	89	70	89	dB	
			Full range	68			68		
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 5$ V to ± 15 V, $V_O = 0,$ $R_S = 50 \Omega$		25°C	82	99	82	99	dB	
			Full range	80			80		

† Full range is 0°C to 70°C.



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TLE2081C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A †	TLE2081C			TLE2081AC			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
I_{CC}	Supply current	$V_O = 0$, No load	25°C	1.35	1.6	2.2	1.35	1.6	2.2	mA
			Full range	2.2			2.2			
I_{OS}	Short-circuit output current	$V_O = 0$	$V_{ID} = 1\text{ V}$	-35			-35			mA
			$V_{ID} = -1\text{ V}$	45			45			

† Full range is 0°C to 70°C.

TLE2081C operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$

PARAMETER	TEST CONDITIONS	T_A †	TLE2081C			TLE2081AC			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
SR+	Positive slew rate	$V_{O(PP)} = \pm 2.3\text{ V}$, $A_{VD} = -1$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$, See Figure 1	25°C	35			35			V/ μ s
			Full range	23			23			
SR-	Negative slew rate	$V_{O(PP)} = \pm 2.3\text{ V}$, $A_{VD} = -1$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$, See Figure 1	25°C	38			38			V/ μ s
			Full range	23			23			
t_s	Settling time	$A_{VD} = -1$, 2-V step, $R_L = 1\text{ k}\Omega$, $C_L = 100\text{ pF}$	To 10 mV	0.25			0.25			μ s
			To 1 mV	0.4			0.4			
V_n	Equivalent input noise voltage	$R_S = 20\ \Omega$, See Figure 3	f = 10 Hz	28			28			nV/ $\sqrt{\text{Hz}}$
			f = 10 kHz	11.6			11.6			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$R_S = 20\ \Omega$, See Figure 3	f = 10 Hz to 10 kHz	6			6			μ V
			f = 0.1 Hz to 10 Hz	0.6			0.6			
I_n	Equivalent input noise current	$V_{IC} = 0$, f = 10 kHz	25°C	2.8			2.8			fA/ $\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 5\text{ V}$, f = 1 kHz, $R_S = 25\ \Omega$	25°C	0.013%			0.013%			
B_1	Unity-gain bandwidth	$V_I = 10\text{ mV}$, $C_L = 25\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Figure 2	25°C	9.4			9.4			MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 4\text{ V}$, $R_L = 2\text{ k}\Omega$, $C_L = 25\text{ pF}$	25°C	2.8			2.8			MHz
ϕ_m	Phase margin at unity gain	$V_I = 10\text{ mV}$, $R_L = 2\text{ k}\Omega$, $C_L = 25\text{ pF}$, See Figure 2	25°C	56°			56°			

† Full range is 0°C to 70°C.



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TLE2081C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2081C			TLE2081AC			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0, V_O = 0, R_S = 50 \Omega$	25°C	0.49	6		0.47	3	mV		
		Full range			8		5			
α_{VIO} Temperature coefficient of input offset voltage		Full range	3.2	29		3.2	29	$\mu V/^\circ C$		
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0, \text{See Figure 4}$	25°C	6	100		6	100	nA		
		Full range		1.4			1.4			
I_{IB} Input bias current		25°C	20	175		20	175	nA		
		Full range		5			5			
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	15 to -11	15 to -11.9		15 to -11	15 to -11.9	V		
		Full range	15 to -10.9			15 to -10.9				
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200 \mu A$	25°C	13.8	14.1		13.8	14.1	V		
		Full range	13.7			13.7				
	$I_O = -2 \text{ mA}$	25°C	13.5	13.9		13.5	13.9			
		Full range	13.4			13.4				
	$I_O = -20 \text{ mA}$	25°C	11.5	12.3		11.5	12.3			
		Full range	11.5			11.5				
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200 \mu A$	25°C	-13.8	-14.2		-13.8	-14.2	V		
		Full range	-13.7			-13.7				
	$I_O = 2 \text{ mA}$	25°C	-13.5	-14		-13.5	-14			
		Full range	-13.4			-13.4				
	$I_O = 20 \text{ mA}$	25°C	-11.5	-12.4		-11.5	-12.4			
		Full range	-11.5			-11.5				
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10 \text{ V}$	$R_L = 600 \Omega$	25°C	80	96		80	96	dB	
			Full range	79			79			
		$R_L = 2 \text{ k}\Omega$	25°C	90	109		90	109		
			Full range	89			89			
		$R_L = 10 \text{ k}\Omega$	25°C	95	118		95	118		
			Full range	94			94			
r_i Input resistance	$V_{IC} = 0$	25°C	10^{12}			10^{12}			Ω	
c_i Input capacitance	$V_{IC} = 0, \text{See Figure 5}$	Common mode	25°C	7.5			7.5			pF
		Differential	25°C	2.5			2.5			
z_o Open-loop output impedance	$f = 1 \text{ MHz}$	25°C	80			80			Ω	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$	25°C	80	98		80	98	dB		
		Full range	79			79				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$	25°C	82	99		82	99	dB		
		Full range	80			81				

† Full range is 0°C to 70°C.



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TLE2081C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15\text{ V}$ (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A †	TLE2081C			TLE2081AC			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
I_{CC}	Supply current	$V_O = 0$, No load	25°C	1.35	1.7	2.2	1.35	1.7	2.2	mA
			Full range	2.2			2.2			
I_{OS}	Short-circuit output current	$V_O = 0$	25°C	$V_{ID} = 1\text{ V}$	-30	-45	-30	-45	mA	
				$V_{ID} = -1\text{ V}$	30	48	30	48		

† Full range is 0°C to 70°C.

TLE2081C operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15\text{ V}$

PARAMETER	TEST CONDITIONS	T_A †	TLE2081C			TLE2081AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)} = 10\text{ V}$, $A_{VD} = -1$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$, See Figure 1	25°C	30	40	30	40	V/ μ s	
			Full range	27			27		
SR-	Negative slew rate	See Figure 1	25°C	30	45	30	45	V/ μ s	
			Full range	27			27		
t_s	Settling time	$A_{VD} = -1$, 10-V step, $R_L = 1\text{ k}\Omega$, $C_L = 100\text{ pF}$	25°C	To 10 mV	0.4		0.4		μ s
				To 1 mV	1.5		1.5		
V_n	Equivalent input noise voltage	$R_S = 20\ \Omega$, See Figure 3	25°C	f = 10 Hz	28		28		nV/ $\sqrt{\text{Hz}}$
				f = 10 kHz	11.6		11.6		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	See Figure 3	25°C	f = 10 Hz to 10 kHz	6		6		μ V
				f = 0.1 Hz to 10 Hz	0.6		0.6		
I_n	Equivalent input noise current	$V_{IC} = 0$, f = 10 kHz	25°C	2.8		2.8		fA/ $\sqrt{\text{Hz}}$	
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20\text{ V}$, f = 1 kHz, $R_S = 25\ \Omega$, $A_{VD} = 10$, $R_L = 2\text{ k}\Omega$	25°C	0.008%		0.008%			
B_1	Unity-gain bandwidth	$V_I = 10\text{ mV}$, $C_L = 25\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Figure 2	25°C	8	10	8	10	MHz	
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 20\text{ V}$, $R_L = 2\text{ k}\Omega$, $A_{VD} = -1$, $C_L = 25\text{ pF}$	25°C	478	637	478	637	kHz	
ϕ_m	Phase margin at unity gain	$V_I = 10\text{ mV}$, $C_L = 25\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Figure 2	25°C	57°		57°			

† Full range is 0°C to 70°C.



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TLE2081M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2081M			TLE2081AM			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0,$ $V_O = 0,$ $R_S = 50\Omega$	25°C	0.34	6		0.3	3	mV		
		Full range			11.2		8.2			
αV_{IO} Temperature coefficient of input offset voltage		Full range	3.2	29*		3.2	29*	$\mu V/^\circ C$		
I_{IO} Input offset current	$V_{IC} = 0,$ $V_O = 0,$ See Figure 4	25°C	5	100		5	100	pA		
		Full range			20		20	nA		
I_{IB} Input bias current		25°C	15	175		15	175	pA		
		Full range			65		65	nA		
V_{ICR} Common-mode input voltage range	$R_S = 50\Omega$	25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9	V		
		Full range	5 to -0.8			5 to -0.8				
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200\mu A$	25°C	3.8	4.1		3.8	4.1	V		
		Full range	3.6			3.6				
	$I_O = -2$ mA	25°C	3.5	3.9		3.5	3.9			
		Full range	3.3			3.3				
	$I_O = -20$ mA	25°C	1.5	2.3		1.5	2.3			
		Full range	1.4			1.4				
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200\mu A$	25°C	-3.8	-4.2		-3.8	-4.2	V		
		Full range	-3.6			-3.6				
	$I_O = 2$ mA	25°C	-3.5	-4.1		-3.5	-4.1			
		Full range	-3.3			-3.3				
	$I_O = 20$ mA	25°C	-1.5	-2.4		-1.5	-2.4			
		Full range	-1.4			-1.4				
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 2.3$ V	$R_L = 600\Omega$	25°C	80	91		80	91	dB	
			Full range	78			78			
		$R_L = 2$ k Ω	25°C	90	100		90	100		
			Full range	88			88			
		$R_L = 10$ k Ω	25°C	95	106		95	106		
			Full range	93			93			
r_i Input resistance	$V_{IC} = 0$	25°C	10^{12}			10^{12}			Ω	
c_i Input capacitance	$V_{IC} = 0,$ See Figure 5	Common mode	25°C	11			11			pF
		Differential	25°C	2.5			2.5			
z_o Open-loop output impedance	$f = 1$ MHz	25°C	80			80			Ω	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin},$ $V_O = 0,$ $R_S = 50\Omega$	25°C	70	89		70	89	dB		
		Full range	68			68				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 5$ V to ± 15 V, $V_O = 0,$ $R_S = 50\Omega$	25°C	82	99		82	99	dB		
		Full range	80			80				

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

† Full range is $-55^\circ C$ to $125^\circ C$.



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TLE2081M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A †	TLE2081M			TLE2081AM			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
I_{CC}	Supply current	$V_O = 0$, No load	25°C	1.35	1.6	2.2	1.35	1.6	2.2	mA
			Full range	2.2			2.2			
I_{OS}	Short-circuit output current	$V_O = 0$	$V_{ID} = 1\text{ V}$	-35			-35			mA
			$V_{ID} = -1\text{ V}$	45			45			

† Full range is -55°C to 125°C .

TLE2081M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$

PARAMETER	TEST CONDITIONS	T_A †	TLE2081M			TLE2081AM			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
SR_+	Positive slew rate	$V_{O(PP)} = \pm 2.3\text{ V}$, $A_{VD} = -1$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$, See Figure 1	25°C	35			35			$\text{V}/\mu\text{s}$
			Full range	20*			20*			
SR_-	Negative slew rate	$V_{O(PP)} = \pm 2.3\text{ V}$, $A_{VD} = -1$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$, See Figure 1	25°C	38			38			$\text{V}/\mu\text{s}$
			Full range	20*			20*			
t_s	Settling time	$A_{VD} = -1$, 2-V step, $R_L = 1\text{ k}\Omega$, $C_L = 100\text{ pF}$	To 10 mV	0.25			0.25			μs
			To 1 mV	0.4			0.4			
V_n	Equivalent input noise voltage	$R_S = 20\ \Omega$, See Figure 3	f = 10 Hz	28			28			$\text{nV}/\sqrt{\text{Hz}}$
			f = 10 kHz	11.6			11.6			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$R_S = 20\ \Omega$, See Figure 3	f = 10 Hz to 10 kHz	6			6			μV
			f = 0.1 Hz to 10 Hz	0.6			0.6			
I_n	Equivalent input noise current	$V_{IC} = 0$, f = 10 kHz	25°C	2.8			2.8			$\text{fA}/\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 5\text{ V}$, f = 1 kHz, $R_S = 25\ \Omega$	25°C	0.013%			0.013%			
B_1	Unity-gain bandwidth	$V_I = 10\text{ mV}$, $C_L = 25\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Figure 2	25°C	9.4			9.4			MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 4\text{ V}$, $R_L = 2\text{ k}\Omega$, $C_L = 25\text{ pF}$	25°C	2.8			2.8			MHz
ϕ_m	Phase margin at unity gain	$V_I = 10\text{ mV}$, $C_L = 25\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Figure 2	25°C	56°			56°			

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

† Full range is -55°C to 125°C .



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TLE2081M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2081M			TLE2081AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0,$ $R_S = 50 \Omega$	$V_O = 0,$	25°C	0.49	6	0.47	3	mV	
			Full range	11.2			8.2		
α_{VIO} Temperature coefficient of input offset voltage			Full range	3.2	29*	3.2	29*	$\mu V/^\circ C$	
I_{IO} Input offset current	$V_{IC} = 0,$ See Figure 4	$V_O = 0,$	25°C	6	100	6	100	pA	
			Full range	20			20		
I_{IB} Input bias current			25°C	20	175	20	175	pA	
			Full range	65			65		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$		25°C	15 to -11	15 to -11.9	15 to -11	15 to -11.9	V	
			Full range	15 to -10.8		15 to -10.8			
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200 \mu A$		25°C	13.8	14.1	13.8	14.1	V	
			Full range	13.6			13.6		
	$I_O = -2$ mA		25°C	13.5	13.9	13.5	13.9		
			Full range	13.3			13.3		
	$I_O = -20$ mA		25°C	11.5	12.3	11.5	12.3		
			Full range	11.4			11.4		
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200 \mu A$		25°C	-13.8	-14.2	-13.8	-14.2	V	
			Full range	-13.6			-13.6		
	$I_O = 2$ mA		25°C	-13.5	-14	-13.5	-14		
			Full range	-13.3			-13.3		
	$I_O = 20$ mA		25°C	-11.5	-12.4	-11.5	-12.4		
			Full range	-11.4			-11.4		
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10$ V	$R_L = 600 \Omega$	25°C	80	96	80	96	dB	
			Full range	78			78		
		$R_L = 2$ k Ω		25°C	90	109	90		109
				Full range	88				88
		$R_L = 10$ k Ω		25°C	95	118	95		118
				Full range	93				93
r_i Input resistance	$V_{IC} = 0$		25°C	10^{12}			10^{12}	Ω	
c_i Input capacitance	$V_{IC} = 0,$ See Figure 5	Common mode	25°C	7.5			7.5	pF	
		Differential	25°C	2.5			2.5		
z_o Open-loop output impedance	$f = 1$ MHz		25°C	80			80	Ω	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin},$ $V_O = 0,$ $R_S = 50 \Omega$		25°C	80	98	80	98	dB	
			Full range	78			78		
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 5$ V to ± 15 V, $V_O = 0,$ $R_S = 50 \Omega$		25°C	82	99	82	99	dB	
			Full range	80			80		

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

† Full range is $-55^\circ C$ to $125^\circ C$.



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TLE2081M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15\text{ V}$ (unless otherwise noted)(continued)

PARAMETER	TEST CONDITIONS	T_A †	TLE2081M			TLE2081AM			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
I_{CC}	Supply current	$V_O = 0$, No load	25°C	1.35	1.7	2.2	1.35	1.7	2.2	mA
			Full range	2.2			2.2			
I_{OS}	Short-circuit output current	$V_O = 0$	25°C	$V_{ID} = 1\text{ V}$	-30	-45	-30	-45	mA	
				$V_{ID} = -1\text{ V}$	30	48	30	48		

† Full range is -55°C to 125°C .

TLE2081M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15\text{ V}$

PARAMETER	TEST CONDITIONS	T_A †	TLE2081M			TLE2081AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	$V_{O(PP)} = 10\text{ V}$, $A_{VD} = -1$, $C_L = 100\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Figure 1	25°C	30	40	30	40	$\text{V}/\mu\text{s}$	
			Full range	22			22		
SR-	Negative slew rate	$V_{O(PP)} = 10\text{ V}$, $A_{VD} = -1$, $C_L = 100\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Figure 1	25°C	30	45	30	45	$\text{V}/\mu\text{s}$	
			Full range	22			22		
t_s	Settling time	$A_{VD} = -1$, 10-V step, $R_L = 1\text{ k}\Omega$, $C_L = 100\text{ pF}$	25°C	To 10 mV	0.4		0.4		μs
				To 1 mV	1.5		1.5		
V_n	Equivalent input noise voltage	$R_S = 20\ \Omega$, See Figure 3	25°C	f = 10 Hz	28		28		$\text{nV}/\sqrt{\text{Hz}}$
				f = 10 kHz	11.6		11.6		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	$R_S = 20\ \Omega$, See Figure 3	25°C	f = 10 Hz to 10 kHz	6		6		μV
				f = 0.1 Hz to 10 Hz	0.6		0.6		
I_n	Equivalent input noise current	$V_{IC} = 0$, f = 10 kHz	25°C	2.8		2.8		$\text{fA}/\sqrt{\text{Hz}}$	
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20\text{ V}$, f = 1 kHz, $R_S = 25\ \Omega$	25°C	0.008%		0.008%			
B_1	Unity-gain bandwidth	$V_I = 10\text{ mV}$, $C_L = 25\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Figure 2	25°C	8*	10	8*	10	MHz	
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)} = 20\text{ V}$, $R_L = 2\text{ k}\Omega$, $C_L = 25\text{ pF}$, $A_{VD} = -1$	25°C	478*	637	478*	637	kHz	
ϕ_m	Phase margin at unity gain	$V_I = 10\text{ mV}$, $C_L = 25\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Figure 2	25°C	57°		57°			

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

† Full range is -55°C to 125°C .



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TLE2081Y electrical characteristics at $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2081Y			UNIT
				MIN	TYP	MAX	
V_{IO}	Input offset voltage	$V_{IC} = 0$,	$V_O = 0$, $R_S = 50\ \Omega$	0.49	6		mV
I_{IO}	Input offset current	$V_{IC} = 0$,	$V_O = 0$, See Figure 4	6	100		pA
I_{IB}	Input bias current			20	175		
V_{ICR}	Common-mode input voltage range	$R_S = 50\ \Omega$		15 to -11	15 to 11.9		V
V_{OM+}	Maximum positive peak output voltage swing	$I_O = -200\ \mu\text{A}$		13.8	14.1		V
		$I_O = -2\ \text{mA}$		13.5	13.9		
		$I_O = -20\ \text{mA}$		11.5	12.3		
V_{OM-}	Maximum negative peak output voltage swing	$I_O = 200\ \mu\text{A}$		-13.8	-14.2		V
		$I_O = 2\ \text{mA}$		-13.5	-14		
		$I_O = 20\ \text{mA}$		-11.5	-12.4		
A_{VD}	Large-signal differential voltage amplification	$V_O = \pm 10\ \text{V}$	$R_L = 600\ \Omega$	80	96		dB
			$R_L = 2\ \text{k}\Omega$	90	109		
			$R_L = 10\ \text{k}\Omega$	95	118		
r_i	Input resistance	$V_{IC} = 0$		10 ¹²			Ω
c_i	Input capacitance	$V_{IC} = 0$, See Figure 5	Common mode	7.5			pF
			Differential	2.5			
z_o	Open-loop output impedance	$f = 1\ \text{MHz}$		80			Ω
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR\text{min}}$,	$V_O = 0$, $R_S = 50\ \Omega$	80	98		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 5\ \text{V}$ to $\pm 15\ \text{V}$, $V_O = 0$, $R_S = 50\ \Omega$		82	99		dB
I_{CC}	Supply current	$V_O = 0$,	No load	1.35	1.7	2.2	mA
I_{OS}	Short-circuit output current	$V_O = 0$	$V_{ID} = 1\ \text{V}$	-30	-45		mA
			$V_{ID} = -1\ \text{V}$	30	48		

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TLE2082C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2082C			TLE2082AC			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0, V_O = 0, R_S = 50 \Omega$	25°C	0.9	6		0.65	4	mV		
		Full range			8.1		5.1			
α_{VIO} Temperature coefficient of input offset voltage		Full range	2.3	25		2.3	25	$\mu V/^\circ C$		
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0, \text{See Figure 4}$	25°C	5	100		5	100	pA		
		Full range			1.4		1.4	nA		
I_{IB} Input bias current		25°C	15	175		15	175	pA		
		Full range			5		5	nA		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9	V		
		Full range	5 to -0.9			5 to -0.9				
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200 \mu A$	25°C	3.8	4.1		3.8	4.1	V		
		Full range	3.7			3.7				
	$I_O = -2 \text{ mA}$	25°C	3.5	3.9		3.5	3.9			
		Full range	3.4			3.4				
$I_O = -20 \text{ mA}$	25°C	1.5	2.3		1.5	2.3				
	Full range	1.5			1.5					
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200 \mu A$	25°C	-3.8	-4.2		-3.8	-4.2	V		
		Full range	-3.7			-3.7				
	$I_O = 2 \text{ mA}$	25°C	-3.5	-4.1		-3.5	-4.1			
		Full range	-3.4			-3.4				
$I_O = 20 \text{ mA}$	25°C	-1.5	-2.4		-1.5	-2.4				
	Full range	-1.5			-1.5					
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 2.3 \text{ V}$	$R_L = 600 \Omega$	25°C	80	91		80	91	dB	
			Full range	79			79			
		$R_L = 2 \text{ k}\Omega$	25°C	90	100		90	100		
			Full range	89			89			
		$R_L = 10 \text{ k}\Omega$	25°C	95	106		95	106		
			Full range	94			94			
r_i Input resistance	$V_{IC} = 0$	25°C	10^{12}			10^{12}			Ω	
c_i Input capacitance	Common mode	$V_{IC} = 0, \text{See Figure 5}$	25°C	11			11			pF
	Differential		25°C	2.5			2.5			
z_o Open-loop output impedance	$f = 1 \text{ MHz}$	25°C	80			80			Ω	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$	25°C	70	89		70	89	dB		
		Full range	68			68				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$	25°C	82	99		82	99	dB		
		Full range	80			80				
I_{CC} Supply current (both channels)	$V_O = 0, \text{No load}$	25°C	2.7	2.9	3.9	2.7	2.9	3.9	mA	
		Full range			3.9			3.9		

† Full range is 0°C to 70°C.



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TLE2082C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A	TLE2082C			TLE2082AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Crosstalk attenuation	$V_{IC} = 0$, $R_L = 2$ k Ω	25°C	120			120			dB
I_{OS} Short-circuit output current	$V_O = 0$	25°C	$V_{ID} = 1$ V			-35			mA
			$V_{ID} = -1$ V			45			

TLE2082C operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V

PARAMETER	TEST CONDITIONS	T_A †	TLE2082C			TLE2082AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR+ Positive slew rate	$V_{O(PP)} = \pm 2.3$ V, $A_{VD} = -1$, $R_L = 2$ k Ω , $C_L = 100$ pF, See Figure 1	25°C	35			35			V/ μ s
		Full range	22			22			
SR- Negative slew rate		25°C	38			38			V/ μ s
		Full range	22			22			
t_s Settling time	$A_{VD} = -1$, 2-V step, $R_L = 1$ k Ω , $C_L = 100$ pF	To 10 mV	0.25			0.25			μ s
		To 1 mV	0.4			0.4			
V_n Equivalent input noise voltage	$R_S = 20$ Ω , See Figure 3	f = 10 Hz	28			28			nV/ \sqrt{Hz}
		f = 10 kHz	11.6			11.6			
$V_{N(PP)}$ Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	6			6			μ V
		f = 0.1 Hz to 10 Hz	0.6			0.6			
I_n Equivalent input noise current	$V_{IC} = 0$, f = 10 kHz	25°C	2.8			2.8			fA/ \sqrt{Hz}
THD + N Total harmonic distortion plus noise	$V_{O(PP)} = 5$ V, $A_{VD} = 10$, f = 1 kHz, $R_L = 2$ k Ω , $R_S = 25$ Ω	25°C	0.013%			0.013%			
B_1 Unity-gain bandwidth	$V_I = 10$ mV, $R_L = 2$ k Ω , $C_L = 25$ pF, See Figure 2	25°C	9.4			9.4			MHz
B_{OM} Maximum output-swing bandwidth	$V_{O(PP)} = 4$ V, $A_{VD} = -1$, $R_L = 2$ k Ω , $C_L = 25$ pF	25°C	2.8			2.8			MHz
ϕ_m Phase margin at unity gain	$V_I = 10$ mV, $R_L = 2$ k Ω , $C_L = 25$ pF, See Figure 2	25°C	56°			56°			

† Full range is 0°C to 70°C.

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TLE2082C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2082C			TLE2082AC			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0,$ $R_S = 50\ \Omega$ $V_O = 0,$	25°C	1.1	7		0.7	4	mV		
		Full range			8.1		5.1			
α_{VIO} Temperature coefficient of input offset voltage		Full range	2.4	25		2.4	25	$\mu\text{V}/^\circ\text{C}$		
I_{IO} Input offset current	$V_{IC} = 0,$ $V_O = 0,$ See Figure 4	25°C	6	100		6	100	pA		
		Full range			1.4		1.4	nA		
I_{IB} Input bias current		25°C	20	175		20	175	pA		
		Full range			5		5	nA		
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	15 to -11	15 to -11.9		15 to -11	15 to -11.9	V		
		Full range	15 to -10.9			15 to -10.9				
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200\ \mu\text{A}$	25°C	13.8	14.1		13.8	14.1	V		
		Full range	13.6			13.6				
	$I_O = -2\ \text{mA}$	25°C	13.5	13.9		13.5	13.9			
		Full range	13.4			13.4				
	$I_O = -20\ \text{mA}$	25°C	11.5	12.3		11.5	12.3			
		Full range	11.5			11.5				
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200\ \mu\text{A}$	25°C	-13.8	-14.2		-13.8	-14.2	V		
		Full range	-13.7			-13.7				
	$I_O = 2\ \text{mA}$	25°C	-13.5	-14		-13.5	-14			
		Full range	-13.4			-13.4				
	$I_O = 20\ \text{mA}$	25°C	-11.5	-12.4		-11.5	-12.4			
		Full range	-11.5			-11.5				
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10\ \text{V}$	$R_L = 600\ \Omega$	25°C	80	96		80	96	dB	
			Full range	79			79			
		$R_L = 2\ \text{k}\Omega$	25°C	90	109		90	109		
			Full range	89			89			
		$R_L = 10\ \text{k}\Omega$	25°C	95	118		95	118		
			Full range	94			94			
r_i Input resistance	$V_{IC} = 0$	25°C	10^{12}			10^{12}			Ω	
c_i Input capacitance	Common mode	$V_{IC} = 0,$ See Figure 5	25°C	7.5			7.5			pF
	Differential		25°C	2.5			2.5			
z_o Open-loop output impedance	$f = 1\ \text{MHz}$	25°C	80			80			Ω	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin},$ $V_O = 0,$ $R_S = 50\ \Omega$	25°C	80	98		80	98	dB		
		Full range	79			79				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 5\ \text{V}$ to $\pm 15\ \text{V},$ $V_O = 0,$ $R_S = 50\ \Omega$	25°C	82	99		82	99	dB		
		Full range	81			81				

† Full range is 0°C to 70°C.



