

TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS181A – 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 TL07x
- Ensured Maximum Noise Floor 17 nV/√Hz
- On-Chip Offset Voltage Trimming for Improved DC Performance
- Wider Supply Rails Increase Dynamic Signal Range to ±19 V

description

The TLE207x 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. Texas Instruments Excalibur process yields a typical noise floor of 11.6 nV/√Hz, 17-nV/√Hz ensured maximum, offering immediate improvement in noise-sensitive circuits designed using the TL07x. The TLE207x also has 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 TLE207x 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 them 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.

The TLE207x family of BiFET amplifiers are Texas Instruments highest performance BiFETs, with tighter input offset voltage and ensured maximum noise specifications. Designers requiring less stringent specifications but seeking the improved ac characteristics of the TLE207x should consider the TLE208x operational amplifier family.

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 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 TLE207x 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.



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

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

 **TEXAS
INSTRUMENTS**

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TLE207x, TLE207xA, TLE207xY

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

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TLE2071 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	2 mV 4 mV	TLE2071ACD TLE2071CD	—	—	TLE2071ACP TLE2071CP	— TLE2071Y
–40°C to 85°C	2 mV 4 mV	TLE2071AID TLE2071ID	—	—	TLE2071AIP TLE2071IP	—
–55°C to 125°C	2 mV 4 mV	— —	TLE2071AMFK TLE2071MFK	TLE2071AMJG TLE2071MJG	— —	—

[†] The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2071ACDR).

[‡] Chip-form versions are tested at T_A = 25°C.

TLE2072 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	3.5 mV 6 mV	TLE2072ACD TLE2072CD	—	—	TLE2072ACP TLE2072CP	— TLE2072Y
–40°C to 85°C	3.5 mV 6 mV	TLE2072AID TLE2072ID	—	—	TLE2072AIP TLE2072IP	—
–55°C to 125°C	3.5 mV 6 mV	—	TLE2072AMFK TLE2072MFK	TLE2072AMJG TLE2072MJG	—	—

[†] The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2072ACDR).

[‡] Chip-form versions are tested at T_A = 25°C.

TLE2074 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	3 mV 5 mV	TLE2074ACDW TLE2074CDW	—	—	TLE2074ACN TLE2074CN	— TLE2074Y
–40°C to 85°C	3 mV 5 mV	TLE2074AIDW TLE2074IDW	—	—	TLE2074AIN TLE2074IN	—
–55°C to 125°C	3 mV 5 mV	—	TLE2074AMFK TLE2074MFK	TLE2074AMJ TLE2074MJ	—	—

[†] The DW packages are available taped and reeled. Add R suffix to device type (e.g., TLE2074ACDWR).

[‡] Chip-form versions are tested at T_A = 25°C.

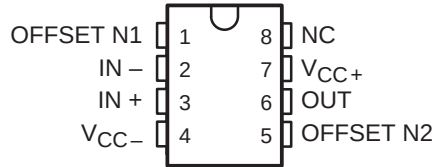


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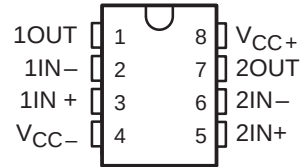
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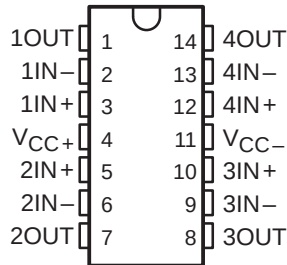
TLE2071 AND TLE2071A
D, JG, OR P PACKAGE
(TOP VIEW)



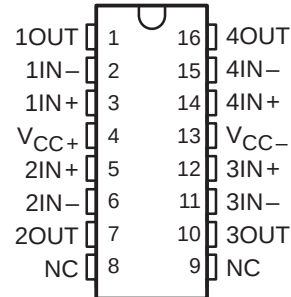
TLE2072 AND TLE2072A
D, JG, OR P PACKAGE
(TOP VIEW)



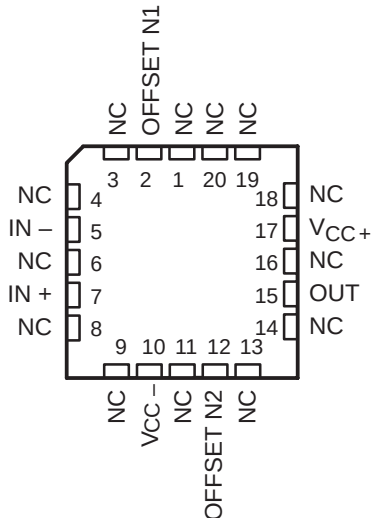
TLE2074 AND TLE2074A
J OR N PACKAGE
(TOP VIEW)