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TLE2082C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A	TLE2082C			TLE2082AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC} Supply current (both channels)	$V_O = 0$, No load	25°C	2.7	3.1	3.9	2.7	3.1	3.9	mA
		Full range	3.9			3.9			
Crosstalk attenuation	$V_{IC} = 0$, $R_L = 2$ k Ω	25°C	120			120			dB
I_{OS} Short-circuit output current	$V_O = 0$	25°C	$V_{ID} = 1$ V	-30	-45	-30	-45	mA	
			$V_{ID} = -1$ V	30	48	30	48		

TLE2082C operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER	TEST CONDITIONS	T_A †	TLE2082C			TLE2082AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR+ Positive slew rate	$V_{O(PP)} = 10$ V, $A_{VD} = -1$, $R_L = 2$ k Ω , $C_L = 100$ pF, See Figure 1	25°C	28	40		28	40	V/ μ s	
		Full range	25			25			
SR- Negative slew rate		25°C	30	45		30	45	V/ μ s	
		Full range	25			25			
t_s Settling time	$A_{VD} = -1$, 10-V step, $R_L = 1$ k Ω , $C_L = 100$ pF	25°C	To 10 mV	0.4		0.4		μ s	
			To 1 mV	1.5		1.5			
V_n Equivalent input noise voltage	$R_S = 20$ Ω , See Figure 3	25°C	f = 10 Hz	28		28		nV/ \sqrt{Hz}	
			f = 10 kHz	11.6		11.6			
$V_{N(PP)}$ Peak-to-peak equivalent input noise voltage		25°C	f = 10 Hz to 10 kHz	6		6		μ V	
			f = 0.1 Hz to 10 Hz	0.6		0.6			
I_n Equivalent input noise current	$V_{IC} = 0$, f = 10 kHz	25°C	2.8		2.8		fA/ \sqrt{Hz}		
THD + N Total harmonic distortion plus noise	$V_{O(PP)} = 20$ V, $A_{VD} = 10$, f = 1 kHz, $R_L = 2$ k Ω , $R_S = 25$ Ω	25°C	0.008%		0.008%				
B_1 Unity-gain bandwidth	$V_I = 10$ mV, $R_L = 2$ k Ω , $C_L = 25$ pF, See Figure 2	25°C	8	10	8	10	MHz		
B_{OM} Maximum output-swing bandwidth	$V_{O(PP)} = 20$ V, $A_{VD} = -1$, $R_L = 2$ k Ω , $C_L = 25$ pF	25°C	478	637	478	637	kHz		
ϕ_m Phase margin at unity gain	$V_I = 10$ mV, $R_L = 2$ k Ω , $C_L = 25$ pF, See Figure 2	25°C	57°		57°				

† Full range is 0°C to 70°C.



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TLE2082I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2082I			TLE2082AI			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0, V_O = 0, R_S = 50\ \Omega$	25°C	0.9	7		0.65	4	mV		
		Full range			8.5		5.5			
α_{VIO} Temperature coefficient of input offset voltage		Full range	2.4	25		2.4	25	$\mu\text{V}/^\circ\text{C}$		
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0, \text{See Figure 4}$	25°C	5	100		5	100	pA		
		Full range			5		5	nA		
I_{IB} Input bias current		25°C	15	175		15	175	pA		
		Full range			10		10	nA		
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9	V		
		Full range	5 to -0.8			5 to -0.8				
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200\ \mu\text{A}$	25°C	3.8	4.1		3.8	4.1	V		
		Full range	3.7			3.7				
	$I_O = -2\ \text{mA}$	25°C	3.5	3.9		3.5	3.9			
		Full range	3.4			3.4				
	$I_O = -20\ \text{mA}$	25°C	1.5	2.3		1.5	2.3			
		Full range	1.5			1.5				
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200\ \mu\text{A}$	25°C	-3.8	-4.2		-3.8	-4.2	V		
		Full range	-3.7			-3.7				
	$I_O = 2\ \text{mA}$	25°C	-3.5	-4.1		-3.5	-4.1			
		Full range	-3.4			-3.4				
	$I_O = 20\ \text{mA}$	25°C	-1.5	-2.4		-1.5	-2.4			
		Full range	-1.5			-1.5				
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 2.3\ \text{V}$	$R_L = 600\ \Omega$	25°C	80	91		80	91	dB	
			Full range	79			79			
		$R_L = 2\ \text{k}\Omega$	25°C	90	100		90	100		
			Full range	89			89			
		$R_L = 10\ \text{k}\Omega$	25°C	95	106		95	106		
			Full range	94			94			
r_i Input resistance	$V_{IC} = 0$	25°C	10^{12}			10^{12}			Ω	
c_i Input capacitance	Common mode	$V_{IC} = 0,$	25°C	11			11			pF
	Differential	See Figure 5	25°C	2.5			2.5			
z_o Open-loop output impedance	$f = 1\ \text{MHz}$	25°C	80			80			Ω	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50\ \Omega$	25°C	70	89		70	89	dB		
		Full range	68			68				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 5\ \text{V to } \pm 15\ \text{V}, V_O = 0, R_S = 50\ \Omega$	25°C	82	99		82	99	dB		
		Full range	80			80				
I_{CC} Supply current (both channels)	$V_O = 0, \text{No load}$	25°C	2.7	2.9	3.9	2.7	2.9	3.9	mA	
		Full range			3.9			3.9		

† Full range is -40°C to 85°C .



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TLE2082I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A	TLE2082I			TLE2082AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Crosstalk attenuation	$V_{IC} = 0$, $R_L = 2\text{ k}\Omega$	25°C	120			120			dB
I_{OS} Short-circuit output current	$V_O = 0$	25°C	$V_{ID} = 1\text{ V}$			-35			mA
			$V_{ID} = -1\text{ V}$			45			

TLE2082I operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$

PARAMETER	TEST CONDITIONS	T_A †	TLE2082I			TLE2082AI			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
SR+ Positive slew rate	$V_{O(PP)} = \pm 2.3\text{ V}$, $A_{VD} = -1$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$, See Figure 1	25°C	35			35			$\text{V}/\mu\text{s}$	
		Full range	20			20				
SR- Negative slew rate	$V_{O(PP)} = \pm 2.3\text{ V}$, $A_{VD} = -1$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$, See Figure 1	25°C	38			38			$\text{V}/\mu\text{s}$	
		Full range	20			20				
t_s Settling time	$A_{VD} = -1$, 2-V step, $R_L = 1\text{ k}\Omega$, $C_L = 100\text{ pF}$	25°C	To 10 mV			0.25			μs	
			To 1 mV			0.4				
V_n Equivalent input noise voltage	$R_S = 20\ \Omega$, See Figure 3	25°C	f = 10 Hz			28			$\text{nV}/\sqrt{\text{Hz}}$	
			f = 10 kHz			11.6				
$V_{N(PP)}$ Peak-to-peak equivalent input noise voltage	$R_S = 20\ \Omega$, See Figure 3	25°C	f = 10 Hz to 10 kHz			6			μV	
			f = 0.1 Hz to 10 Hz			0.6				
I_n Equivalent input noise current	$V_{IC} = 0$, f = 10 kHz	25°C	2.8			2.8			$\text{fA}/\sqrt{\text{Hz}}$	
THD + N Total harmonic distortion plus noise	$V_{O(PP)} = 5\text{ V}$, f = 1 kHz, $R_S = 25\ \Omega$	$A_{VD} = 10$, $R_L = 2\text{ k}\Omega$	25°C	0.013%			0.013%			
B_1 Unity-gain bandwidth	$V_I = 10\text{ mV}$, $C_L = 25\text{ pF}$	$R_L = 2\text{ k}\Omega$, See Figure 2	25°C	9.4			9.4			MHz
B_{OM} Maximum output-swing bandwidth	$V_{O(PP)} = 4\text{ V}$, $R_L = 2\text{ k}\Omega$	$A_{VD} = -1$, $C_L = 25\text{ pF}$	25°C	2.8			2.8			MHz
ϕ_m Phase margin at unity gain	$V_I = 10\text{ mV}$, $C_L = 25\text{ pF}$	$R_L = 2\text{ k}\Omega$, See Figure 2	25°C	56°			56°			

† Full range is 40°C to 85°C.

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TLE2082I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2082I			TLE2082AI			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0,$ $R_S = 50 \Omega$ $V_O = 0,$	25°C	1.1	7		0.7	4	mV		
		Full range			8.5		5.5			
α_{VIO} Temperature coefficient of input offset voltage		Full range	2.4	25		2.4	25	$\mu V/^\circ C$		
I_{IO} Input offset current	$V_{IC} = 0,$ $V_O = 0,$ See Figure 4	25°C	6	100		6	100	pA		
		Full range			5		5	nA		
I_{IB} Input bias current		25°C	20	175		20	175	pA		
		Full range			10		10	nA		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	15 to -11	15 to -11.9		15 to -11	15 to -11.9	V		
		Full range	15 to -10.8			15 to -10.8				
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200 \mu A$	25°C	13.8	14.1		13.8	14.1	V		
		Full range	13.7			13.7				
	$I_O = -2$ mA	25°C	13.5	13.9		13.5	13.9			
		Full range	13.4			13.4				
	$I_O = -20$ mA	25°C	11.5	12.3		11.5	12.3			
		Full range	11.5			11.5				
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200 \mu A$	25°C	-13.8	-14.2		-13.8	-14.2	V		
		Full range	-13.7			-13.7				
	$I_O = 2$ mA	25°C	-13.5	-14		-13.5	-14			
		Full range	-13.4			-13.4				
	$I_O = 20$ mA	25°C	-11.5	-12.4		-11.5	-12.4			
		Full range	-11.5			-11.5				
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10$ V	$R_L = 600 \Omega$	25°C	80	96		80	96	dB	
			Full range	79			79			
		$R_L = 2$ k Ω	25°C	90	109		90	109		
			Full range	89			89			
		$R_L = 10$ k Ω	25°C	95	118		95	118		
			Full range	94			94			
r_i Input resistance	$V_{IC} = 0$	25°C	10^{12}			10^{12}			Ω	
c_i Input capacitance	Common mode	$V_{IC} = 0,$ See Figure 5	25°C	7.5			7.5			pF
	Differential		25°C	2.5			2.5			
z_o Open-loop output impedance	$f = 1$ MHz	25°C	80			80			Ω	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin},$ $V_O = 0,$ $R_S = 50 \Omega$	25°C	80	98		80	98	dB		
		Full range	79			79				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 5$ V to ± 15 V, $V_O = 0,$ $R_S = 50 \Omega$	25°C	82	99		82	99	dB		
		Full range	80			80				

† Full range is $-40^\circ C$ to $85^\circ C$.



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TLE2082I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A	TLE2082I			TLE2082AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC} Supply current (both channels)	$V_O = 0$, No load	25°C	2.7	3.1	3.9	2.7	3.1	3.9	mA
		Full range	3.9			3.9			
Crosstalk attenuation	$V_{IC} = 0$, $R_L = 2$ k Ω	25°C	120			120			dB
I_{OS} Short-circuit output current	$V_O = 0$	25°C	$V_{ID} = 1$ V	-30	-45	-30	-45	mA	
			$V_{ID} = -1$ V	30	48	30	48		

TLE2082I operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER	TEST CONDITIONS	T_A †	TLE2082I			TLE2082AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR+ Positive slew rate	$V_{O(PP)} = 10$ V, $A_{VD} = -1$, $R_L = 2$ k Ω , $C_L = 100$ pF, See Figure 1	25°C	28	40		28	40	V/ μ s	
		Full range	22			22			
SR- Negative slew rate		25°C	30	45		30	45	V/ μ s	
		Full range	22			22			
t_s Settling time	$A_{VD} = -1$, 10-V step, $R_L = 1$ k Ω , $C_L = 100$ pF	25°C	To 10 mV	0.4		0.4		μ s	
			To 1 mV	1.5		1.5			
V_n Equivalent input noise voltage	$R_S = 20$ Ω , See Figure 3	25°C	f = 10 Hz	28		28		nV/ \sqrt{Hz}	
			f = 10 kHz	11.6		11.6			
$V_{N(PP)}$ Peak-to-peak equivalent input noise voltage		25°C	f = 10 Hz to 10 kHz	6		6		μ V	
			f = 0.1 Hz to 10 Hz	0.6		0.6			
I_n Equivalent input noise current	$V_{IC} = 0$, f = 10 kHz	25°C	2.8		2.8		fA/ \sqrt{Hz}		
THD + N Total harmonic distortion plus noise	$V_{O(PP)} = 20$ V, $A_{VD} = 10$, f = 1 kHz, $R_L = 2$ k Ω , $R_S = 25$ Ω	25°C	0.008%		0.008%				
B_1 Unity-gain bandwidth	$V_I = 10$ mV, $R_L = 2$ k Ω , $C_L = 25$ pF, See Figure 2	25°C	8	10	8	10	MHz		
B_{OM} Maximum output-swing bandwidth	$V_{O(PP)} = 20$ V, $A_{VD} = -1$, $R_L = 2$ k Ω , $C_L = 25$ pF	25°C	478	637	478	637	kHz		
ϕ_m Phase margin at unity gain	$V_I = 10$ mV, $R_L = 2$ k Ω , $C_L = 25$ pF, See Figure 2	25°C	57°		57°				

† Full range is -40°C to 85°C.

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TLE2082M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2082M			TLE2082AM			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0, V_O = 0, R_S = 50\ \Omega$	25°C	0.9	7		0.65	4	mV		
		Full range			9.5		6.5			
α_{VIO} Temperature coefficient of input offset voltage		Full range	2.3	25*		2.3	25*	$\mu\text{V}/^\circ\text{C}$		
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0, \text{See Figure 4}$	25°C	5	100		5	100	pA		
		Full range			20		20	nA		
I_{IB} Input bias current		25°C	15	175		15	175	pA		
		Full range			60		60	nA		
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9	V		
		Full range	5 to -0.8			5 to -0.8				
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200\ \mu\text{A}$	25°C	3.8	4.1		3.8	4.1	V		
		Full range	3.6			3.6				
	$I_O = -2\ \text{mA}$	25°C	3.5	3.9		3.5	3.9			
		Full range	3.3			3.3				
$I_O = -20\ \text{mA}$	25°C	1.5	2.3		1.5	2.3				
	Full range	1.4			1.4					
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200\ \mu\text{A}$	25°C	-3.8	-4.2		-3.8	-4.2	V		
		Full range	-3.6			-3.6				
	$I_O = 2\ \text{mA}$	25°C	-3.5	-4.1		-3.5	-4.1			
		Full range	-3.3			-3.3				
$I_O = 20\ \text{mA}$	25°C	-1.5	-2.4		-1.5	-2.4				
	Full range	-1.4			-1.4					
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 2.3\ \text{V}$	$R_L = 600\ \Omega$	25°C	80	91		80	91	dB	
			Full range	78			78			
		$R_L = 2\ \text{k}\Omega$	25°C	90	100		90	100		
			Full range	88			88			
		$R_L = 10\ \text{k}\Omega$	25°C	95	106		95	106		
			Full range	93			93			
r_i Input resistance	$V_{IC} = 0$	25°C	10^{12}			10^{12}			Ω	
c_i Input capacitance	Common mode	$V_{IC} = 0, \text{See Figure 5}$	25°C	11			11			pF
	Differential		25°C	2.5			2.5			
z_o Open-loop output impedance	$f = 1\ \text{MHz}$	25°C	80			80			Ω	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICR\text{min}}, V_O = 0, R_S = 50\ \Omega$	25°C	70	89		70	89	dB		
		Full range	68			68				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 5\ \text{V to } \pm 15\ \text{V}, V_O = 0, R_S = 50\ \Omega$	25°C	82	99		82	99	dB		
		Full range	80			80				

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

† Full range is -55°C to 125°C .



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TLE2082M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A †	TLE2082M			TLE2082AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC} Supply current (both channels)	$V_O = 0$, No load	25°C	2.7	2.9	3.6	2.7	2.9	3.6	mA
		Full range	3.6			3.6			
Crosstalk attenuation	$V_{IC} = 0$, $R_L = 2$ k Ω	25°C	120			120			dB
I_{OS} Short-circuit output current	$V_O = 0$	25°C	$V_{ID} = 1$ V			–35			mA
			$V_{ID} = -1$ V			45			

† Full range is –55°C to 125°C.

TLE2082M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V

PARAMETER	TEST CONDITIONS	T_A †	TLE2082M			TLE2082AM			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
SR+ Positive slew rate	$V_{O(PP)} = \pm 2.3$ V, $A_{VD} = -1$, $R_L = 2$ k Ω , $C_L = 100$ pF, See Figure 1	25°C	35			35			V/ μ s	
		Full range	18*			18*				
SR– Negative slew rate	$V_{O(PP)} = \pm 2.3$ V, $A_{VD} = -1$, $R_L = 2$ k Ω , $C_L = 100$ pF, See Figure 1	25°C	38			38			V/ μ s	
		Full range	18*			18*				
t_s Settling time	$A_{VD} = -1$, 2-V step, $R_L = 1$ k Ω , $C_L = 100$ pF	25°C	To 10 mV			0.25			μ s	
			To 1 mV			0.4				
V_n Equivalent input noise voltage	$R_S = 20$ Ω , See Figure 3	25°C	f = 10 Hz			28			nV/ \sqrt{Hz}	
			f = 10 kHz			11.6				
$V_{N(PP)}$ Peak-to-peak equivalent input noise voltage	$R_S = 20$ Ω , See Figure 3	25°C	f = 10 Hz to 10 kHz			6			μ V	
			f = 0.1 Hz to 10 Hz			0.6				
I_n Equivalent input noise current	$V_{IC} = 0$, f = 10 kHz	25°C	2.8			2.8			fA/ \sqrt{Hz}	
THD + N Total harmonic distortion plus noise	$V_{O(PP)} = 5$ V, f = 1 kHz, $R_S = 25$ Ω	$A_{VD} = 10$, $R_L = 2$ k Ω	25°C	0.013%			0.013%			
B_1 Unity-gain bandwidth	$V_I = 10$ mV, $C_L = 25$ pF,	$R_L = 2$ k Ω , See Figure 2	25°C	9.4			9.4			MHz
B_{OM} Maximum output-swing bandwidth	$V_{O(PP)} = 4$ V, $R_L = 2$ k Ω ,	$A_{VD} = -1$, $C_L = 25$ pF	25°C	2.8			2.8			MHz
ϕ_m Phase margin at unity gain	$V_I = 10$ mV, $C_L = 25$ pF,	$R_L = 2$ k Ω , See Figure 2	25°C	56°			56°			

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

† Full range is –55°C to 125°C.

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TLE2082M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2082M			TLE2082AM			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0, V_O = 0, R_S = 50 \Omega$	25°C	1.1	7		0.7	4	mV		
		Full range			9.5		6.5			
α_{VIO} Temperature coefficient of input offset voltage		Full range	2.4	25*		2.4	25*	$\mu V/^\circ C$		
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0, \text{See Figure 4}$	25°C	6	100		6	100	pA		
		Full range			20		20	nA		
I_{IB} Input bias current		25°C	20	175		20	175	pA		
		Full range			65		65	nA		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	15 to -11	15 to -11.9		15 to -11	15 to -11.9	V		
		Full range	15 to -10.8			15 to -10.8				
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200 \mu A$	25°C	13.8	14.1		13.8	14.1	V		
		Full range	13.6			13.6				
	$I_O = -2 \text{ mA}$	25°C	13.5	13.9		13.5	13.9			
		Full range	13.3			13.3				
	$I_O = -20 \text{ mA}$	25°C	11.5	12.3		11.5	12.3			
		Full range	11.4			11.4				
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200 \mu A$	25°C	-13.8	-14.2		-13.8	-14.2	V		
		Full range	-13.6			-13.6				
	$I_O = 2 \text{ mA}$	25°C	-13.5	-14		-13.5	-14			
		Full range	-13.3			-13.3				
	$I_O = 20 \text{ mA}$	25°C	-11.5	-12.4		-11.5	-12.4			
		Full range	-11.4			-11.4				
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10 \text{ V}$	$R_L = 600 \Omega$	25°C	80	96		80	96	dB	
			Full range	78			78			
		$R_L = 2 \text{ k}\Omega$	25°C	90	109		90	109		
			Full range	88			88			
		$R_L = 10 \text{ k}\Omega$	25°C	95	118		95	118		
			Full range	93			93			
r_i Input resistance	$V_{IC} = 0$	25°C	10^{12}			10^{12}			Ω	
c_i Input capacitance	Common mode	$V_{IC} = 0, \text{See Figure 5}$	25°C	7.5			7.5			pF
	Differential		25°C	2.5			2.5			
z_o Open-loop output impedance	$f = 1 \text{ MHz}$	25°C	80			80			Ω	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$	25°C	80	98		80	98	dB		
		Full range	78			78				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$	25°C	82	99		82	99	dB		
		Full range	80			80				

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

† Full range is $-55^\circ C$ to $125^\circ C$.



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TLE2082M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)
(continued)

PARAMETER	TEST CONDITIONS	T_A †	TLE2082M			TLE2082AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC}	Supply current (both channels) $V_O = 0$, No load	25°C	2.7	3.1	3.6	2.7	3.1	3.6	mA
		Full range	3.6			3.6			
	Crosstalk attenuation	$V_{IC} = 0$, $R_L = 2$ k Ω	120			120			dB
I_{OS}	Short-circuit output current $V_O = 0$	$V_{ID} = 1$ V	–30	–45		–30	–45		mA
		$V_{ID} = -1$ V	30	48		30	48		

† Full range is –55°C to 125°C.

TLE2082M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER	TEST CONDITIONS	T_A †	TLE2082M			TLE2082AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate $V_{O(PP)} = 10$ V, $A_{VD} = -1$, $R_L = 2$ k Ω , $C_L = 100$ pF, See Figure 1	25°C	28	40		28	40		V/ μ s
		Full range	20			20			
SR–	Negative slew rate	25°C	30	45		30	45		V/ μ s
		Full range	20			20			
t_s	Settling time $A_{VD} = -1$, 10-V step, $R_L = 1$ k Ω , $C_L = 100$ pF	25°C	To 10 mV			0.4			μ s
			To 1 mV			1.5			
V_n	Equivalent input noise voltage $R_S = 20$ Ω , See Figure 3	25°C	f = 10 Hz			28			nV/ \sqrt{Hz}
			f = 10 kHz			11.6			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	25°C	f = 10 Hz to 10 kHz			6			μ V
			f = 0.1 Hz to 10 Hz			0.6			
I_n	Equivalent input noise current $V_{IC} = 0$, f = 10 kHz	25°C	2.8			2.8			fA/ \sqrt{Hz}
THD + N	Total harmonic distortion plus noise $V_{O(PP)} = 20$ V, $A_{VD} = 10$, f = 1 kHz, $R_L = 2$ k Ω , $R_S = 25$ Ω	25°C	0.008%			0.008%			
B_1	Unity-gain bandwidth $V_I = 10$ mV, $R_L = 2$ k Ω , $C_L = 25$ pF, See Figure 2	25°C	8*	10		8*	10		MHz
B_{OM}	Maximum output-swing bandwidth $V_{O(PP)} = 20$ V, $A_{VD} = -1$, $R_L = 2$ k Ω , $C_L = 25$ pF	25°C	478*	637		478*	637		kHz
ϕ_m	Phase margin at unity gain $V_I = 10$ mV, $R_L = 2$ k Ω , $C_L = 25$ pF, See Figure 2	25°C	57°			57°			

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

† Full range is –55°C to 125°C.