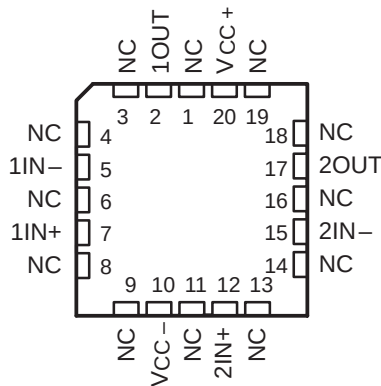
TLE2074 AND TLE2074A
DW PACKAGE
(TOP VIEW)



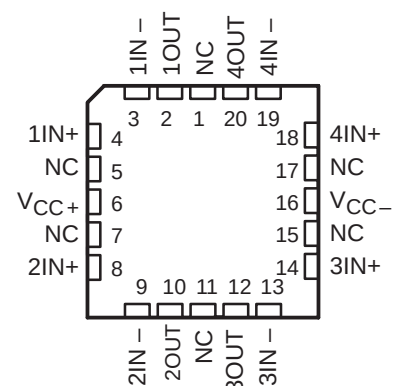
TLE2071M AND TLE2071AM
FK PACKAGE
(TOP VIEW)



TLE2072M AND TLE2072AM
FK PACKAGE
(TOP VIEW)

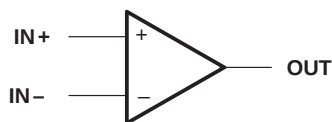


TLE2074M AND TLE2074AM
FK PACKAGE
(TOP VIEW)



NC – No internal connection

symbol



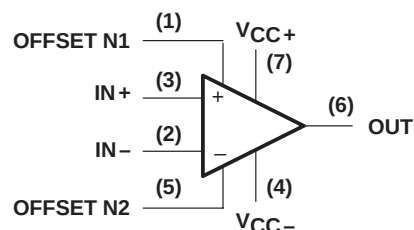
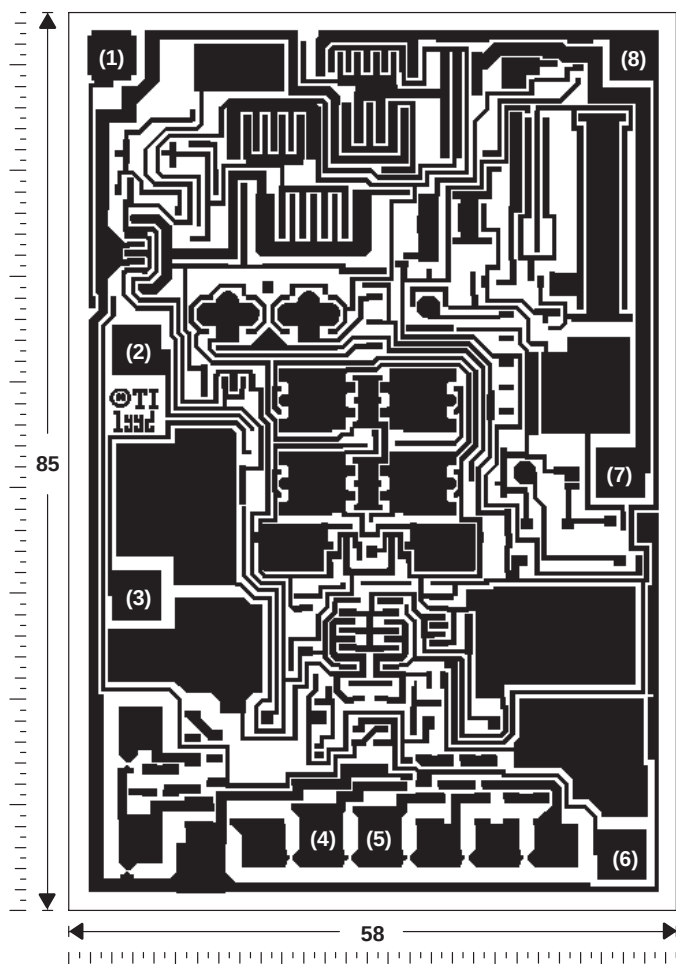
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TLE2071Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2071C. 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.