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TLE2082Y electrical characteristics at $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TLE2082Y			UNIT	
				MIN	TYP	MAX		
V_{IO}	Input offset voltage	$V_{IC} = 0$,	$V_O = 0$,	$R_S = 50\ \Omega$	1.1	6	mV	
I_{IO}	Input offset current	$V_{IC} = 0$,	$V_O = 0$,	See Figure 4	6	100	pA	
I_{IB}	Input bias current				20	175	pA	
V_{ICR}	Common-mode input voltage range	$R_S = 50\ \Omega$		15 to -11	15 to 11.9		V	
V_{OM+}	Maximum positive peak output voltage swing	$I_O = -200\ \mu\text{A}$		13.8	14.1	V		
		$I_O = -2\ \text{mA}$		13.5	13.9			
		$I_O = -20\ \text{mA}$		11.5	12.3			
V_{OM-}	Maximum negative peak output voltage swing	$I_O = 200\ \mu\text{A}$		-13.8	-14.2	V		
		$I_O = 2\ \text{mA}$		-13.5	-14			
		$I_O = 20\ \text{mA}$		-11.5	-12.4			
A_{VD}	Large-signal differential voltage amplification	$V_O = \pm 10\ \text{V}$	$R_L = 600\ \Omega$	80	96	dB		
			$R_L = 2\ \text{k}\Omega$	90	109			
			$R_L = 10\ \text{k}\Omega$	95	118			
r_i	Input resistance	$V_{IC} = 0$		10 ¹²		Ω		
c_i	Input capacitance	Common mode	$V_O = 0$,	See Figure 5	7.5		pF	
		Differential			2.5			
z_o	Open-loop output impedance	$f = 1\ \text{MHz}$		80		Ω		
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$,	$V_O = 0$,	$R_S = 50\ \Omega$	80	98	dB	
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 5\ \text{V}$ to $\pm 15\ \text{V}$,		$V_O = 0$,	82	99	dB	
I_{CC}	Supply current (both channels)	$V_O = 0$,	No load		2.7	3.1	3.9	mA
I_{OS}	Short-circuit output current	$V_O = 0$	$V_{ID} = 1\ \text{V}$	-30	-45	mA		
			$V_{ID} = -1\ \text{V}$	30	48			



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TLE2084C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2084C			TLE2084AC			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0, V_O = 0, R_S = 50 \Omega$	25°C	-1.6		7	-0.5		4	mV	
		Full range			9.1			6.1		
α_{VIO} Temperature coefficient of input offset voltage		Full range		10.1	30		10.1	30	$\mu V/^\circ C$	
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0, \text{See Figure 4}$	25°C		15	100		15	100	pA	
		Full range			1.4			1.4	nA	
I_{IB} Input bias current		25°C		20	175		20	175	pA	
		Full range			5			5	nA	
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9		V	
		Full range	5 to -0.9			5 to -0.9				
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200 \mu A$	25°C	3.8	4.1		3.8	4.1		V	
		Full range	3.7			3.7				
	$I_O = -2 \text{ mA}$	25°C	3.5	3.9		3.5	3.9			
		Full range	3.4			3.4				
	$I_O = -20 \text{ mA}$	25°C	1.5	2.3		1.5	2.3			
		Full range	1.5			1.5				
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200 \mu A$	25°C	-3.8	-4.2		-3.8	-4.2		V	
		Full range	-3.7			-3.7				
	$I_O = 2 \text{ mA}$	25°C	-3.5	-4.1		-3.5	-4.1			
		Full range	-3.4			-3.4				
	$I_O = 20 \text{ mA}$	25°C	-1.5	-2.4		-1.5	-2.4			
		Full range	-1.5			-1.5				
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 2.3 \text{ V}$	$R_L = 600 \Omega$	25°C	80	91		80	91	dB	
			Full range	79			79			
		$R_L = 2 \text{ k}\Omega$	25°C	90	100		90	100		
			Full range	89			89			
		$R_L = 10 \text{ k}\Omega$	25°C	95	106		95	106		
			Full range	94			94			
r_i Input resistance	$V_{IC} = 0$	25°C		10^{12}		10^{12}		Ω		
c_i Input capacitance	$V_{IC} = 0, \text{See Figure 5}$	Common mode	25°C		11		11	pF		
		Differential	25°C		2.5		2.5			
z_o Open-loop output impedance	$f = 1 \text{ MHz}$	25°C		80		80		Ω		
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$	25°C	70	89		70	89	dB		
		Full range	68			68				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$	25°C	82	99		82	99	dB		
		Full range	80			80				
I_{CC} Supply current (four amplifiers)	$V_O = 0, \text{No load}$	25°C	5.2	6.3	7.5	5.2	6.3	7.5	mA	
		Full range			7.5			7.5		
a_x Crosstalk attenuation	$V_{IC} = 0, R_L = 2 \text{ k}\Omega$	25°C		120			120	dB		

† Full range is 0°C to 70°C.



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TLE2084C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A †	TLE2084C			TLE2084AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{OS}	Short-circuit output current $V_O = 0$	25°C	$V_{ID} = 1\text{ V}$			-35			mA
			$V_{ID} = -1\text{ V}$			45			

† Full range is 0°C to 70°C.

TLE2084C operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$

PARAMETER	TEST CONDITIONS	T_A †	TLE2084C			TLE2084AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate $V_{O(PP)} = \pm 2.3\text{ V}$, $A_{VD} = -1$, $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$, See Figure 1	25°C	35			35			$\text{V}/\mu\text{s}$
		Full range	22			22			
SR-	Negative slew rate	25°C	38			38			$\text{V}/\mu\text{s}$
		Full range	22			22			
t_s	Settling time $A_{VD} = -1$, 2-V step, $R_L = 1\text{ k}\Omega$, $C_L = 100\text{ pF}$	25°C	To 10 mV			0.25			μs
			To 1 mV			0.4			
V_n	Equivalent input noise voltage $R_S = 20\ \Omega$, See Figure 3	25°C	f = 10 Hz			28			$\text{nV}/\sqrt{\text{Hz}}$
			f = 10 kHz			11.6			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	25°C	f = 10 Hz to 10 kHz			6			μV
			f = 0.1 Hz to 10 Hz			0.6			
I_n	Equivalent input noise current $V_{IC} = 0$, f = 10 kHz	25°C	2.8			2.8			$\text{fA}/\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion plus noise $V_{O(PP)} = 5\text{ V}$, f = 1 kHz, $R_S = 25\ \Omega$, $A_{VD} = 10$, $R_L = 2\text{ k}\Omega$	25°C	0.013%			0.013%			
B_1	Unity-gain bandwidth $V_I = 10\text{ mV}$, $C_L = 25\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Figure 2	25°C	9.4			9.4			MHz
BOM	Maximum output-swing bandwidth $V_{O(PP)} = 4\text{ V}$, $R_L = 2\text{ k}\Omega$, $A_{VD} = -1$, $C_L = 25\text{ pF}$	25°C	2.8			2.8			MHz
ϕ_m	Phase margin at unity gain $V_I = 10\text{ mV}$, $C_L = 25\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Figure 2	25°C	56°			56°			

† Full range is 0°C to 70°C.



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TLE2084C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2084C			TLE2084AC			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0, V_O = 0, R_S = 50 \Omega$	25°C	-1.6	7		-0.5	4	mV		
		Full range			9.1		6.1			
α_{VIO} Temperature coefficient of input offset voltage		Full range	10.1	30		10.1	30	$\mu V/^\circ C$		
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0, \text{See Figure 4}$	25°C	15	100		15	100	pA		
		Full range			1.4		1.4	nA		
I_{IB} Input bias current		25°C	25	175		25	175	pA		
		Full range			5		5	nA		
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	15 to -11	15 to -11.9		15 to -11	15 to -11.9	V		
		Full range	15 to -10.9			15 to -10.9				
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200 \mu A$	25°C	13.8	14.1		13.8	14.1	V		
		Full range	13.7			13.7				
	$I_O = -2 \text{ mA}$	25°C	13.5	13.9		13.5	13.9			
		Full range	13.4			13.4				
	$I_O = -20 \text{ mA}$	25°C	11.5	12.3		11.5	12.3			
		Full range	11.5			11.5				
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200 \mu A$	25°C	-13.8	-14.2		-13.8	-14.2	V		
		Full range	-13.7			-13.7				
	$I_O = 2 \text{ mA}$	25°C	-13.7	-14		-13.7	-14			
		Full range	-13.6			-13.6				
	$I_O = 20 \text{ mA}$	25°C	-11.5	-12.4		-11.5	-12.4			
		Full range	-11.5			-11.5				
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10 \text{ V}$	$R_L = 600 \Omega$	25°C	80	96		80	96	dB	
			Full range	79			79			
		$R_L = 2 \text{ k}\Omega$	25°C	90	109		90	109		
			Full range	89			89			
		$R_L = 10 \text{ k}\Omega$	25°C	95	118		95	118		
			Full range	94			94			
r_i Input resistance	$V_{IC} = 0$	25°C	10^{12}			10^{12}			Ω	
c_i Input capacitance	$V_{IC} = 0, \text{See Figure 5}$	Common mode	25°C	7.5			7.5			pF
		Differential	25°C	2.5			2.5			
z_o Open-loop output impedance	$f = 1 \text{ MHz}$	25°C	80			80			Ω	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$	25°C	80	98		80	98	dB		
		Full range	79			79				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$	25°C	82	99		82	99	dB		
		Full range	81			81				
I_{CC} Supply current (four amplifiers)	$V_O = 0, \text{No load}$	25°C	5.2	6.5	7.5	5.2	6.5	7.5	mA	
		Full range			7.5			7.5		
a_x Crosstalk attenuation	$V_{IC} = 0, R_L = 2 \text{ k}\Omega$	25°C	120			120			dB	

† Full range is 0°C to 70°C.



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TLE2084C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15\text{ V}$ (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A †	TLE2084C			TLE2084AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{OS}	Short-circuit output current $V_O = 0$	25°C	$V_{ID} = 1\text{ V}$		-30 -45		-30 -45		mA
			$V_{ID} = -1\text{ V}$		30 48		30 48		

† Full range is 0°C to 70°C.

TLE2084C operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15\text{ V}$

PARAMETER	TEST CONDITIONS	T_A †	TLE2084C			TLE2084AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	25°C	25 40		25 40		V/μs		
			Full range		22				
SR-	Negative slew rate	25°C	30 45		30 45		V/μs		
			Full range		25				
t_s	Settling time	25°C	To 10 mV		0.4		0.4		μs
			To 1 mV		1.5		1.5		
V_n	Equivalent input noise voltage	25°C	f = 10 Hz		28		28		nV/√Hz
			f = 10 kHz		11.6		11.6		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	25°C	f = 10 Hz to 10 kHz		6		6		μV
			f = 0.1 Hz to 10 Hz		0.6		0.6		
I_n	Equivalent input noise current	25°C	2.8		2.8		fA/√Hz		
THD + N	Total harmonic distortion plus noise	25°C	0.008%		0.008%				
B_1	Unity-gain bandwidth	25°C	8 10		8 10		MHz		
B_{OM}	Maximum output-swing bandwidth	25°C	478 637		478 637		kHz		
ϕ_m	Phase margin at unity gain	25°C	57°		57°				

† Full range is 0°C to 70°C.



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TLE2084M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2084M			TLE2084AM			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V_{IO} Input offset voltage	$V_{IC} = 0, V_O = 0,$ $R_S = 50\ \Omega$	25°C	-1.6	7		-0.5	4	mV		
		Full range			12.5		9.5			
α_{VIO} Temperature coefficient of input offset voltage		Full range	10.1	30*		10.1	30*	$\mu\text{V}/^\circ\text{C}$		
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0,$ See Figure 4	25°C	15	100		15	100	pA		
		Full range			20		20	nA		
I_{IB} Input bias current		25°C	20	175		20	175	pA		
		Full range			65		65	nA		
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9	V		
		Full range	5 to -0.8			5 to -0.8				
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200\ \mu\text{A}$	25°C	3.8	4.1		3.8	4.1	V		
		Full range	3.6			3.6				
	$I_O = -2\ \text{mA}$	25°C	3.5	3.9		3.5	3.9			
		Full range	3.3			3.3				
	$I_O = -20\ \text{mA}$	25°C	1.5	2.3		1.5	2.3			
		Full range	1.4			1.4				
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200\ \mu\text{A}$	25°C	-3.8	-4.2		-3.8	-4.2	V		
		Full range	-3.6			-3.6				
	$I_O = 2\ \text{mA}$	25°C	-3.5	-4.1		-3.5	-4.1			
		Full range	-3.3			-3.3				
	$I_O = 20\ \text{mA}$	25°C	-1.5	-2.4		-1.5	-2.4			
		Full range	-1.4			-1.4				
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 2.3\ \text{V}$	$R_L = 600\ \Omega$	25°C	80	91		80	91	dB	
			Full range	78			78			
		$R_L = 2\ \text{k}\Omega$	25°C	90	100		90	100		
			Full range	88			88			
		$R_L = 10\ \text{k}\Omega$	25°C	95	106		95	106		
			Full range	93			93			
r_i Input resistance	$V_{IC} = 0$	25°C	10^{12}			10^{12}			Ω	
c_i Input capacitance	$V_{IC} = 0,$ See Figure 5	Common mode	25°C	11			11			pF
		Differential	25°C	2.5			2.5			
z_o Open-loop output impedance	$f = 1\ \text{MHz}$	25°C	80			80			Ω	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICR\text{min}},$ $V_O = 0, R_S = 50\ \Omega$	25°C	70	89		70	89	dB		
		Full range	68			68				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 5\ \text{V}$ to $\pm 15\ \text{V},$ $V_O = 0, R_S = 50\ \Omega$	25°C	82	99		82	99	dB		
		Full range	80			80				
I_{CC} Supply current (four amplifiers)	$V_O = 0,$ No load	25°C	5.2	6.3	7.5	5.2	6.3	7.5	mA	
		Full range			7.5			7.5		
a_x Crosstalk attenuation	$V_{IC} = 0, R_L = 2\ \text{k}\Omega$	25°C	120			120			dB	

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

† Full range is -55°C to 125°C .



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TLE2084M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A	TLE2084M			TLE2084AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{OS}	Short-circuit output current $V_O = 0$	25°C	$V_{ID} = 1\text{ V}$			-35			mA
			$V_{ID} = -1\text{ V}$			45			

TLE2084M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$

PARAMETER	TEST CONDITIONS	T_A †	TLE2084M			TLE2084AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	25°C	35			35			V/ μ s
			Full range			18*			
SR-	Negative slew rate	25°C	38			38			V/ μ s
			Full range			18*			
t_s	Settling time	25°C	To 10 mV			0.25			μ s
			To 1 mV			0.4			
V_n	Equivalent input noise voltage	25°C	f = 10 Hz			28			nV/ $\sqrt{\text{Hz}}$
			f = 10 kHz			11.6			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	25°C	f = 10 Hz to 10 kHz			6			μ V
			f = 0.1 Hz to 10 Hz			0.6			
I_n	Equivalent input noise current	25°C	2.8			2.8			fA/ $\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion plus noise	25°C	0.013%			0.013%			
B_1	Unity-gain bandwidth	25°C	9.4			9.4			MHz
BOM	Maximum output-swing bandwidth	25°C	2.8			2.8			MHz
ϕ_m	Phase margin at unity gain	25°C	56°			56°			

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

† Full range is -55°C to 125°C.



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TLE2084M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_A †	TLE2084M			TLE2084AM			UNIT		
			MIN	TYP	MAX	MIN	TYP	MAX			
V_{IO} Input offset voltage	$V_{IC} = 0, V_O = 0, R_S = 50\ \Omega$	25°C	-1.6	7		-0.5	4	mV			
		Full range			12.5		7.5				
α_{VIO} Temperature coefficient of input offset voltage		Full range	10.1	30*		10.1	30*	$\mu\text{V}/^\circ\text{C}$			
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0, \text{See Figure 4}$	25°C	15	100		15	100	pA			
		Full range			20		20	nA			
I_{IB} Input bias current		25°C	25	175		25	175	pA			
		Full range			65		65	nA			
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	15 to -11	15 to -11.9		15 to -11	15 to -11.9	V			
		Full range	15 to -10.8			15 to -10.8					
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200\ \mu\text{A}$	25°C	13.8	14.1		13.8	14.1	V			
		Full range	13.6			13.6					
	$I_O = -2\ \text{mA}$	25°C	13.5	13.9		13.5	13.9				
		Full range	13.3			13.3					
	$I_O = -20\ \text{mA}$	25°C	11.5	12.3		11.5	12.3				
		Full range	11.4			11.4					
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200\ \mu\text{A}$	25°C	-13.8	-14.2		-13.8	-14.2	V			
		Full range	-13.6			-13.6					
	$I_O = 2\ \text{mA}$	25°C	-13.5	-14		-13.5	-14				
		Full range	-13.3			-13.3					
	$I_O = 20\ \text{mA}$	25°C	-11.5	-12.4		-11.5	-12.4				
		Full range	-11.4			-11.4					
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10\ \text{V}$	$R_L = 600\ \Omega$	25°C	80	96		80	96	dB		
			Full range	78			78				
		$R_L = 2\ \text{k}\Omega$	25°C	90	109		90	109			
			Full range	88			88				
		$R_L = 10\ \text{k}\Omega$	25°C	95	118		95	118			
			Full range	93			93				
r_i Input resistance	$V_{IC} = 0$	25°C	10^{12}			10^{12}			Ω		
c_i Input capacitance	$V_{IC} = 0, \text{See Figure 5}$	Common mode	25°C	7.5			7.5			pF	
		Differential	25°C	2.5			2.5				
z_o Open-loop output impedance	$f = 1\ \text{MHz}$	25°C	80			80			Ω		
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50\ \Omega$	25°C	80	98			80	98			dB
		Full range	78				78				
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 5\ \text{V to } \pm 15\ \text{V}, V_O = 0, R_S = 50\ \Omega$	25°C	82	99			82	99			dB
		Full range	80				80				
I_{CC} Supply current (four amplifiers)	$V_O = 0, \text{No load}$	25°C	5.2	6.5	7.5	5.2	6.5	7.5	mA		
		Full range			7.5			7.5			
a_x Crosstalk attenuation	$V_{IC} = 0, R_L = 2\ \text{k}\Omega$	25°C	120			120			dB		

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

† Full range is -55°C to 125°C .



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TLE2084M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15\text{ V}$ (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A	TLE2084M			TLE2084AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{OS}	Short-circuit output current $V_O = 0$	25°C	$V_{ID} = 1\text{ V}$			$V_{ID} = 1\text{ V}$			mA
			$V_{ID} = -1\text{ V}$			$V_{ID} = -1\text{ V}$			

TLE2084M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15\text{ V}$

PARAMETER	TEST CONDITIONS	T_A †	TLE2084M			TLE2084AM			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR+	Positive slew rate	25°C	25			25			V/μs
			Full range			17			
SR-	Negative slew rate	25°C	30			30			V/μs
			Full range			20			
t_s	Settling time	25°C	To 10 mV			0.4			μs
			To 1 mV			1.5			
V_n	Equivalent input noise voltage	25°C	f = 10 Hz			28			nV/√Hz
			f = 10 kHz			11.6			
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	25°C	f = 10 Hz to 10 kHz			6			μV
			f = 0.1 Hz to 10 Hz			0.6			
I_n	Equivalent input noise current	25°C	f = 10 kHz			2.8			fA/√Hz
THD + N	Total harmonic distortion plus noise	25°C	0.008%			0.008%			
B_1	Unity-gain bandwidth	25°C	8*	10		8*	10		MHz
B_{OM}	Maximum output-swing bandwidth	25°C	478*	637		478*	637		kHz
ϕ_m	Phase margin at unity gain	25°C	57°			57°			

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

† Full range is -55°C to 125°C.



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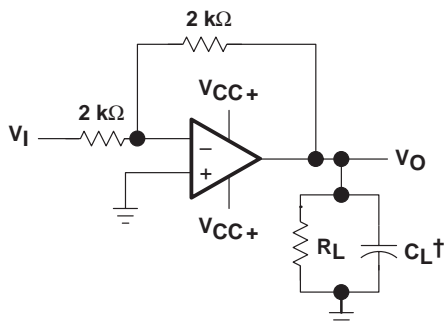
TLE2084Y electrical characteristics at $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		TLE2084Y			UNIT
				MIN	TYP	MAX	
V_{IO}	Input offset voltage	$V_{IC} = 0$, $R_S = 50\ \Omega$	$V_O = 0$,			7	mV
I_{IO}	Input offset current	$V_{IC} = 0$,	$V_O = 0$,		15	100	pA
I_{IB}	Input bias current	See Figure 4			25	175	pA
V_{ICR}	Common-mode input voltage range	$R_S = 50\ \Omega$		15 to -11	15 to 11.9		V
V_{OM+}	Maximum positive peak output voltage swing	$I_O = -200\ \mu\text{A}$		13.8	14.1		V
		$I_O = -2\ \text{mA}$		13.5	13.9		
		$I_O = -20\ \text{mA}$		11.5	12.3		
V_{OM-}	Maximum negative peak output voltage swing	$I_O = 200\ \mu\text{A}$		-13.8	-14.2		V
		$I_O = 2\ \text{mA}$		-13.5	-14		
		$I_O = 20\ \text{mA}$		-11.5	-12.4		
A_{VD}	Large-signal differential voltage amplification	$V_O = \pm 10\ \text{V}$	$R_L = 600\ \Omega$	80	96		dB
			$R_L = 2\ \text{k}\Omega$	90	109		
			$R_L = 10\ \text{k}\Omega$	95	118		
r_i	Input resistance	$V_{IC} = 0$		10 ¹²			Ω
c_i	Input capacitance	$V_{IC} = 0$, See Figure 5	Common mode	7.5			pF
			Differential	2.5			
z_o	Open-loop output impedance	$f = 1\ \text{MHz}$		80			Ω
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	$V_O = 0$,	80	98		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 5\ \text{V}$ to $\pm 15\ \text{V}$, $V_O = 0$, $R_S = 50\ \Omega$		82	99		dB
I_{CC}	Supply current (four amplifiers)	$V_O = 0$,	No load	5.2	6.5	7.5	mA
I_{OS}	Short-circuit output current	$V_O = 0$	$V_{ID} = 1\ \text{V}$	-30	-45		mA
			$V_{ID} = -1\ \text{V}$	30	48		

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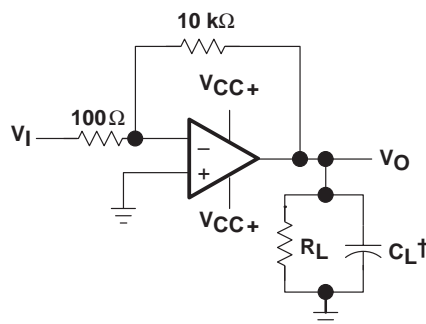
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PARAMETER MEASUREMENT INFORMATION



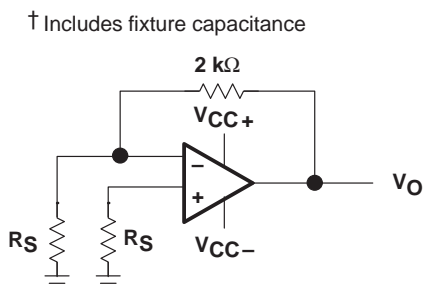
† Includes fixture capacitance

Figure 1. Slew-Rate Test Circuit



† Includes fixture capacitance

Figure 2. Unity-Gain Bandwidth and Phase-Margin Test Circuit



† Includes fixture capacitance

Figure 3. Noise-Voltage Test Circuit

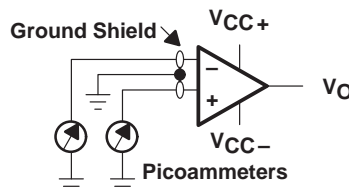


Figure 4. Input-Bias and Offset-Current Test Circuit

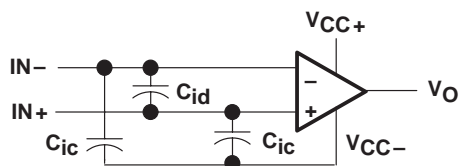


Figure 5. Internal Input Capacitance

typical values

Typical values presented in this data sheet represent the median (50% point) of device parametric performance.

input bias and offset current

At the picoampere bias-current level typical of the TLE208x and TLE208xA, accurate measurement of the bias becomes difficult. Not only does this measurement require a picoammeter, but test socket leakages can easily exceed the actual device bias currents. To accurately measure these small currents, Texas Instruments uses a two-step process. The socket leakage is measured using picoammeters with bias voltages applied but with no device in the socket. The device is then inserted in the socket and a second test is performed that measures both the socket leakage and the device input bias current. The two measurements are then subtracted algebraically to determine the bias current of the device.

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
V_{IO}	Input offset voltage	Distribution	6, 7, 8
α_{VIO}	Input offset voltage temperature coefficient	Distribution	9, 10, 11
I_{IO}	Input offset current	vs Free-air temperature	12 – 15
I_{IB}	Input bias current	vs Free-air temperature vs Supply voltage	12 – 15 16
V_{ICR}	Common-mode input voltage range	vs Free-air temperature	17
V_{ID}	Differential input voltage	vs Output voltage	18, 19
V_{OM+}	Maximum positive peak output voltage	vs Output current vs Free-air temperature vs Supply voltage	20, 21 24, 25 26
V_{OM-}	Maximum negative peak output voltage	vs Output current vs Free-air temperature vs Supply voltage	22, 23 24, 25 26
$V_{O(PP)}$	Maximum peak-to-peak output voltage	vs Frequency	27
V_O	Output voltage	vs Settling time	28
A_{VD}	Large-signal differential voltage amplification	vs Load resistance vs Free-air temperature	29 30, 31
A_{VD}	Small-signal differential voltage amplification	vs Frequency	32, 33
$CMRR$	Common-mode rejection ratio	vs Frequency vs Free-air temperature	34 35
k_{SVR}	Supply-voltage rejection ratio	vs Frequency vs Free-air temperature	36 37
I_{CC}	Supply current	vs Supply voltage vs Free-air temperature vs Differential input voltage	38, 39, 40 41, 42, 43 44 – 49
I_{OS}	Short-circuit output current	vs Supply voltage vs Elapsed time vs Free-air temperature	50 51 52
SR	Slew rate	vs Free-air temperature vs Load resistance vs Differential input voltage	53, 54 55 56
V_n	Equivalent input noise voltage	vs Frequency	57
V_n	Input-referred noise voltage	vs Noise bandwidth frequency Over a 10-second time interval	58 59
	Third-octave spectral noise density	vs Frequency bands	60
$THD + N$	Total harmonic distortion plus noise	vs Frequency	61, 62
B_1	Unity-gain bandwidth	vs Load capacitance	63
	Gain-bandwidth product	vs Free-air temperature vs Supply voltage	64 65
	Gain margin	vs Load capacitance	66
ϕ_m	Phase margin	vs Free-air temperature vs Supply voltage vs Load capacitance	67 68 69
	Phase shift	vs Frequency	32, 33

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TYPICAL CHARACTERISTICS

Table of Graphs (Continued)

		FIGURE
Noninverting large-signal pulse response	vs Time	70
Small-signal pulse response	vs Time	71
z_o	Closed-loop output impedance vs Frequency	72
a_x	Crosstalk attenuation vs Frequency	73

**DISTRIBUTION OF TLE2081
INPUT OFFSET VOLTAGE**

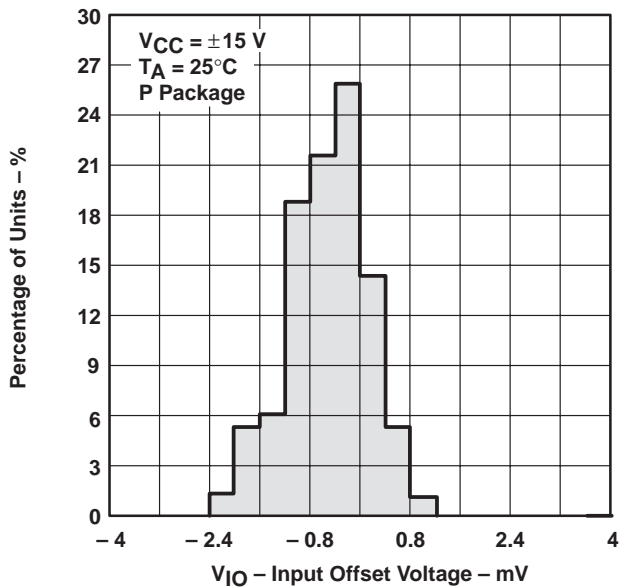


Figure 6

**DISTRIBUTION OF TLE2082
INPUT OFFSET VOLTAGE**

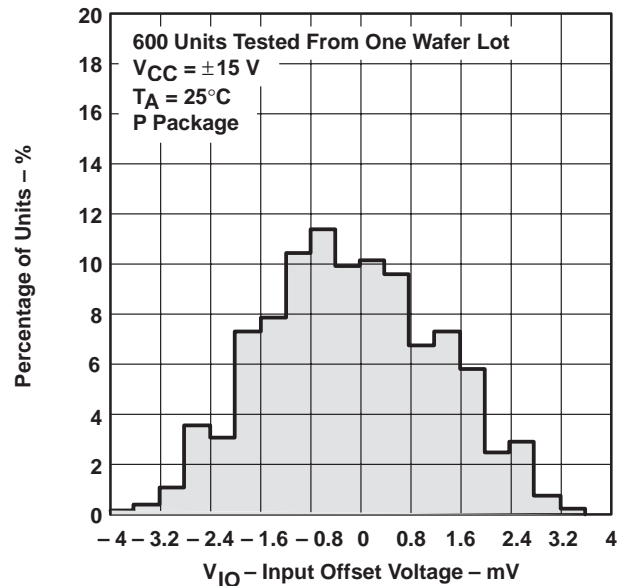


Figure 7

TYPICAL CHARACTERISTICS

DISTRIBUTION OF TLE2084
INPUT OFFSET VOLTAGE

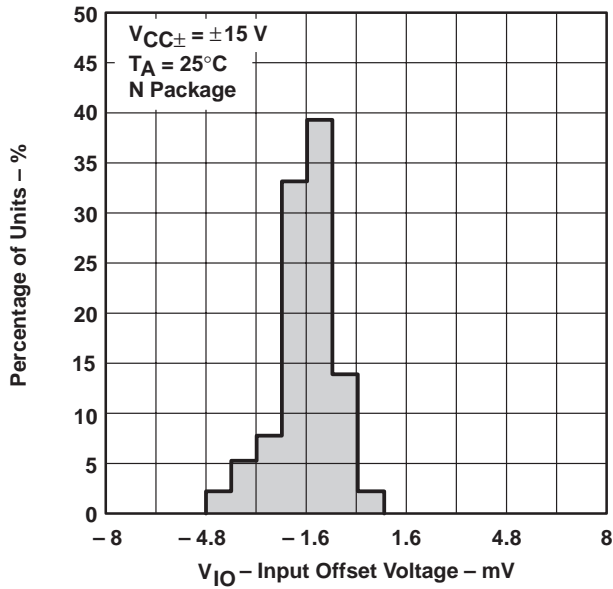


Figure 8

DISTRIBUTION OF TLE2081 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT

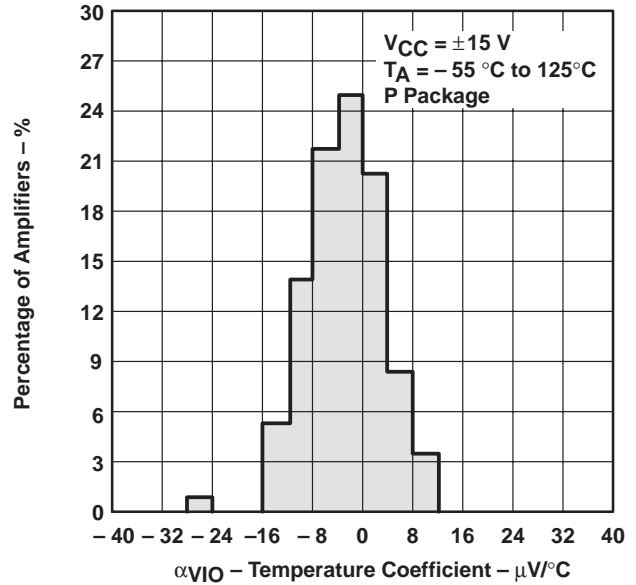


Figure 9

DISTRIBUTION OF TLE2082 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT

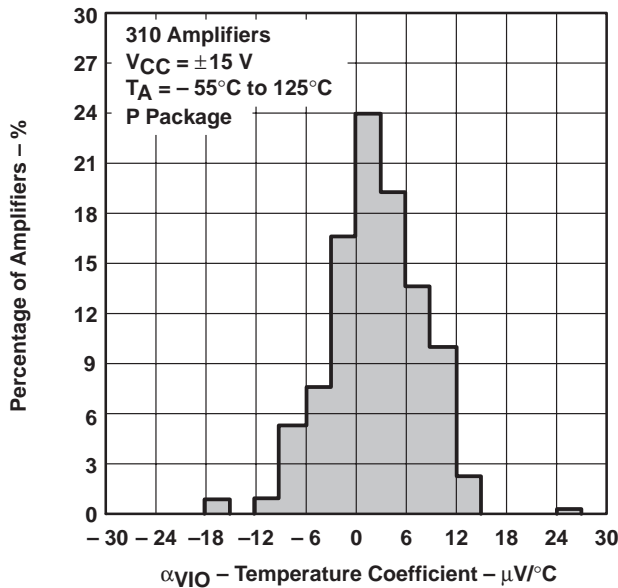


Figure 10

DISTRIBUTION OF TLE2084 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT

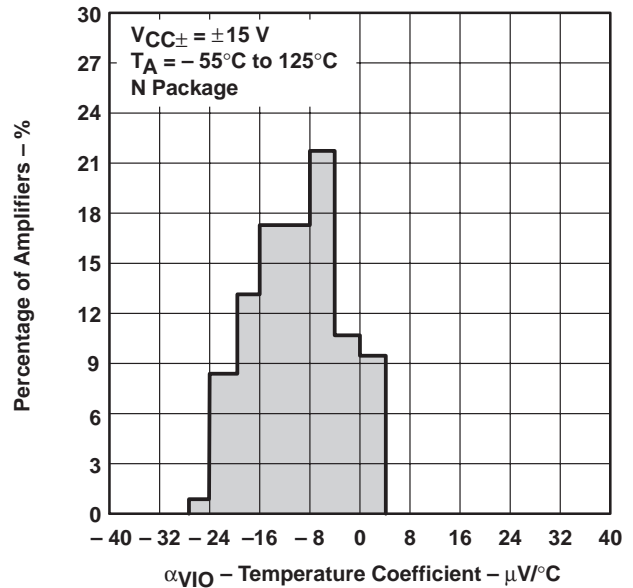


Figure 11

TLE208x, TLE208xA, TLE208xY
EXCALIBUR HIGH-SPEED JFET-INPUT
OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS†

TLE2081 AND TLE2082
INPUT BIAS CURRENT AND INPUT OFFSET CURRENT
vs
FREE-AIR TEMPERATURE

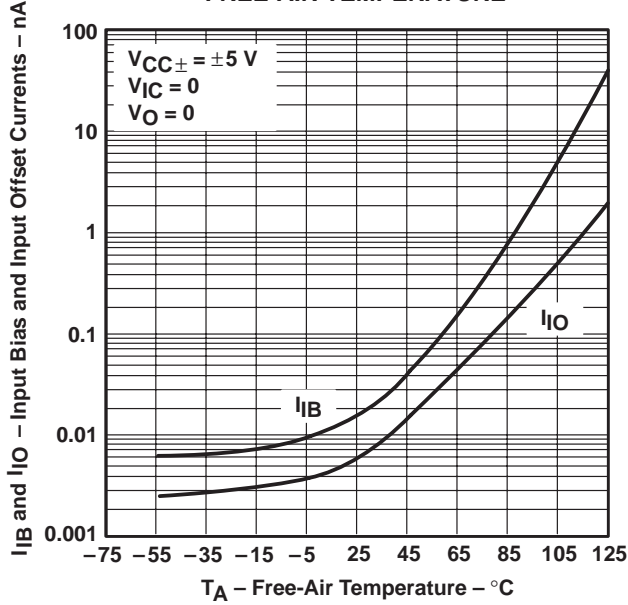


Figure 12

TLE2084
INPUT BIAS CURRENT AND INPUT OFFSET CURRENT
vs
FREE-AIR TEMPERATURE

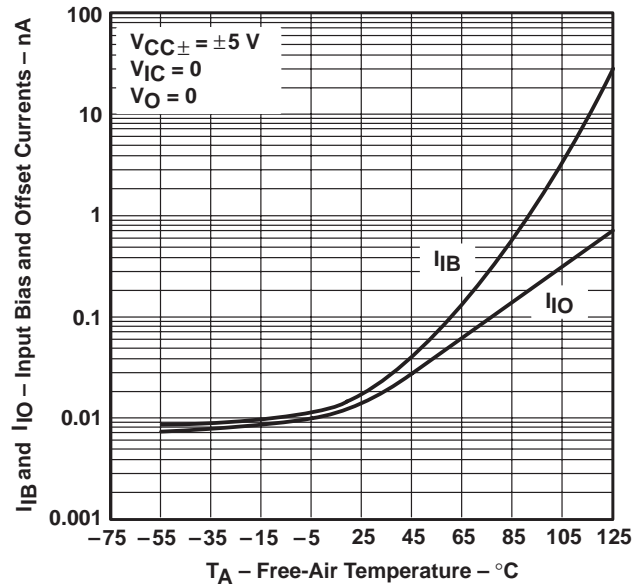


Figure 13

TLE2081 AND TLE2082
INPUT BIAS CURRENT AND INPUT OFFSET CURRENT
vs
FREE-AIR TEMPERATURE

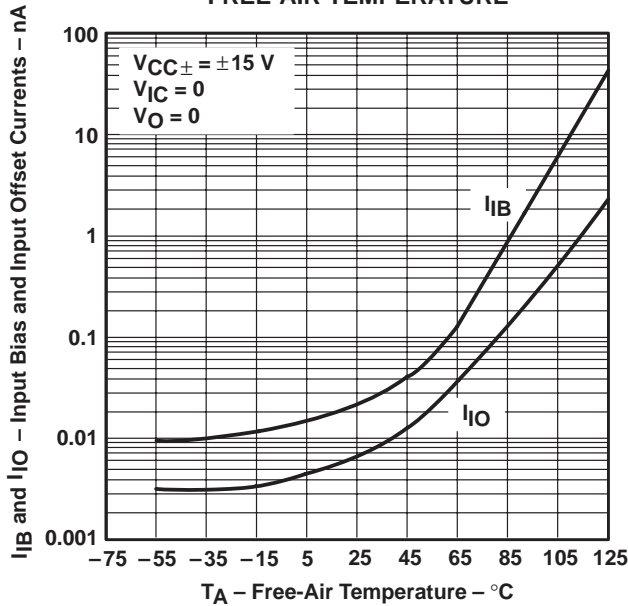


Figure 14

TLE2084
INPUT BIAS CURRENT AND INPUT OFFSET CURRENT
vs
FREE-AIR TEMPERATURE

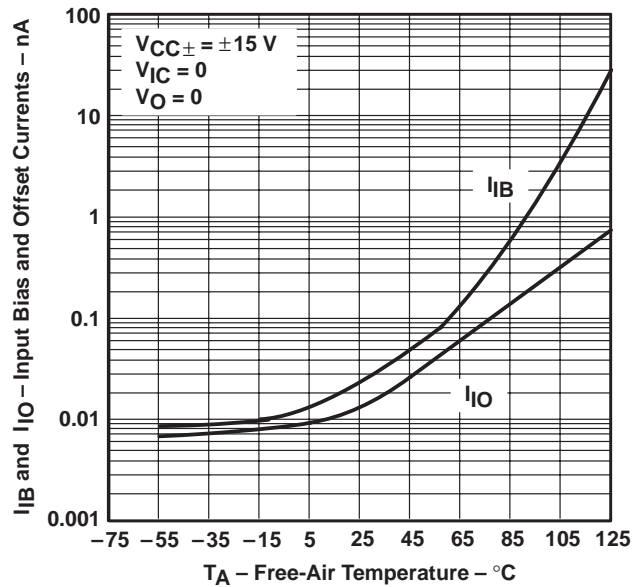
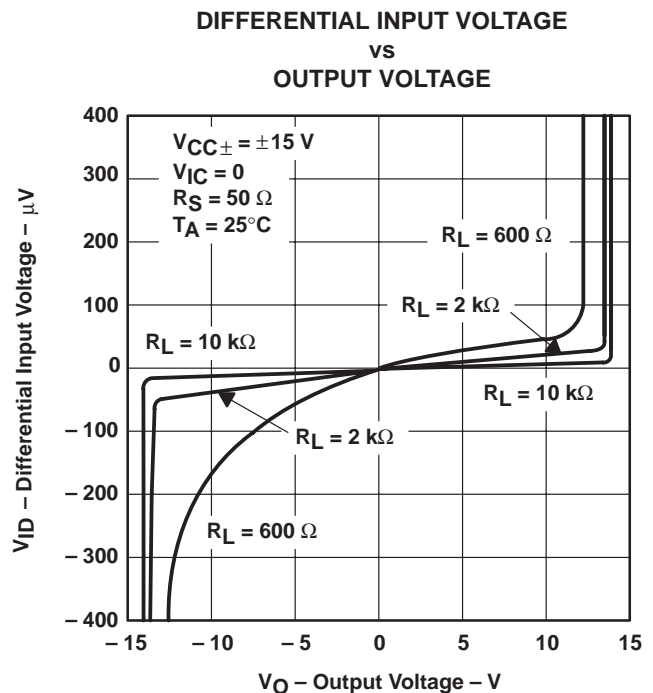
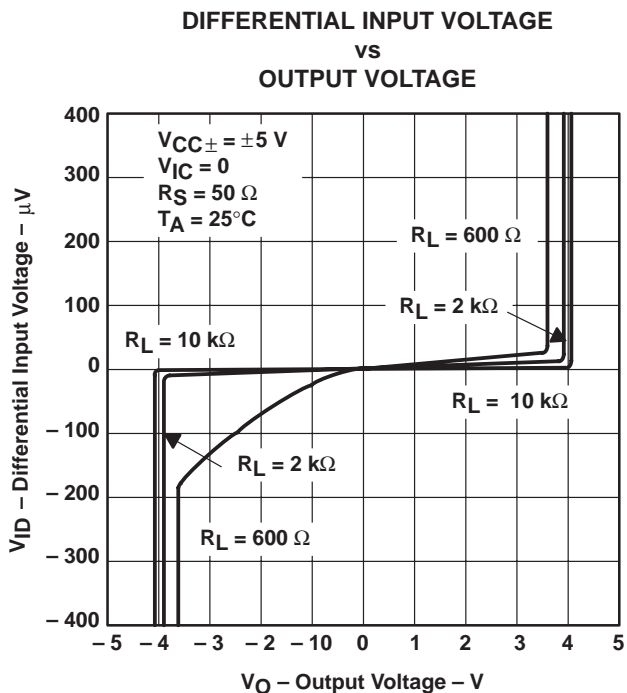
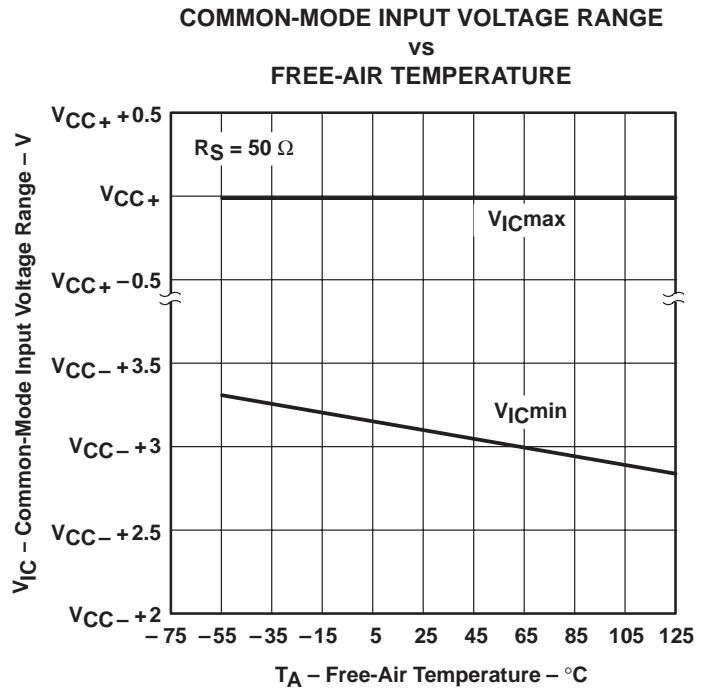
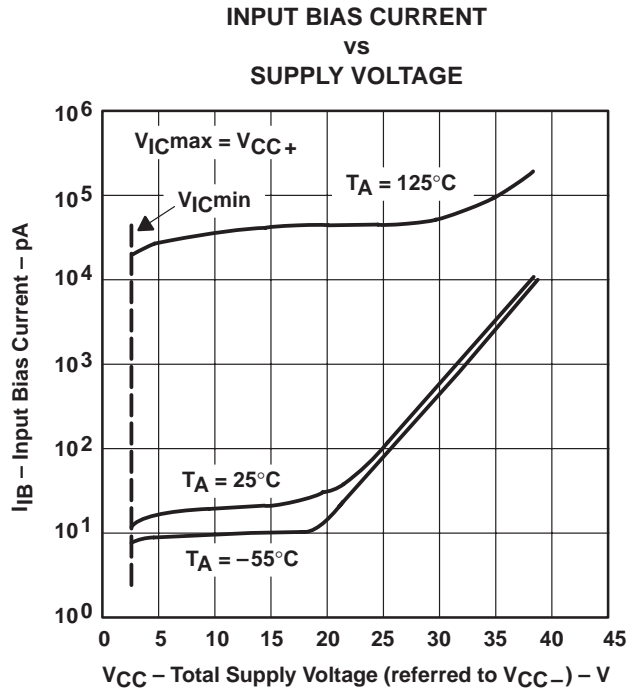


Figure 15

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

TYPICAL CHARACTERISTICS†



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

TLE208x, TLE208xA, TLE208xY
EXCALIBUR HIGH-SPEED JFET-INPUT
OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS†

TLE2081 AND TLE2082
MAXIMUM POSITIVE PEAK OUTPUT VOLTAGE
vs
OUTPUT CURRENT

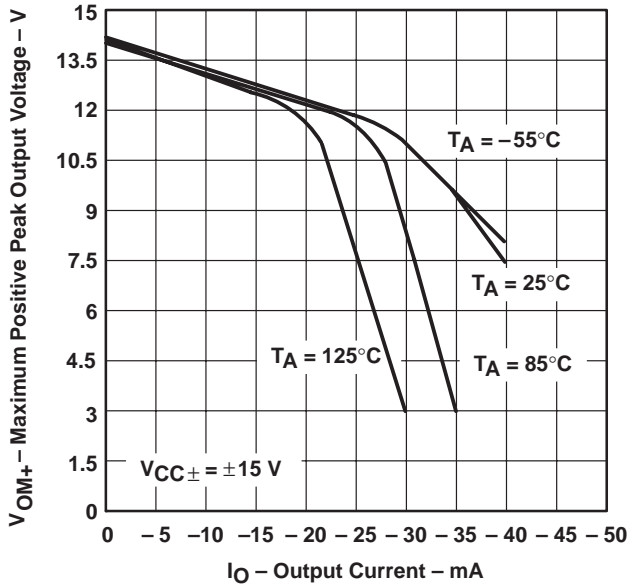


Figure 20

TLE2084
MAXIMUM POSITIVE PEAK OUTPUT VOLTAGE
vs
OUTPUT CURRENT

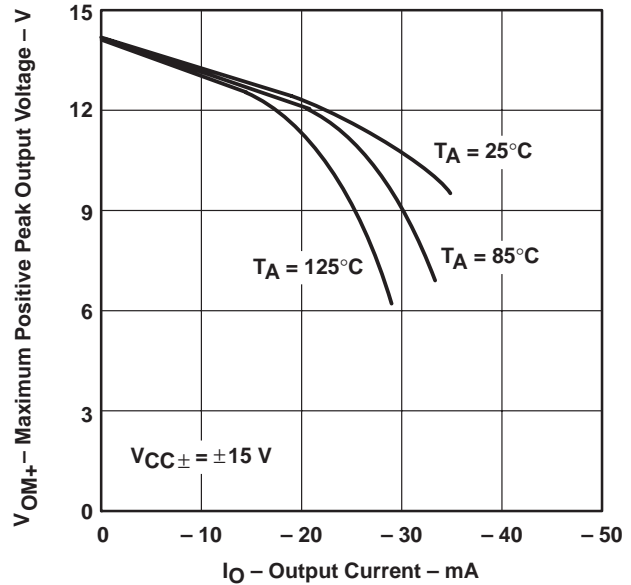


Figure 21

TLE2081 AND TLE2082
MAXIMUM NEGATIVE PEAK OUTPUT VOLTAGE
vs
OUTPUT CURRENT

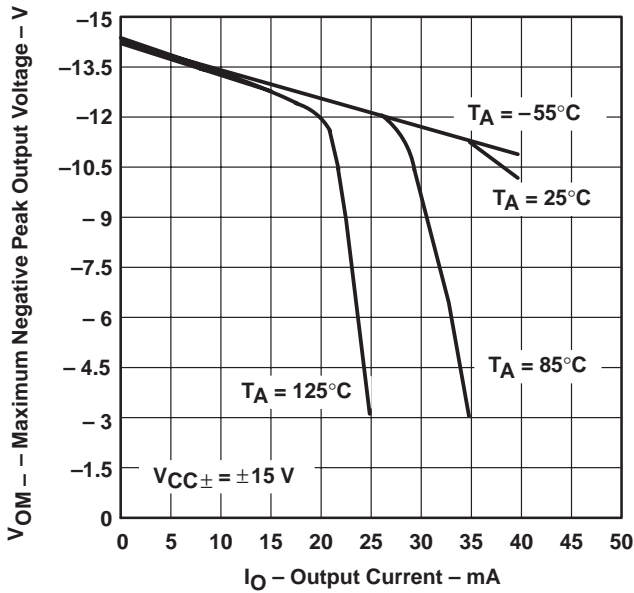


Figure 22

TLE2084
MAXIMUM NEGATIVE PEAK OUTPUT VOLTAGE
vs
OUTPUT CURRENT

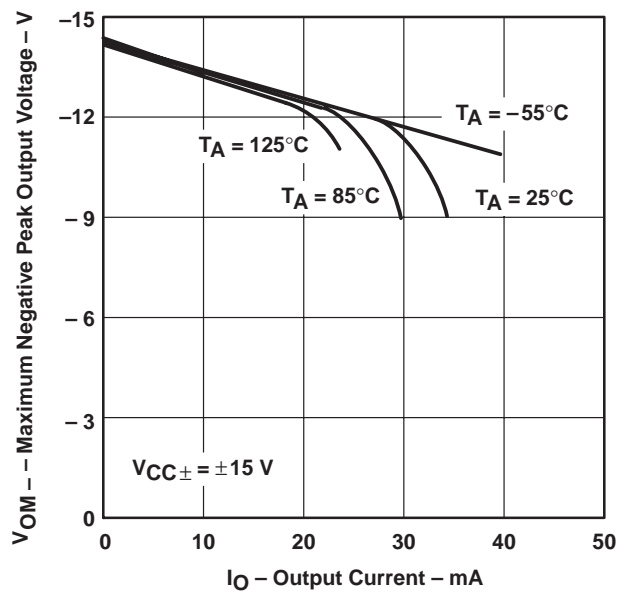


Figure 23

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



TYPICAL CHARACTERISTICS†

MAXIMUM PEAK OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

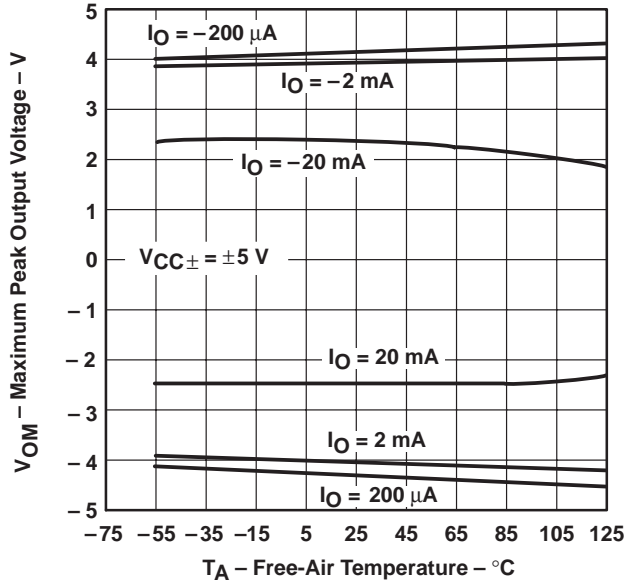


Figure 24

MAXIMUM PEAK OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

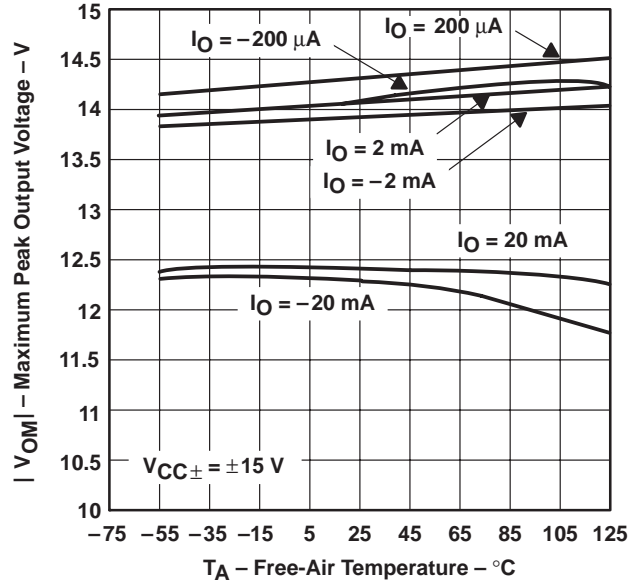


Figure 25

MAXIMUM PEAK OUTPUT VOLTAGE
vs
SUPPLY VOLTAGE

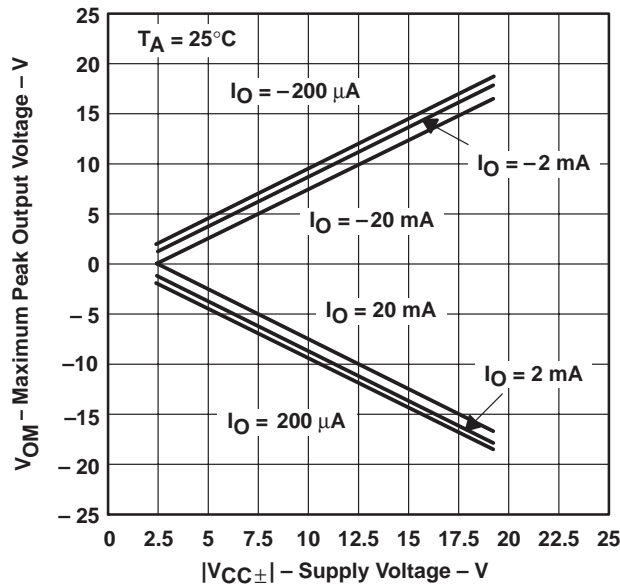


Figure 26

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE
vs
FREQUENCY

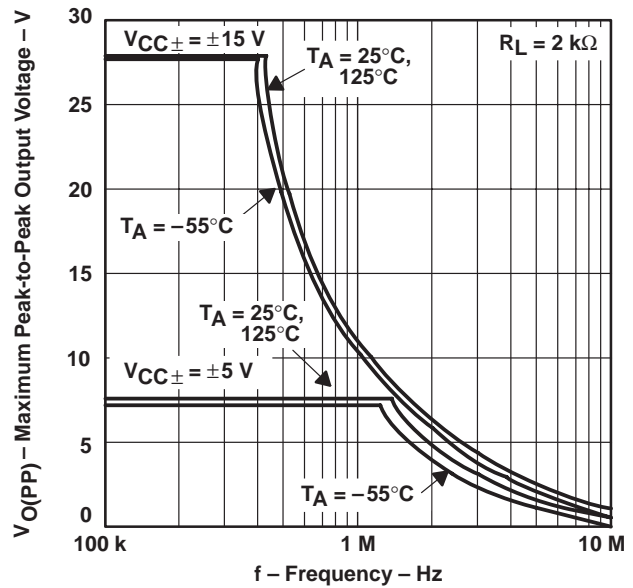


Figure 27

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

TLE208x, TLE208xA, TLE208xY
 EXCALIBUR HIGH-SPEED JFET-INPUT
 OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS†

OUTPUT VOLTAGE
 vs
 SETTILING TIME

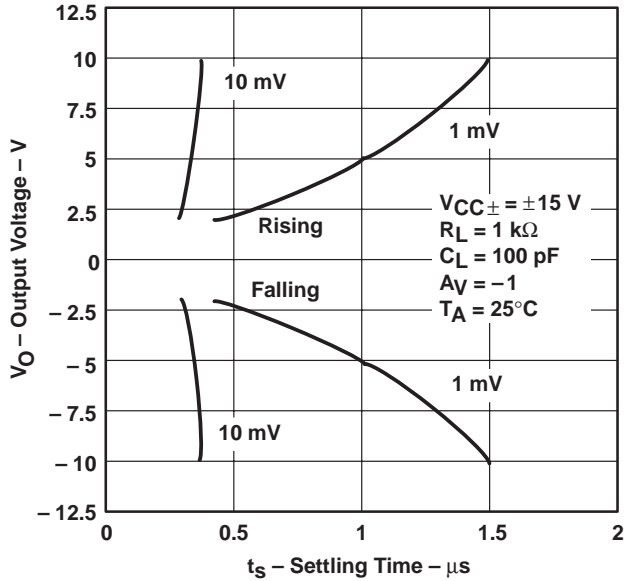


Figure 28

LARGE-SIGNAL DIFFERENTIAL
 VOLTAGE AMPLIFICATION
 vs
 LOAD RESISTANCE

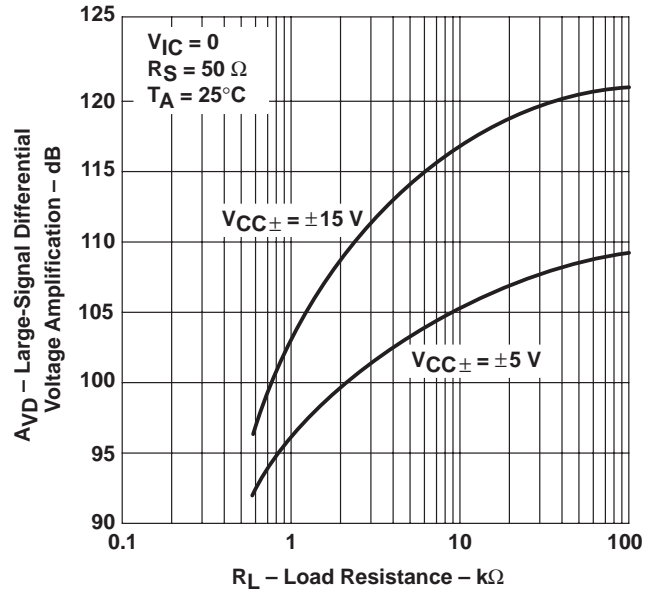


Figure 29

LARGE-SIGNAL DIFFERENTIAL
 VOLTAGE AMPLIFICATION
 vs
 FREE-AIR TEMPERATURE

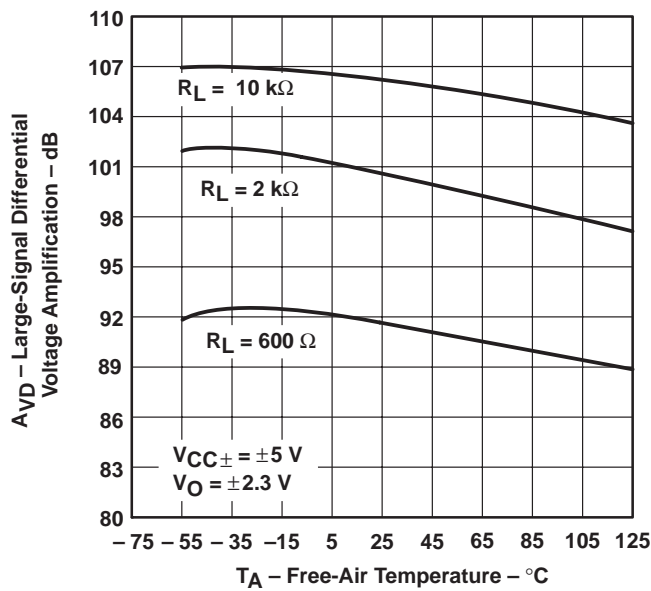


Figure 30

LARGE-SIGNAL DIFFERENTIAL
 VOLTAGE AMPLIFICATION
 vs
 FREE-AIR TEMPERATURE

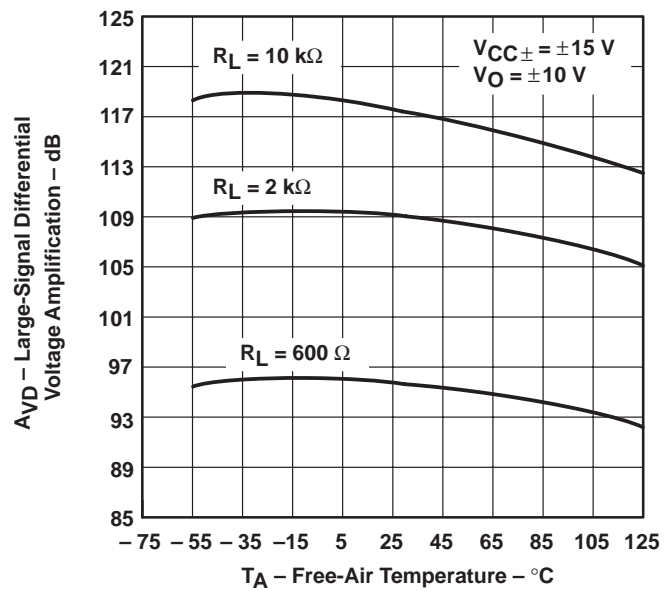


Figure 31

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



TYPICAL CHARACTERISTICS

SMALL-SIGNAL DIFFERENTIAL VOLTAGE
 AMPLIFICATION AND PHASE SHIFT
 vs
 FREQUENCY

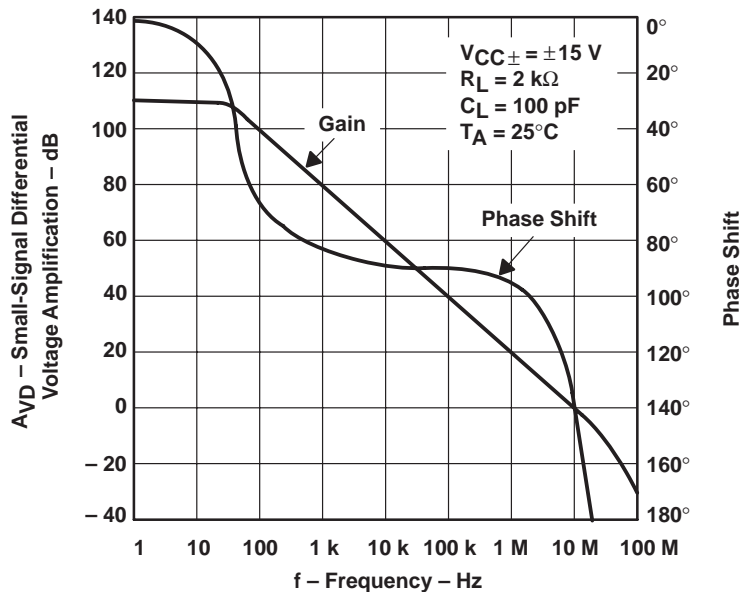


Figure 32

SMALL-SIGNAL DIFFERENTIAL VOLTAGE
 AMPLIFICATION AND PHASE SHIFT
 vs
 FREQUENCY

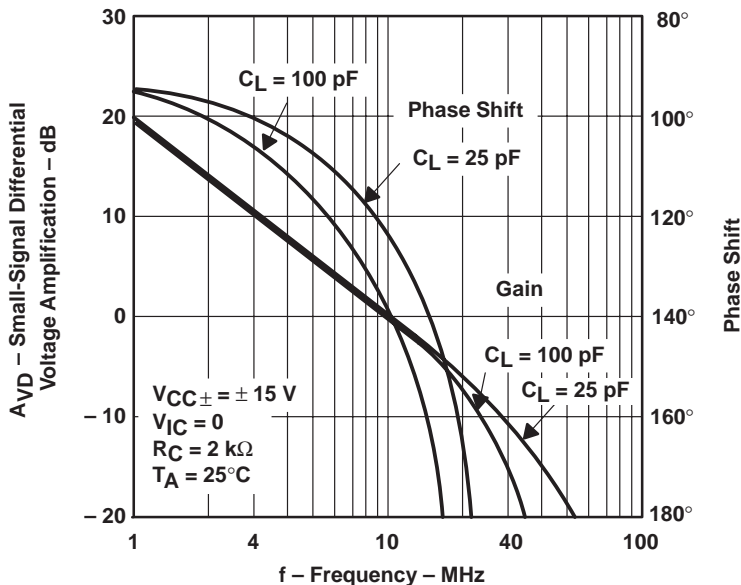


Figure 33

TLE208x, TLE208xA, TLE208xY
EXCALIBUR HIGH-SPEED JFET-INPUT
OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS†

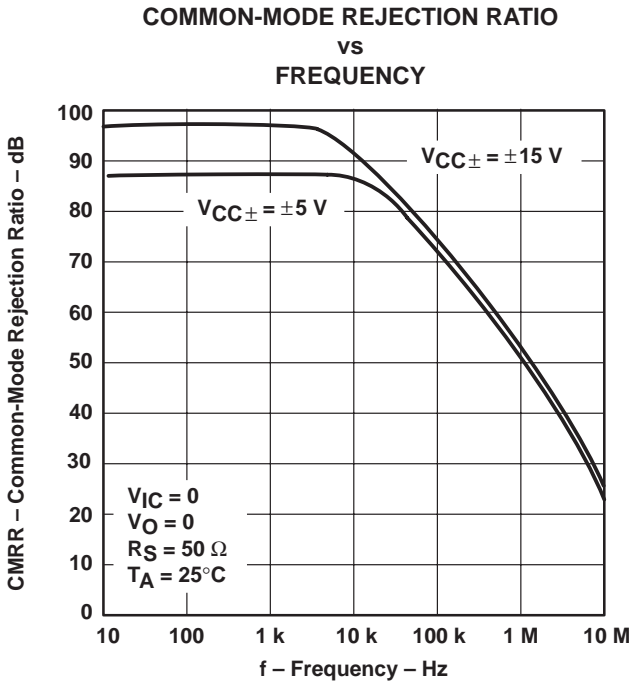


Figure 34

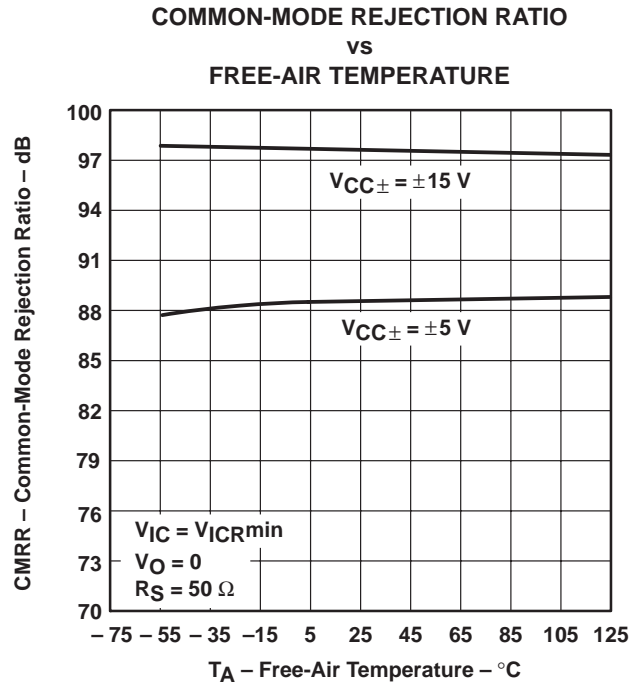


Figure 35

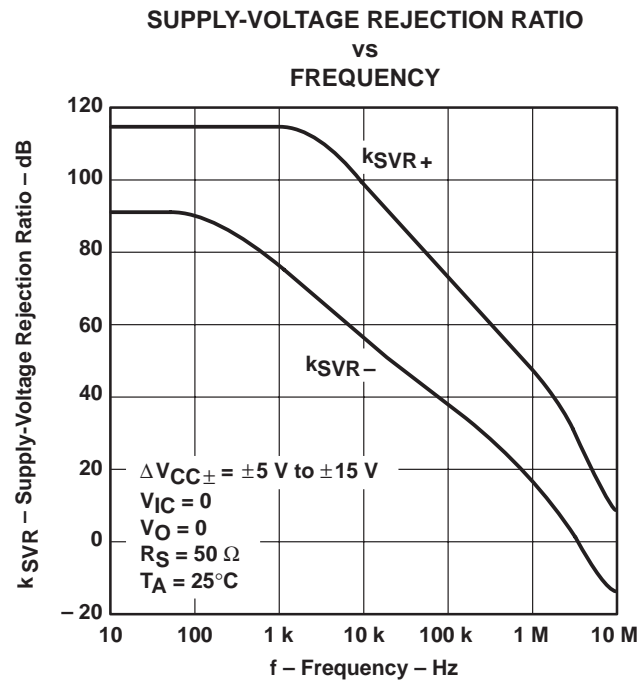


Figure 36

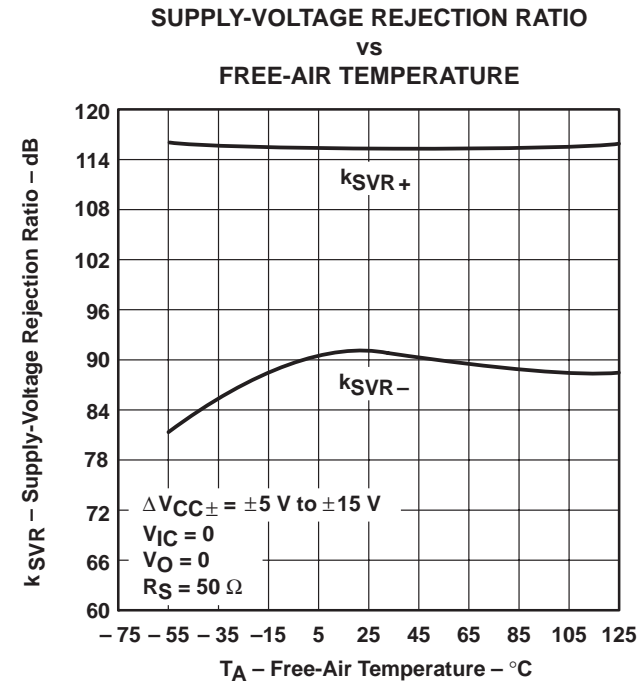
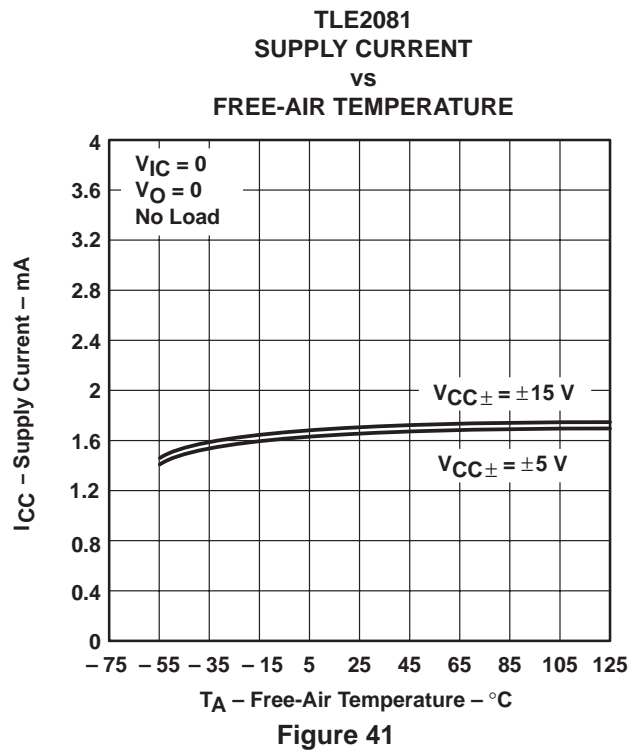
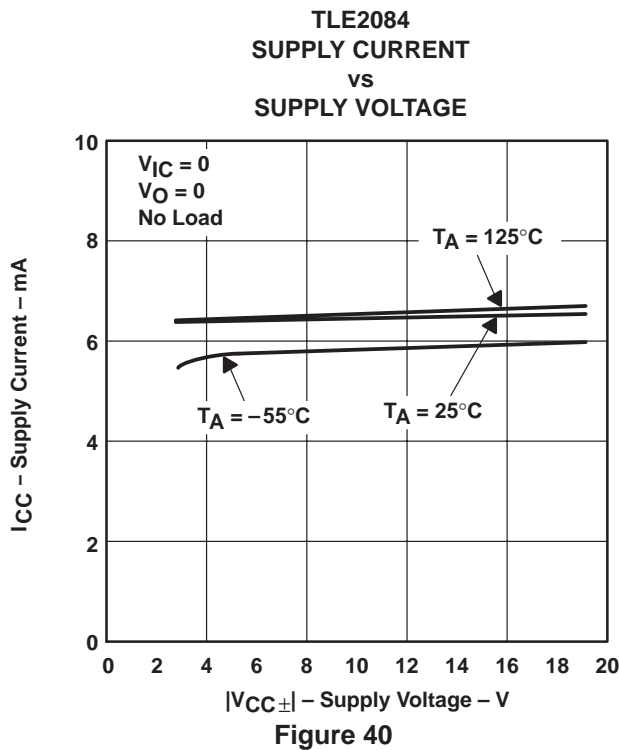
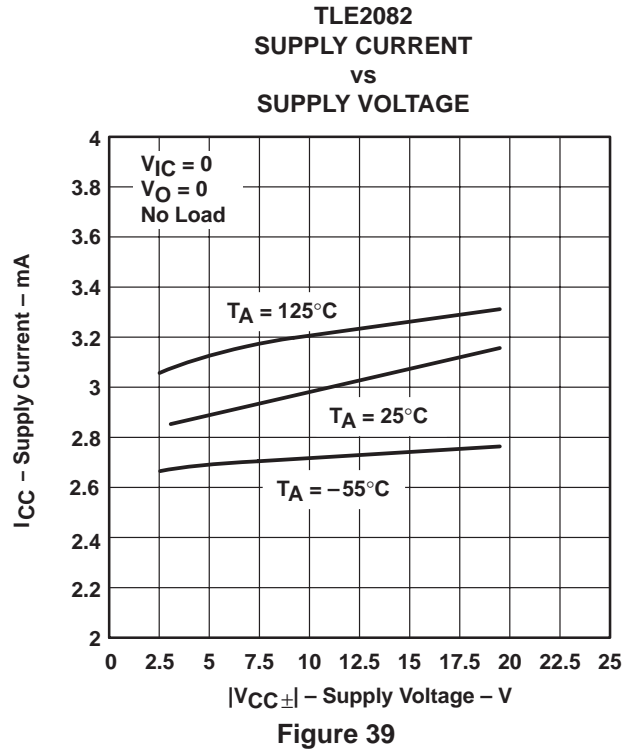
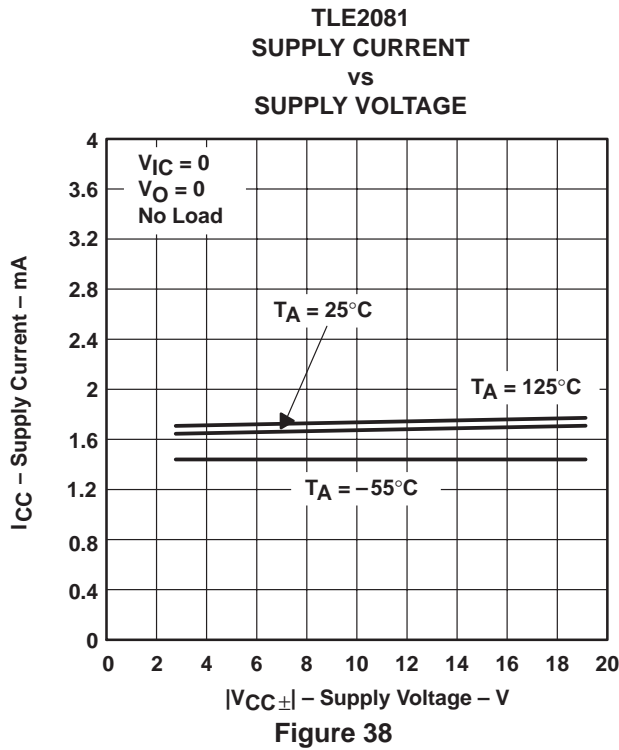


Figure 37

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



TYPICAL CHARACTERISTICS†

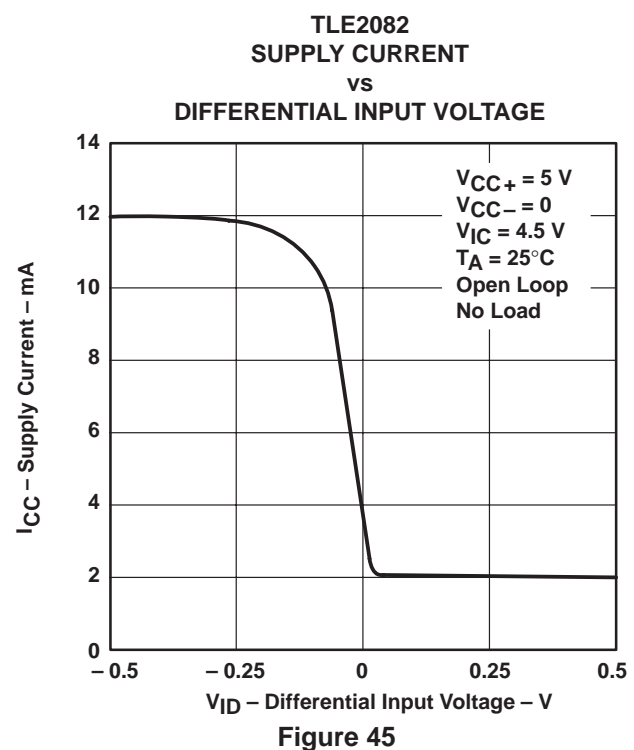
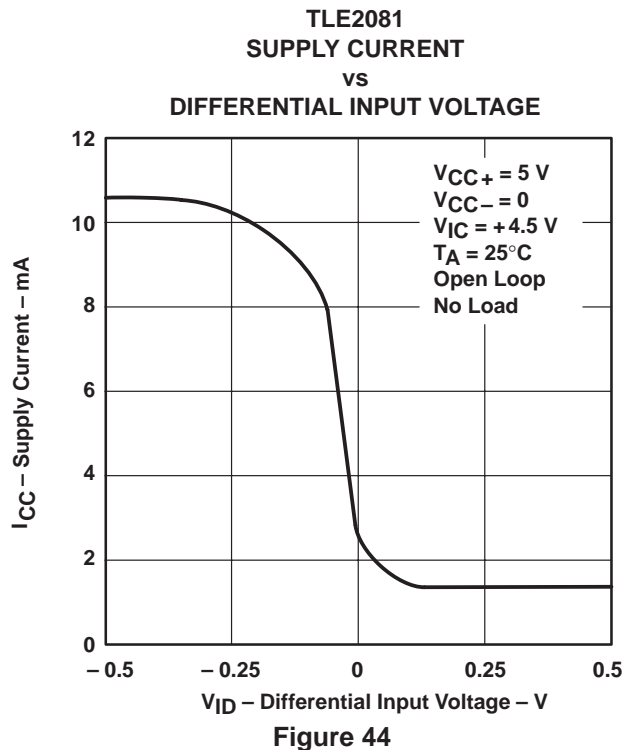
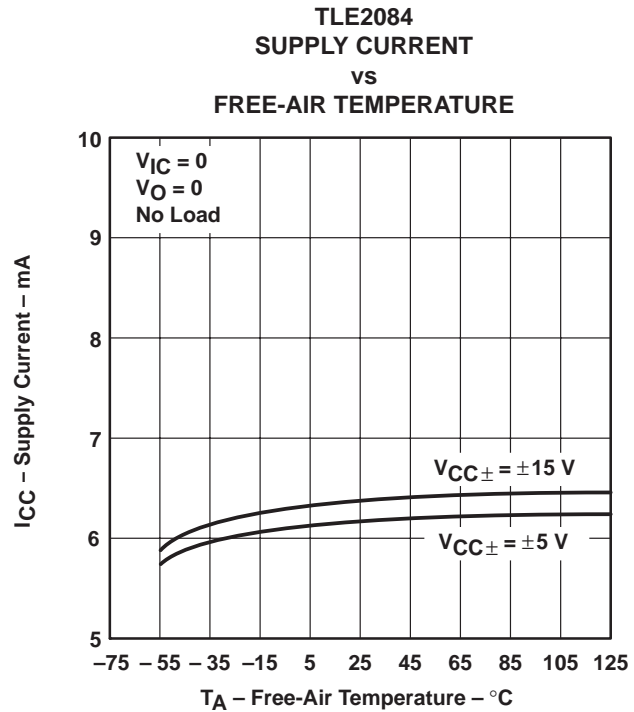
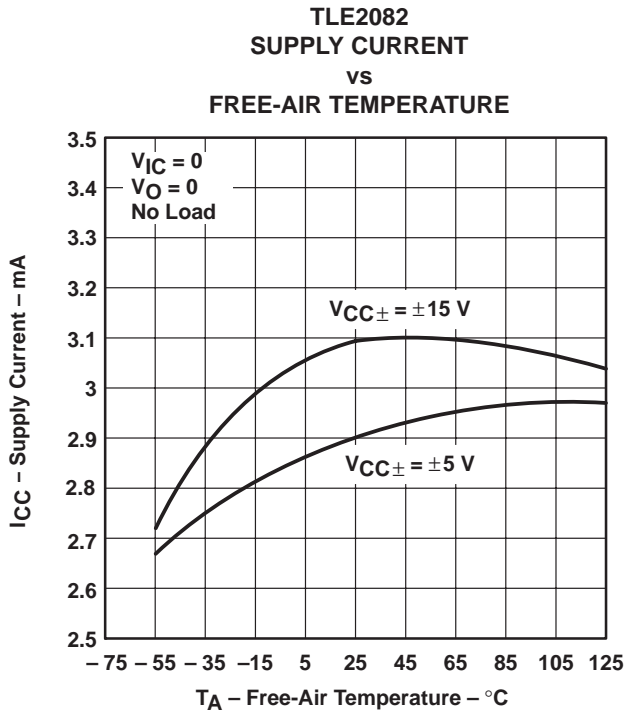


† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

TLE208x, TLE208xA, TLE208xY
EXCALIBUR HIGH-SPEED JFET-INPUT
OPERATIONAL AMPLIFIERS

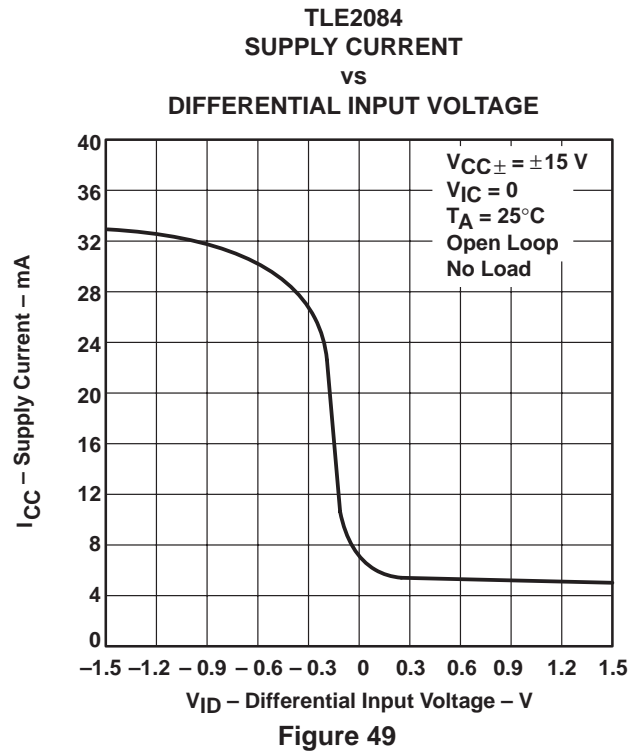
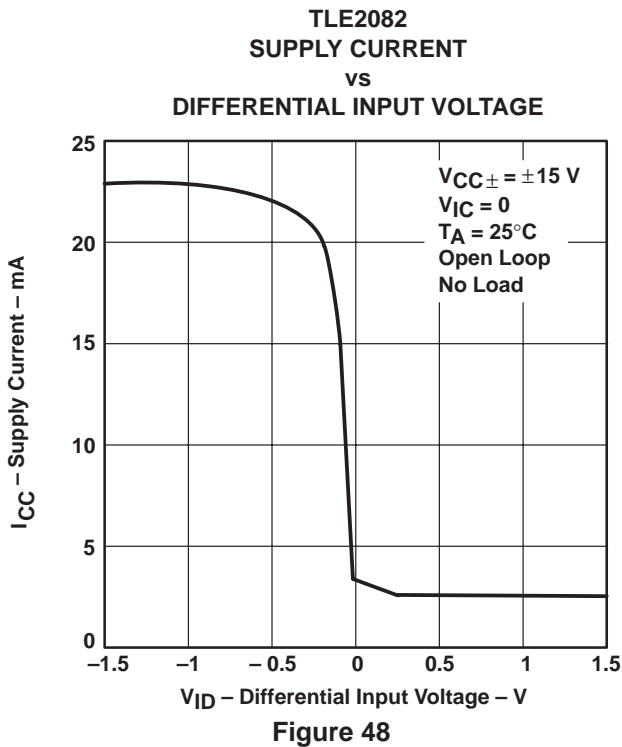
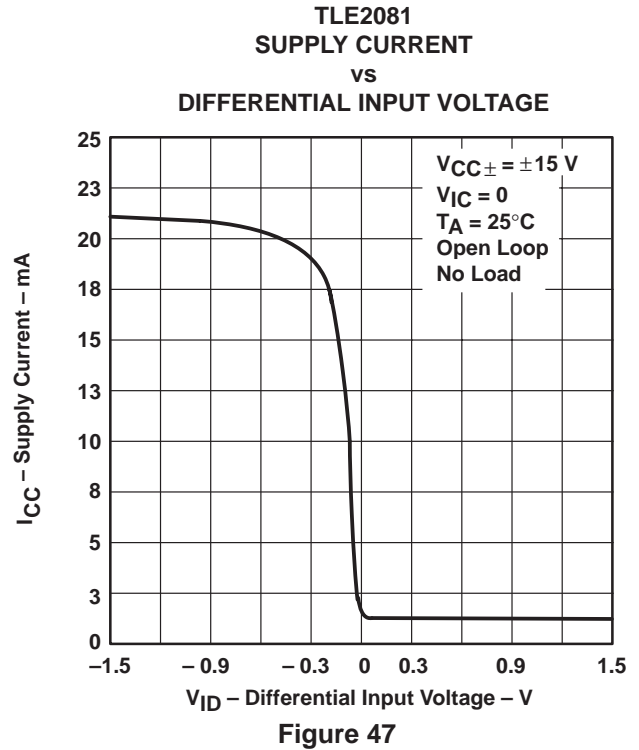
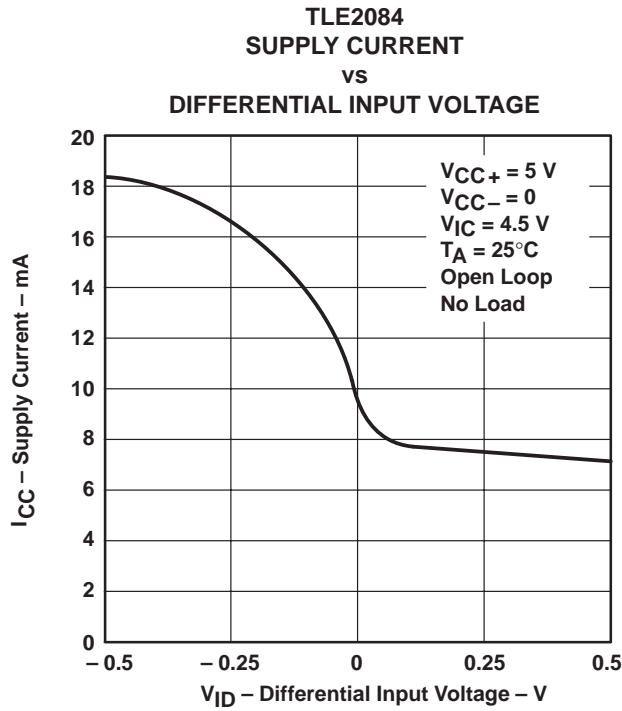
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TYPICAL CHARACTERISTICS†



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

TYPICAL CHARACTERISTICS



TLE208x, TLE208xA, TLE208xY
 EXCALIBUR HIGH-SPEED JFET-INPUT
 OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS†

SHORT-CIRCUIT OUTPUT CURRENT
 vs
 SUPPLY VOLTAGE

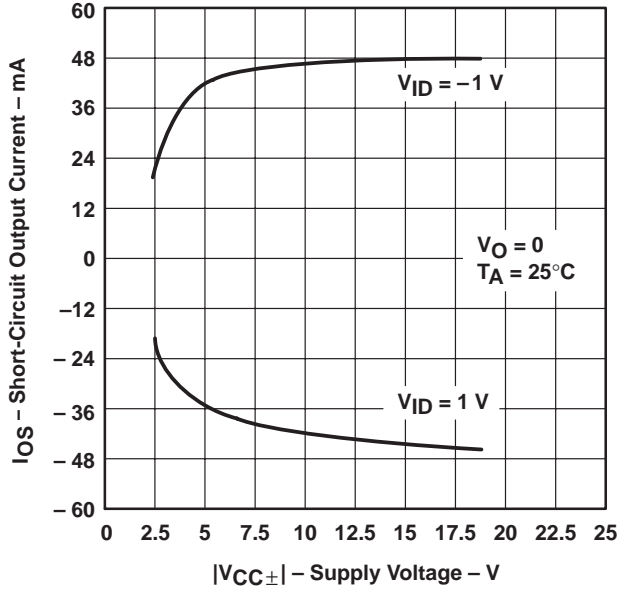


Figure 50

SHORT-CIRCUIT OUTPUT CURRENT
 vs
 ELAPSED TIME

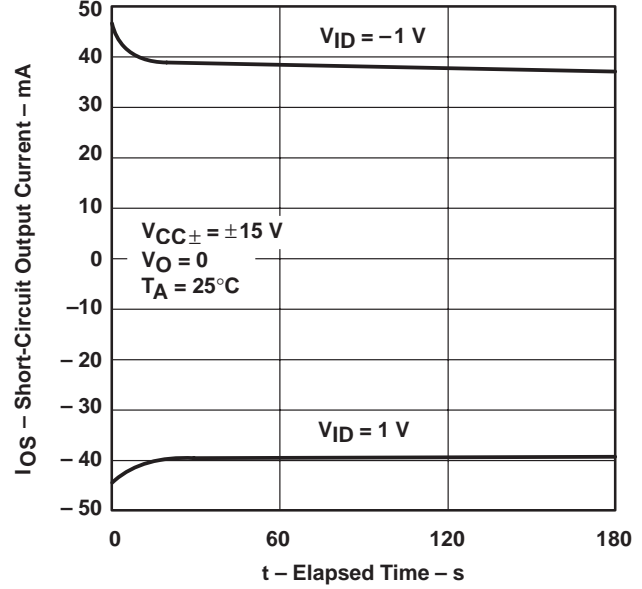


Figure 51

SHORT-CIRCUIT OUTPUT CURRENT
 vs
 FREE-AIR TEMPERATURE

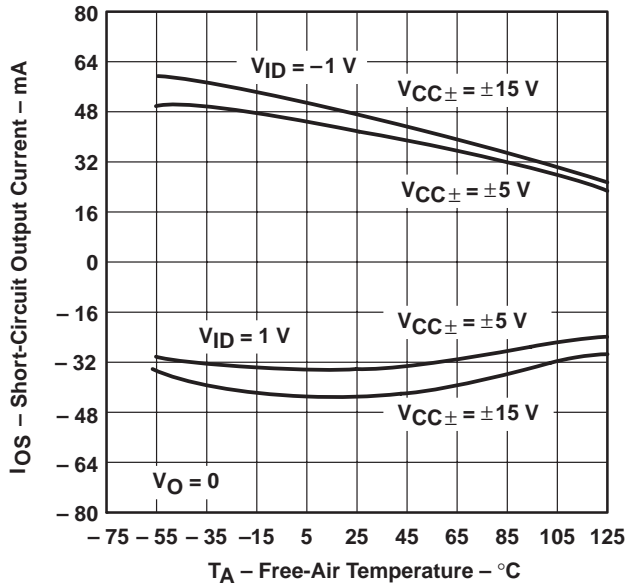


Figure 52

SLEW RATE
 vs
 FREE-AIR TEMPERATURE

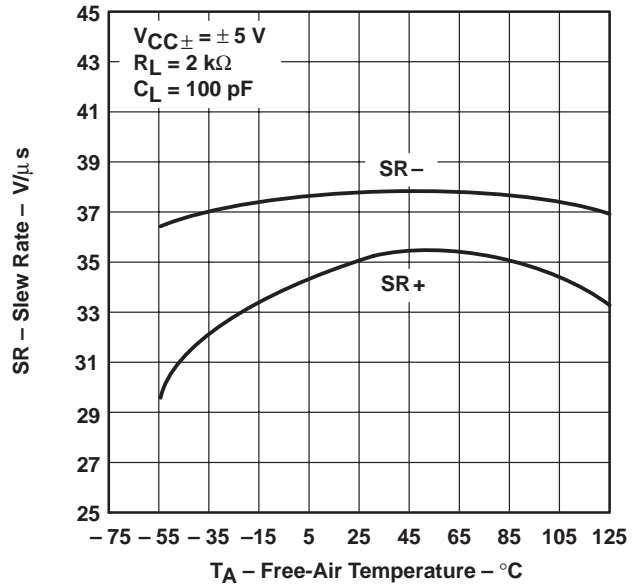


Figure 53

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



TYPICAL CHARACTERISTICS†

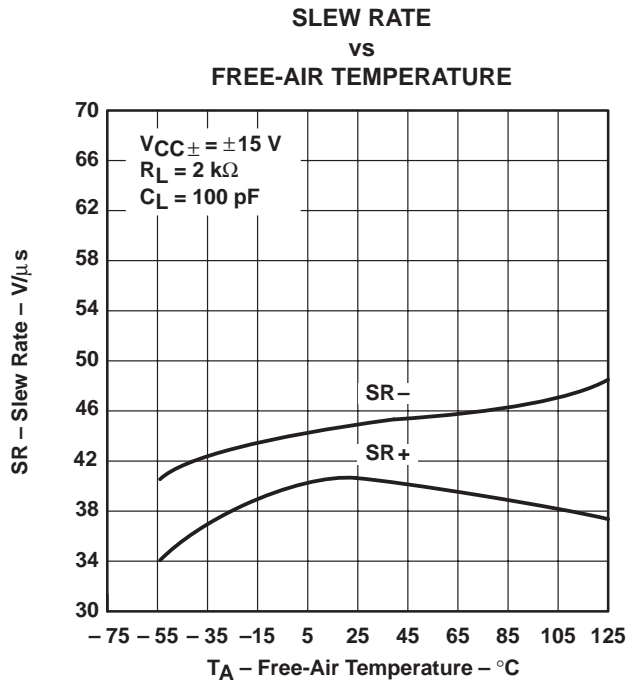


Figure 54

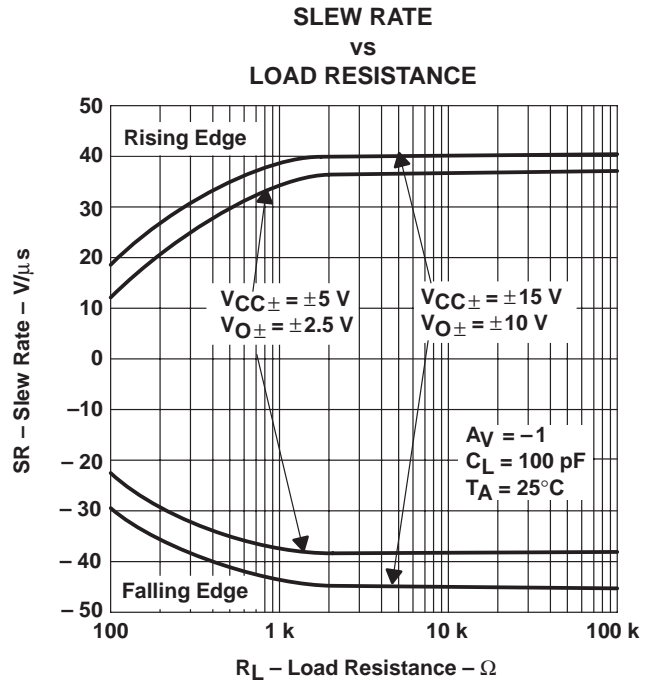


Figure 55

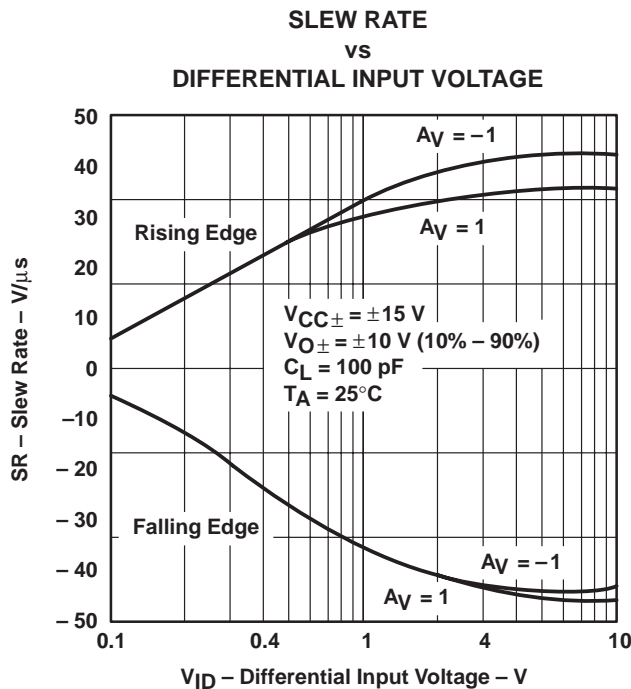


Figure 56

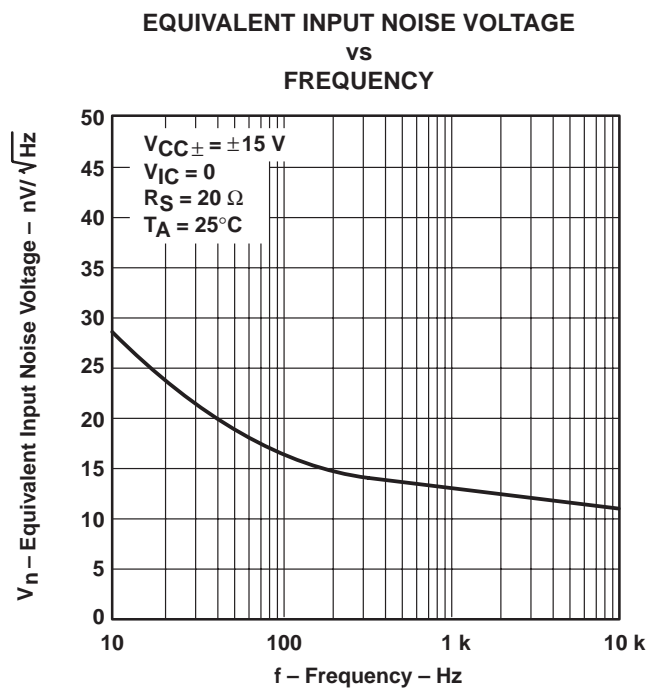


Figure 57

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

TLE208x, TLE208xA, TLE208xY
 EXCALIBUR HIGH-SPEED JFET-INPUT
 OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS

INPUT-REFERRED NOISE VOLTAGE
 vs
 NOISE BANDWIDTH FREQUENCY

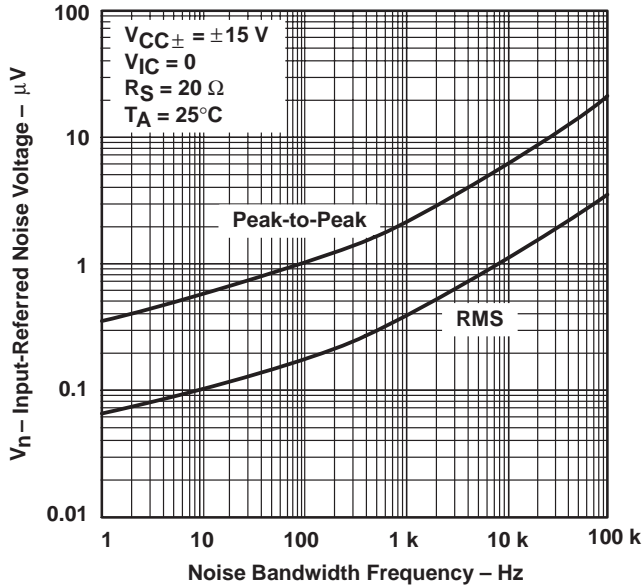


Figure 58

INPUT-REFERRED NOISE VOLTAGE
 OVER A 10-SECOND TIME INTERVAL

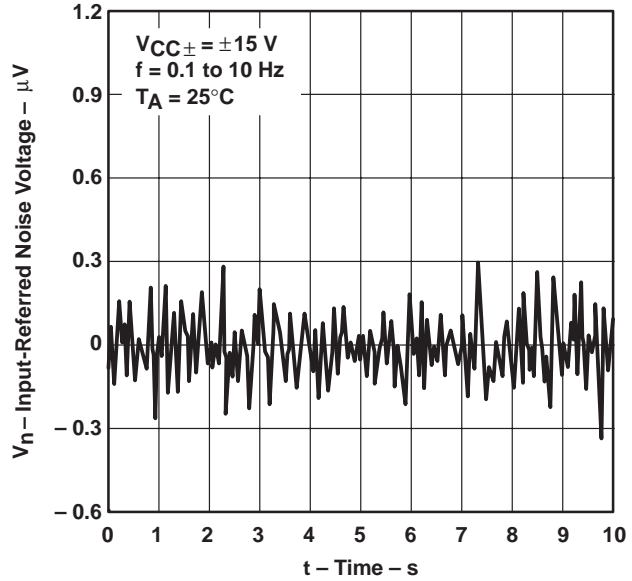


Figure 59

THIRD-OCTAVE SPECTRAL NOISE DENSITY
 vs
 FREQUENCY BANDS

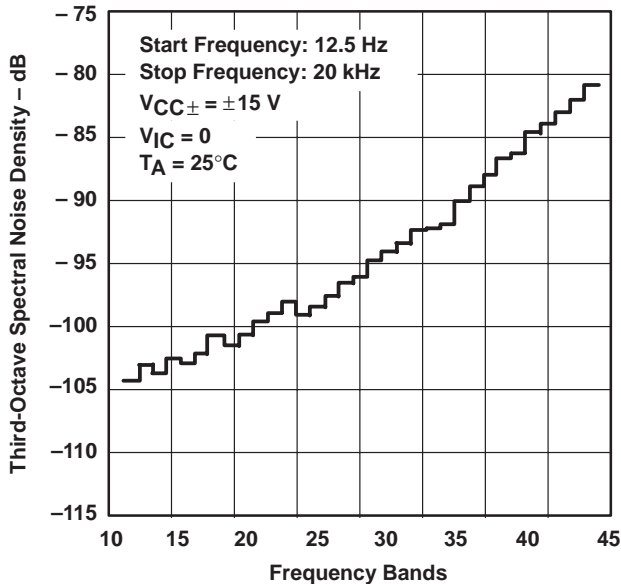


Figure 60

TOTAL HARMONIC DISTORTION PLUS NOISE
 vs
 FREQUENCY

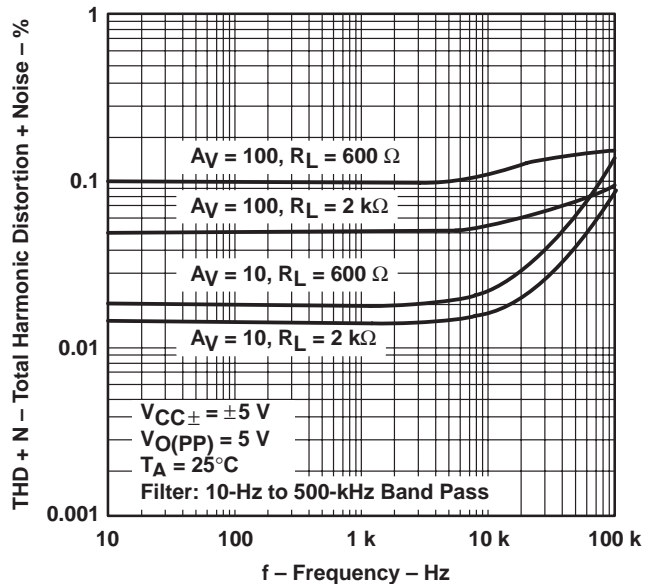


Figure 61

TYPICAL CHARACTERISTICS†

TOTAL HARMONIC DISTORTION PLUS NOISE
vs
FREQUENCY

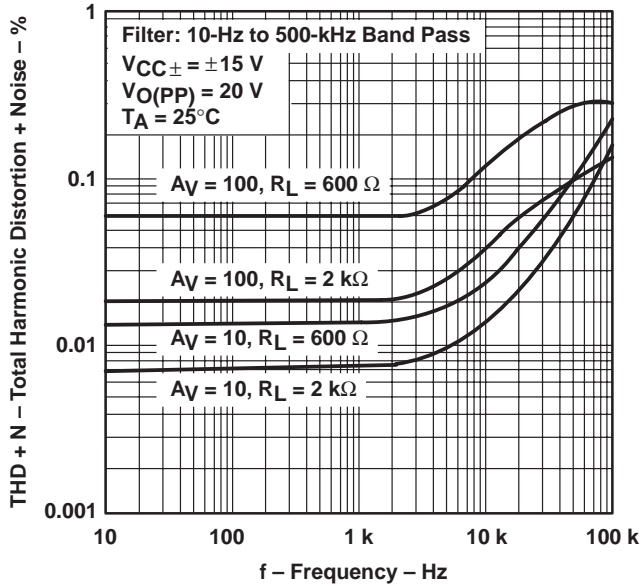


Figure 62

UNITY-GAIN BANDWIDTH
vs
LOAD CAPACITANCE

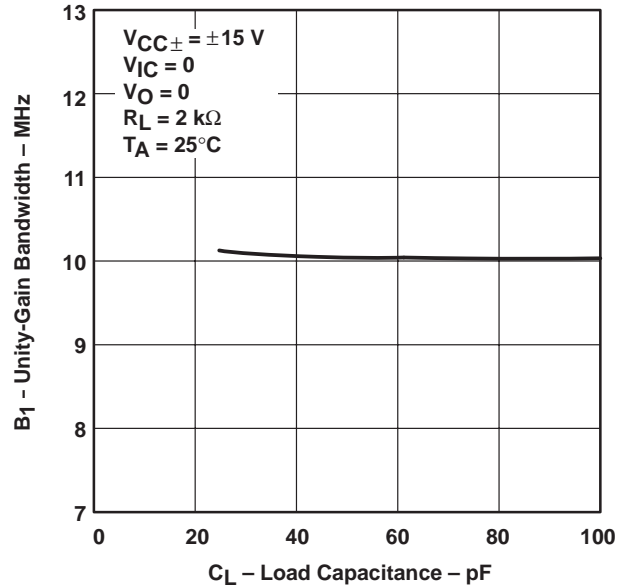


Figure 63

GAIN-BANDWIDTH PRODUCT
vs
FREE-AIR TEMPERATURE

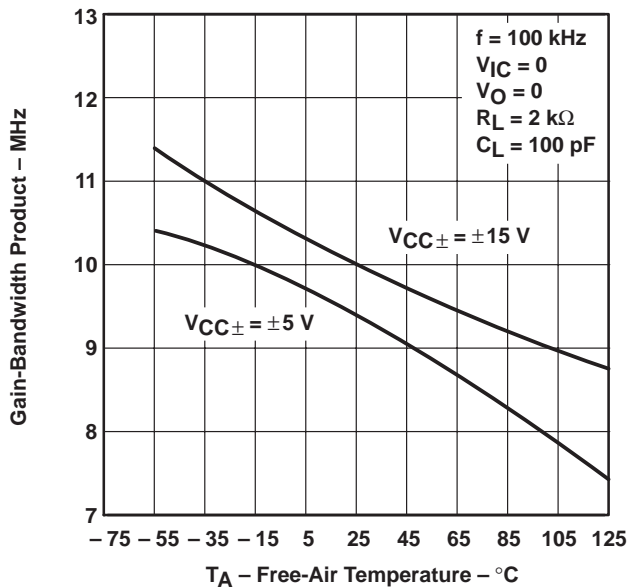


Figure 64

GAIN-BANDWIDTH PRODUCT
vs
SUPPLY VOLTAGE

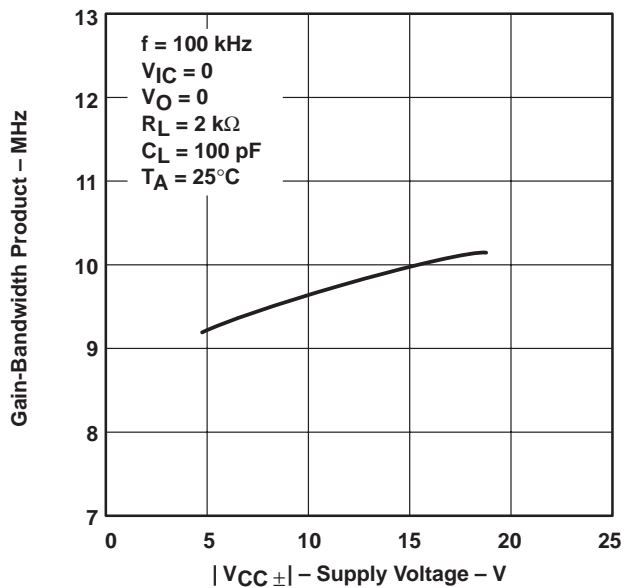


Figure 65

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

TLE208x, TLE208xA, TLE208xY
 EXCALIBUR HIGH-SPEED JFET-INPUT
 OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS†

GAIN MARGIN
 vs
 LOAD CAPACITANCE

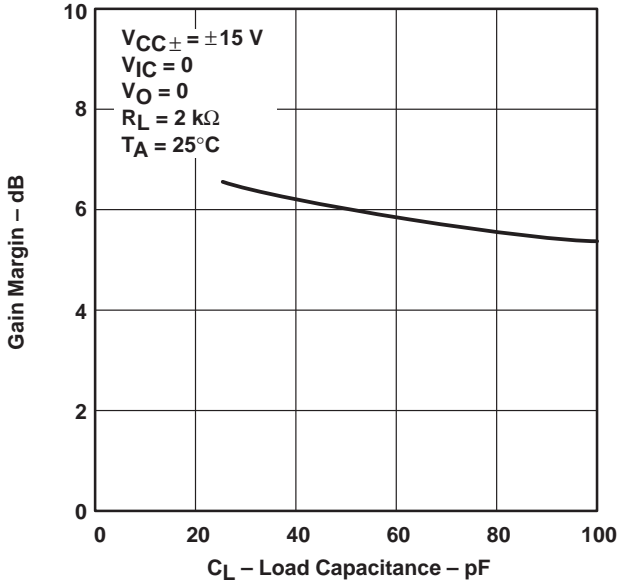


Figure 66

PHASE MARGIN
 vs
 FREE-AIR TEMPERATURE

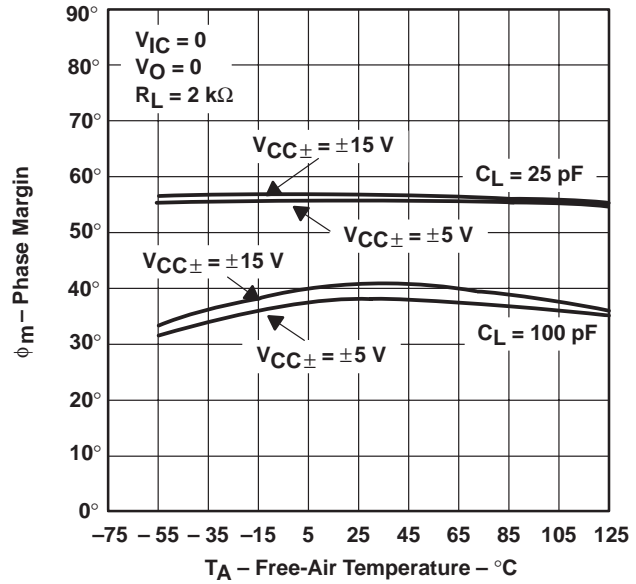


Figure 67

PHASE MARGIN
 vs
 SUPPLY VOLTAGE

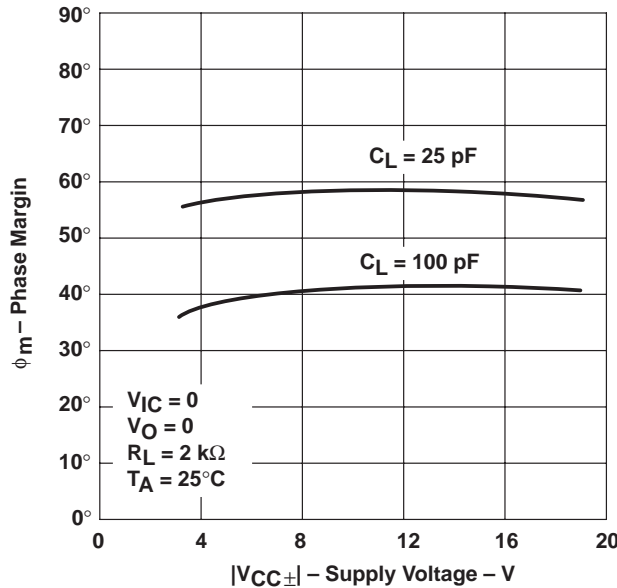


Figure 68

PHASE MARGIN
 vs
 LOAD CAPACITANCE

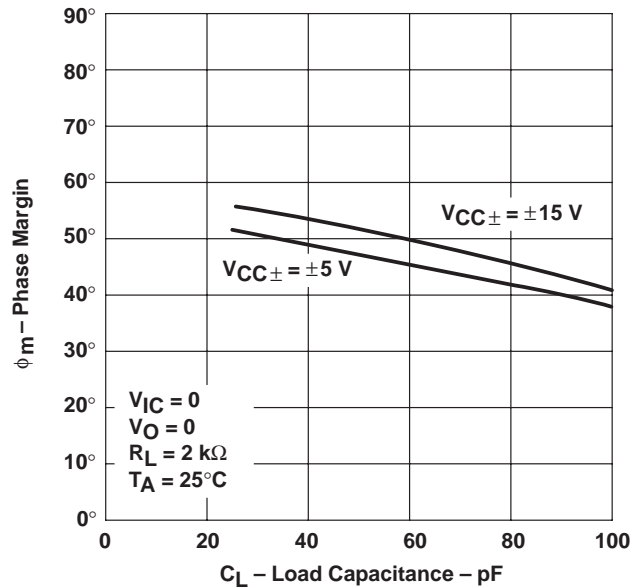


Figure 69

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



TYPICAL CHARACTERISTICS†

NONINVERTING LARGE-SIGNAL
PULSE RESPONSE

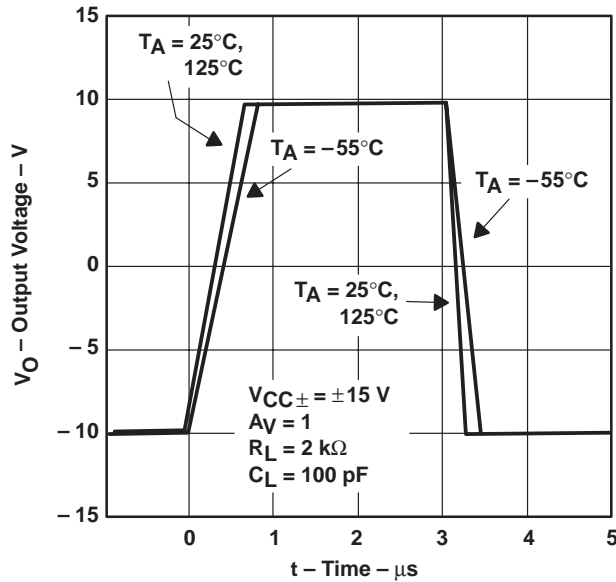


Figure 70

SMALL-SIGNAL PULSE RESPONSE

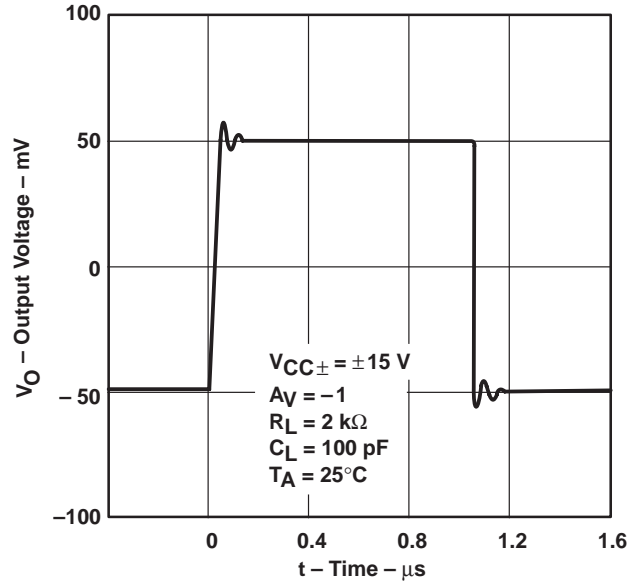


Figure 71

CLOSED-LOOP OUTPUT IMPEDANCE
vs
FREQUENCY

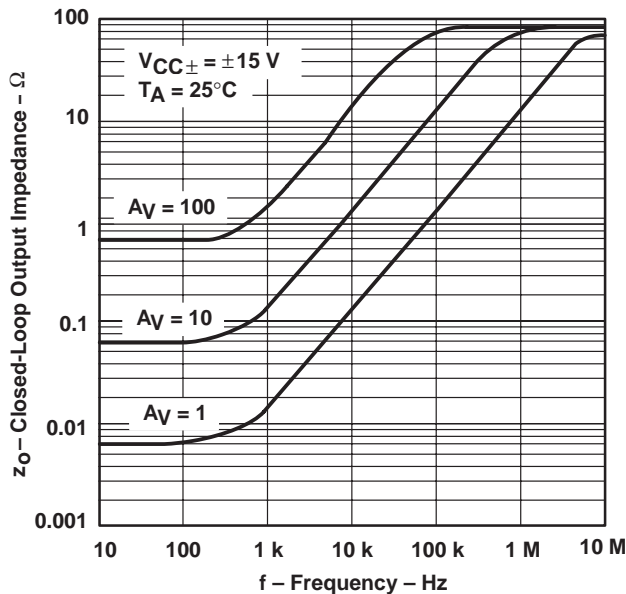


Figure 72

TLE2082 AND TLE2084
CROSSTALK ATTENUATION
vs
FREQUENCY

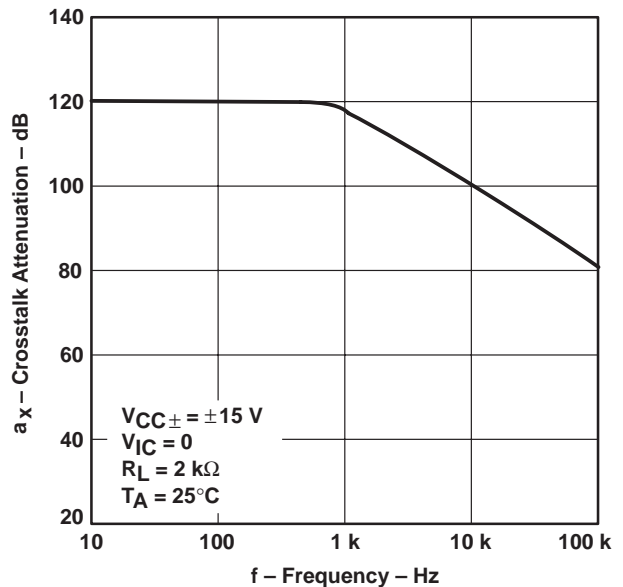


Figure 73

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

TLE208x, TLE208xA, TLE208xY EXCALIBUR HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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APPLICATION INFORMATION

input characteristics

The TLE208x, TLE208xA, and TLE208xB are specified with a minimum and a maximum input voltage that if exceeded at either input could cause the device to malfunction. Because of the extremely high input impedance and resulting low bias current requirements, the TLE208x, TLE208xA, and TLE208xB are well suited for low-level signal processing; however, leakage currents on printed-circuit boards and sockets can easily exceed bias current requirements and cause degradation in system performance. It is good practice to include guard rings around inputs (see Figure 74). These guards should be driven from a low-impedance source at the same voltage level as the common-mode input.

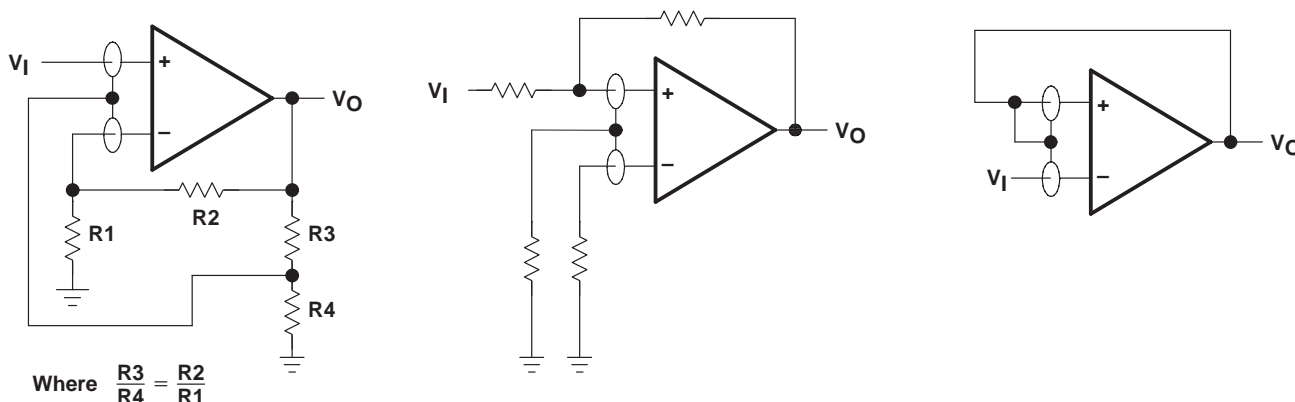


Figure 74. Use of Guard Rings

TLE2081 input offset voltage nulling

The TLE2061 series offers external null pins that can be used to further reduce the input offset voltage. The circuit of Figure 75 can be connected as shown if the feature is desired. When external nulling is not needed, the null pins may be left unconnected.

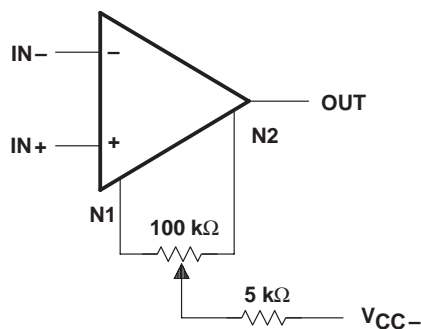


Figure 75. Input Offset Voltage Nulling

APPLICATION INFORMATION

macromodel information

Macromodel information provided was derived using *PSpice™ Parts™* model generation software. The Boyle macromodel (see Note 4) and subcircuit in Figure 58 were generated using the TLE208x 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 4: 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).

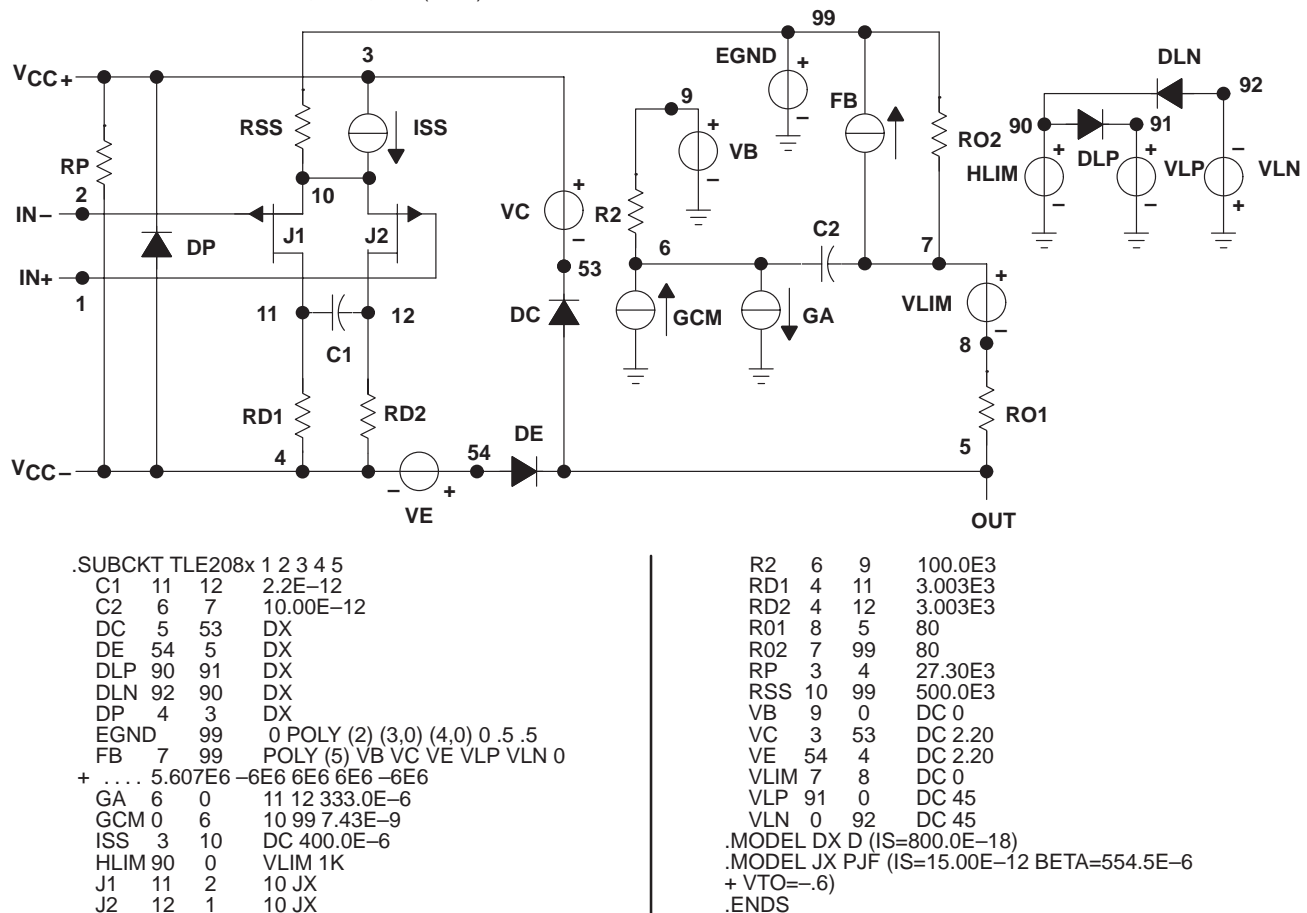


Figure 76. Boyle Macromodel and Subcircuit

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TLE208x, TLE208xA, TLE208xY
EXCALIBUR HIGH-SPEED JFET-INPUT
OPERATIONAL AMPLIFIERS

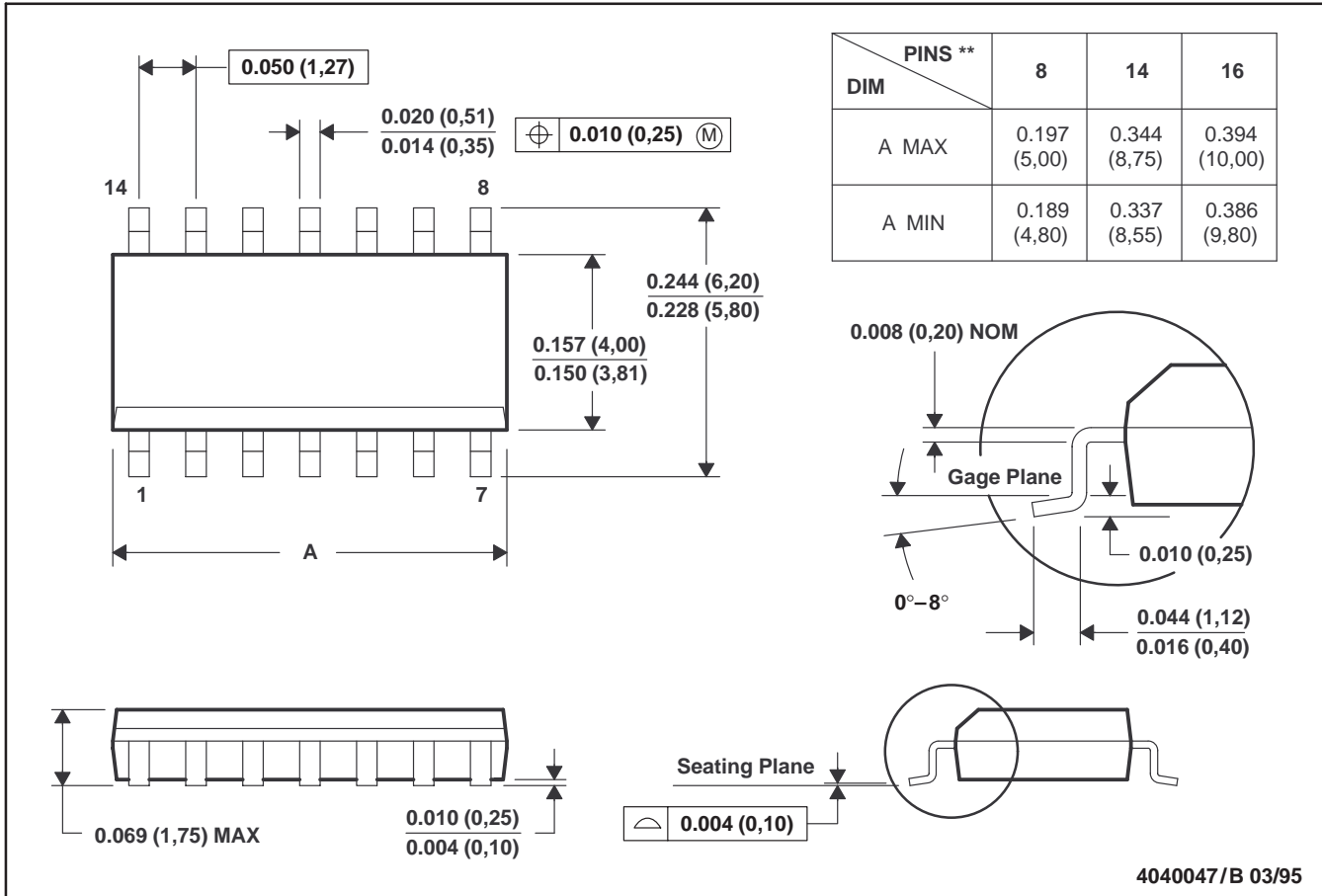
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MECHANICAL INFORMATION

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. Four center pins are connected to die mount pad.
 E. Falls within JEDEC MS-012

TLE208x, TLE208xA, TLE208xY
EXCALIBUR HIGH-SPEED JFET-INPUT
OPERATIONAL AMPLIFIERS

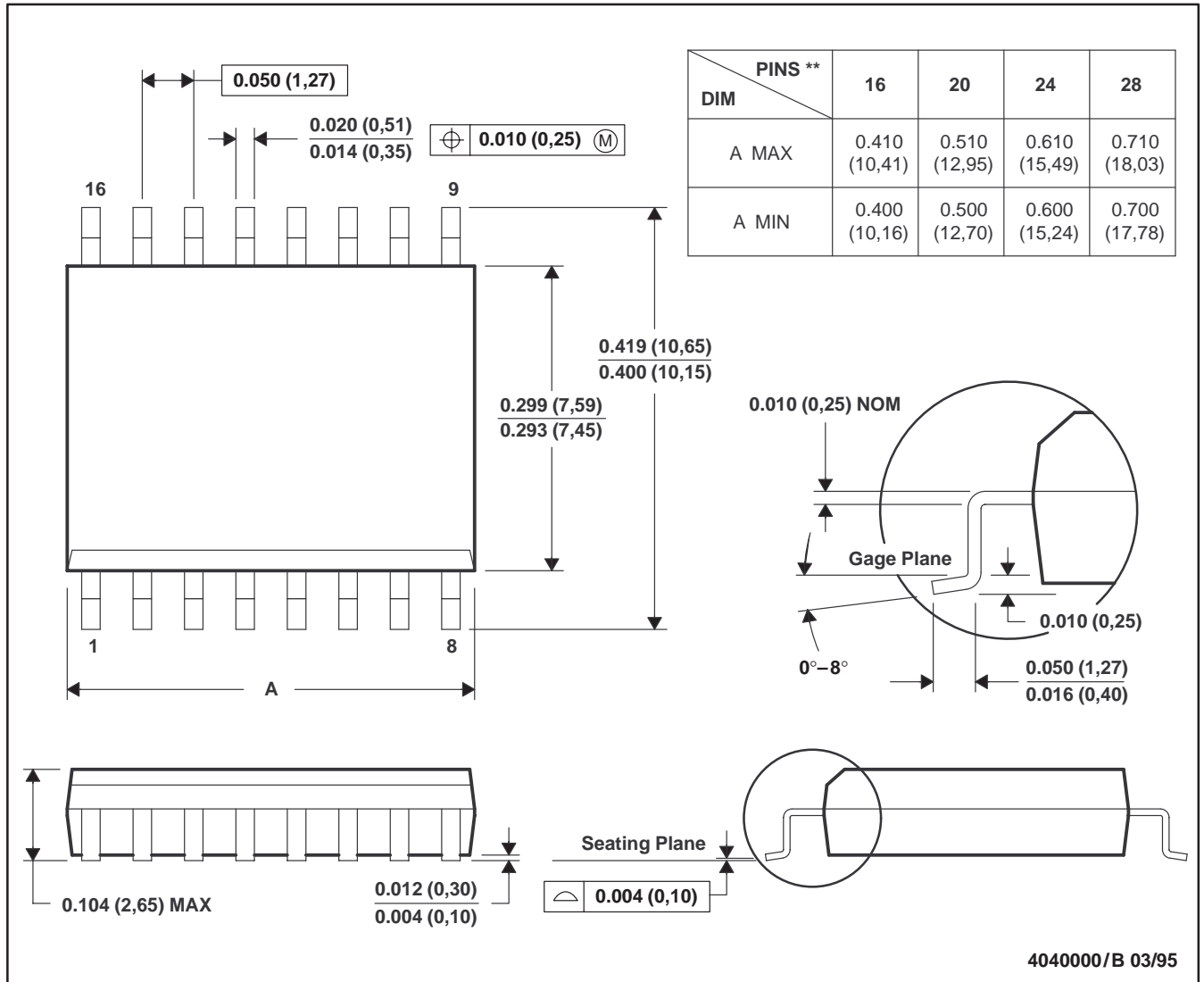
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MECHANICAL INFORMATION

DW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

16 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-013

TLE208x, TLE208xA, TLE208xY
EXCALIBUR HIGH-SPEED JFET-INPUT
OPERATIONAL AMPLIFIERS

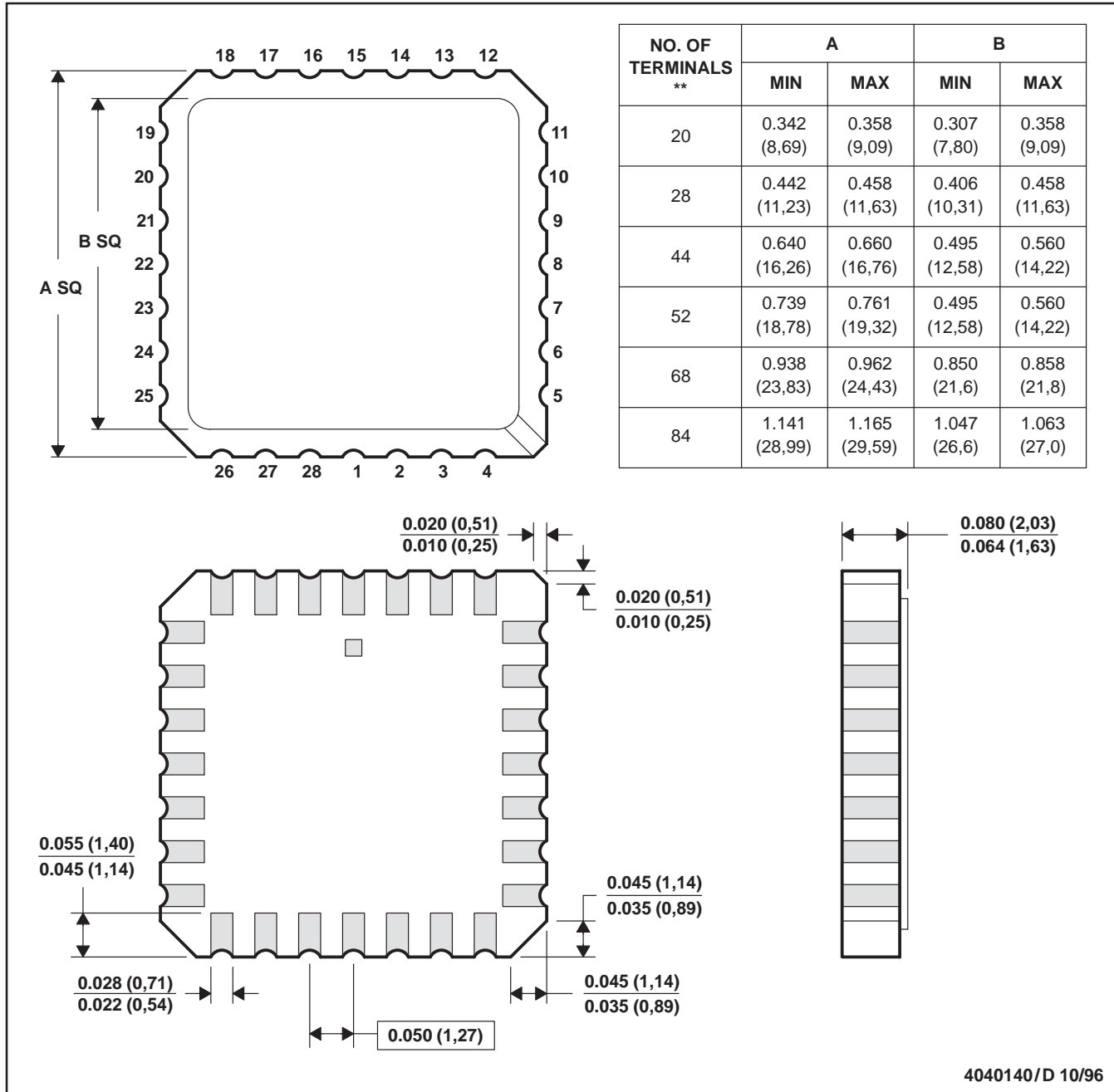
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MECHANICAL INFORMATION

FK (S-CQCC-N)**

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



4040140/D 10/96

- 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



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TLE208x, TLE208xA, TLE208xY
EXCALIBUR HIGH-SPEED JFET-INPUT
OPERATIONAL AMPLIFIERS

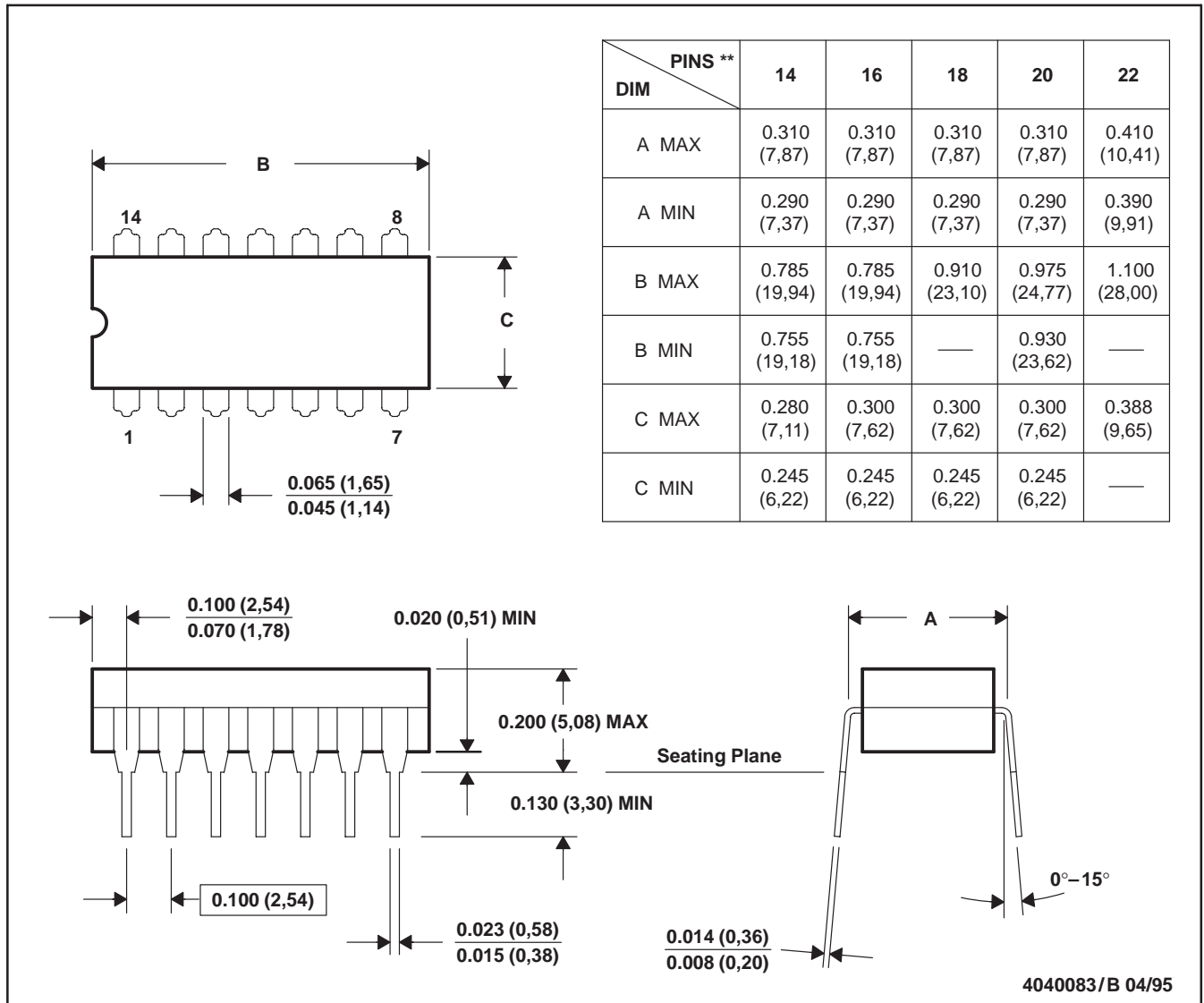
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MECHANICAL INFORMATION

J (R-GDIP-T**)

CERAMIC DUAL-IN-LINE PACKAGE

14 PIN 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 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

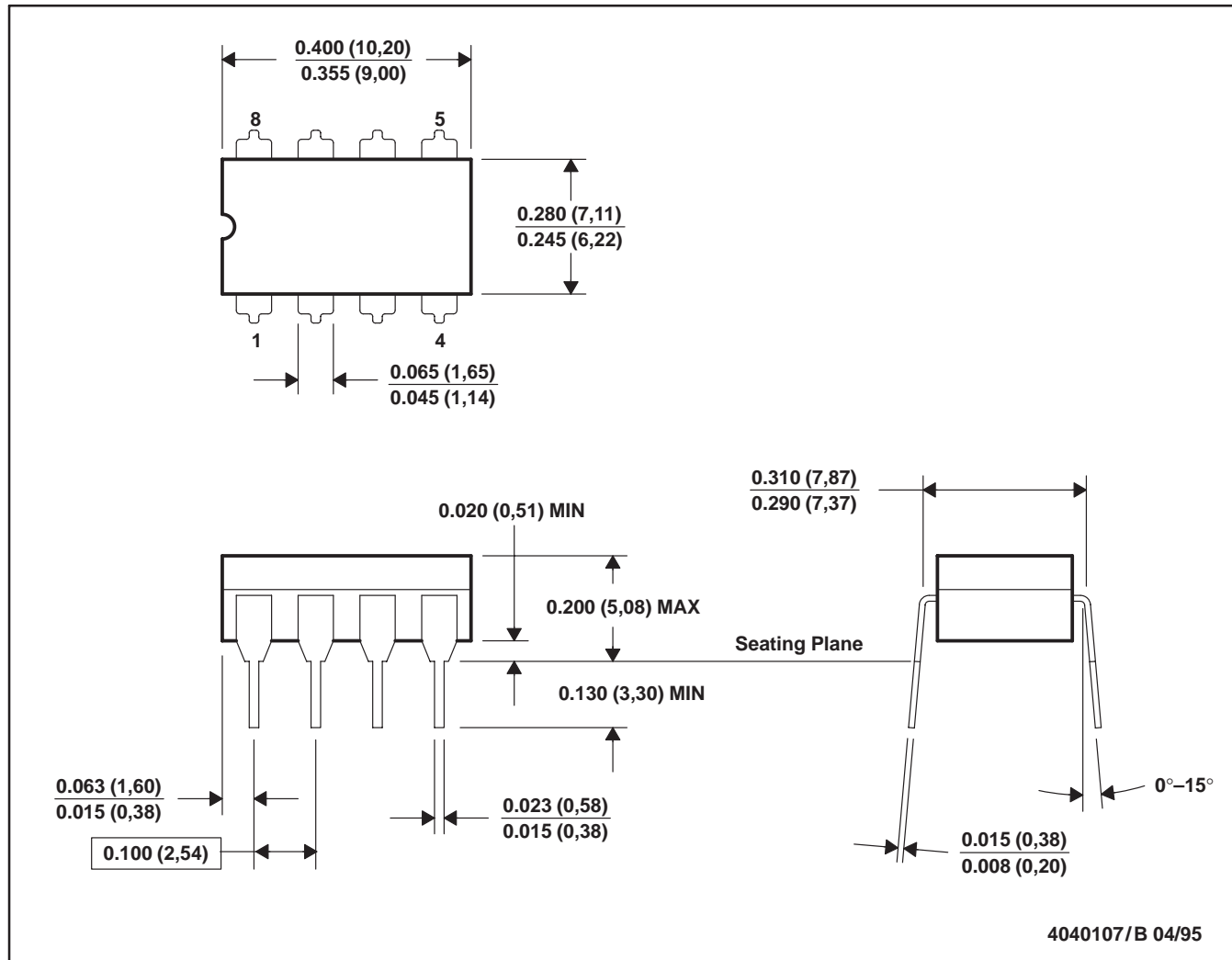
TLE208x, TLE208xA, TLE208xY
EXCALIBUR HIGH-SPEED JFET-INPUT
OPERATIONAL AMPLIFIERS

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MECHANICAL INFORMATION

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

TLE208x, TLE208xA, TLE208xY
EXCALIBUR HIGH-SPEED JFET-INPUT
OPERATIONAL AMPLIFIERS

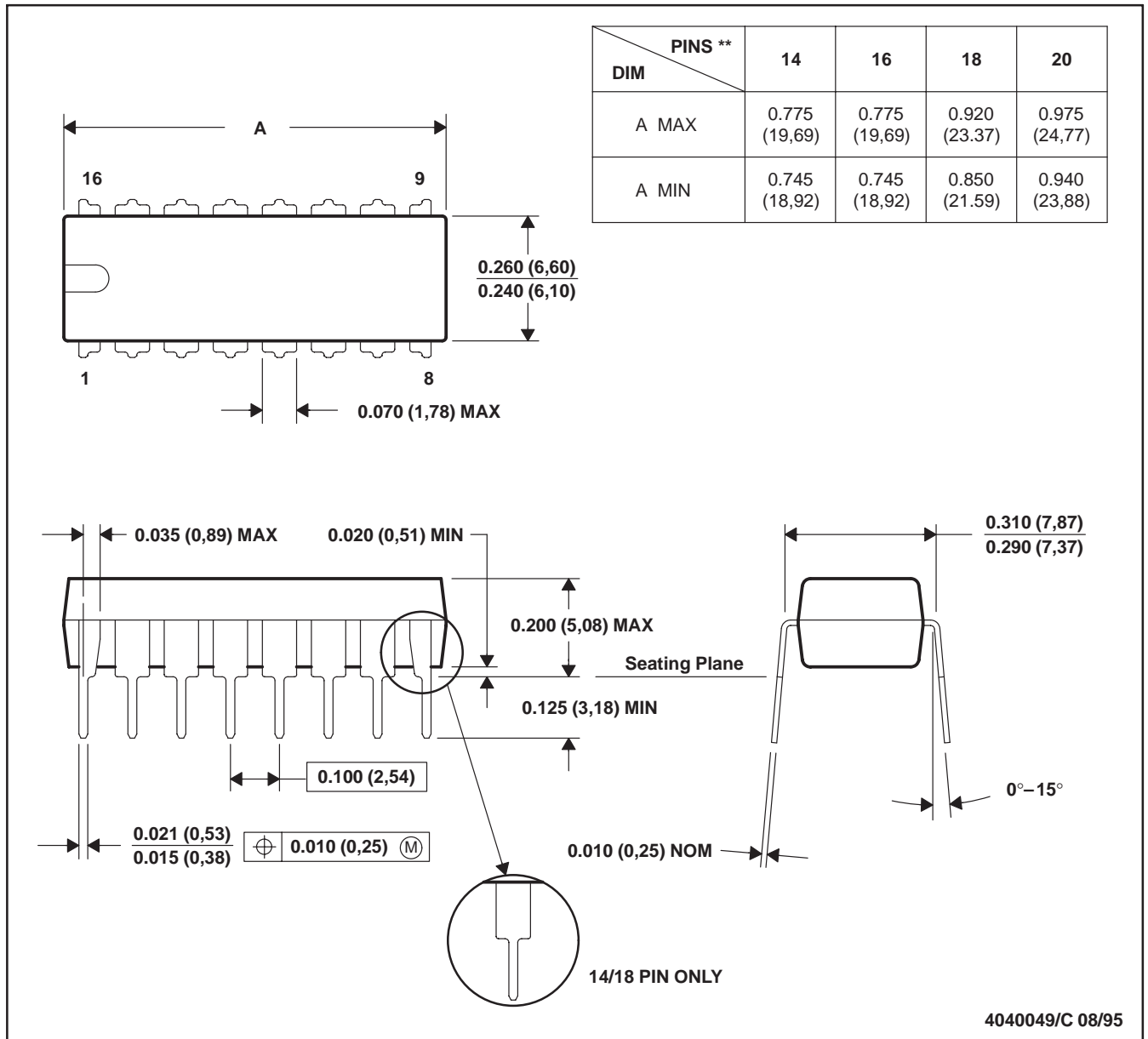
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MECHANICAL INFORMATION

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.)

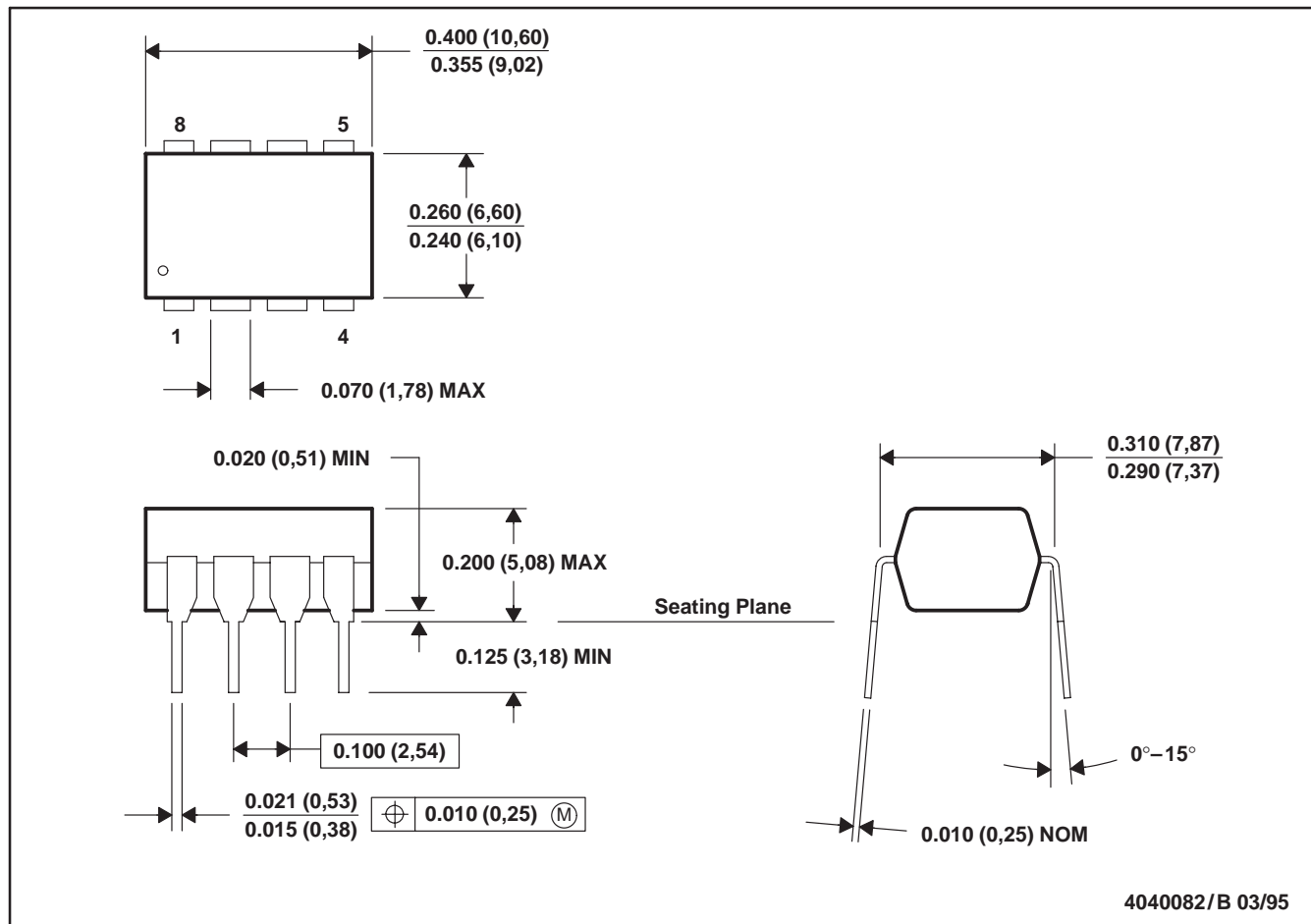
TLE208x, TLE208xA, TLE208xY
 EXCALIBUR HIGH-SPEED JFET-INPUT
 OPERATIONAL AMPLIFIERS

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MECHANICAL INFORMATION

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

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