BONDING PAD ASSIGNMENTS



CHIP THICKNESS: 15 TYPICAL

BONDING PADS: 4×4 MINIMUM

$T_{jmax} = 150^{\circ}\text{C}$

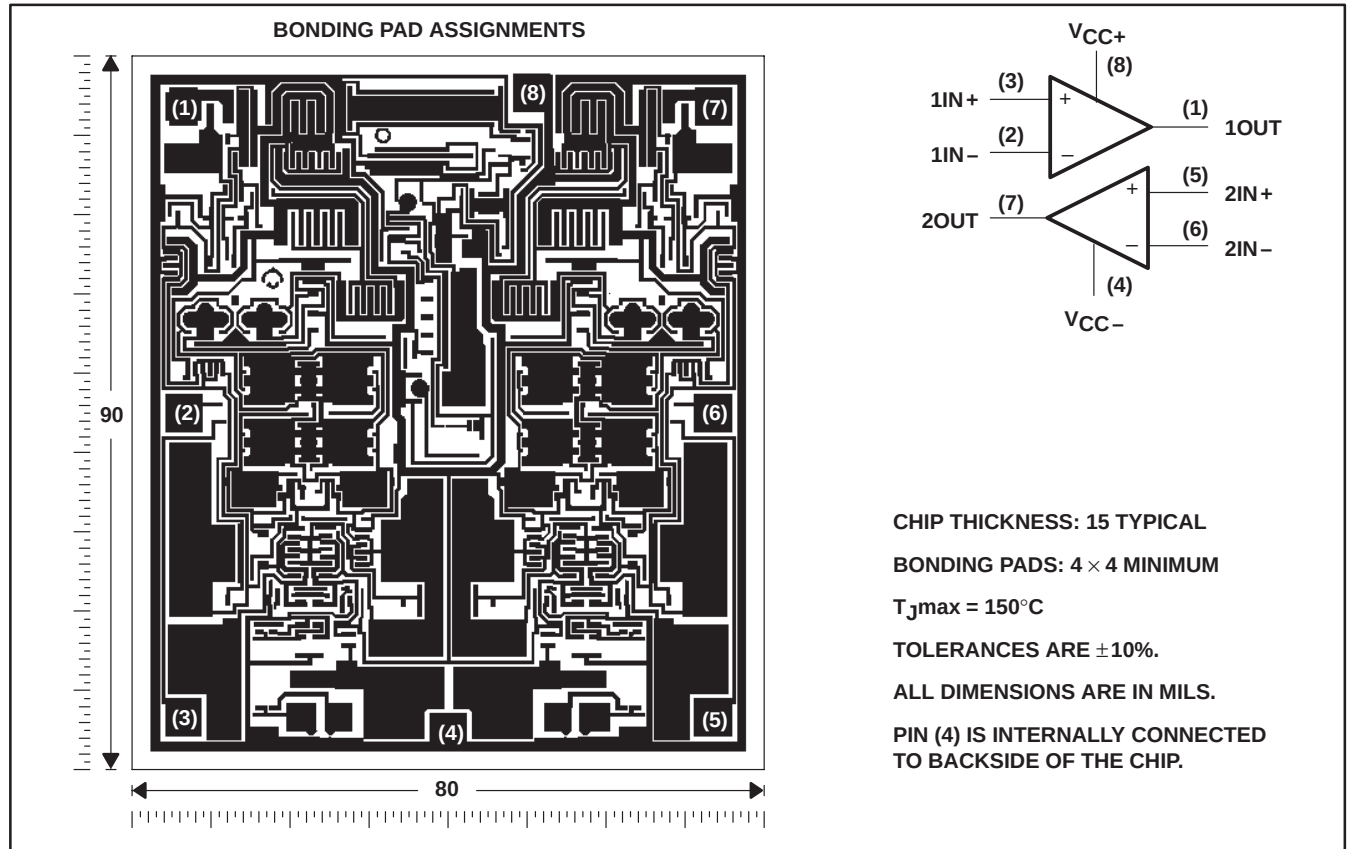
TOLERANCES ARE $\pm 10\%$.

ALL DIMENSIONS ARE IN MILS.

PIN (4) IS INTERNALLY CONNECTED
TO BACKSIDE OF THE CHIP.

TLE2072Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2072C. 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.

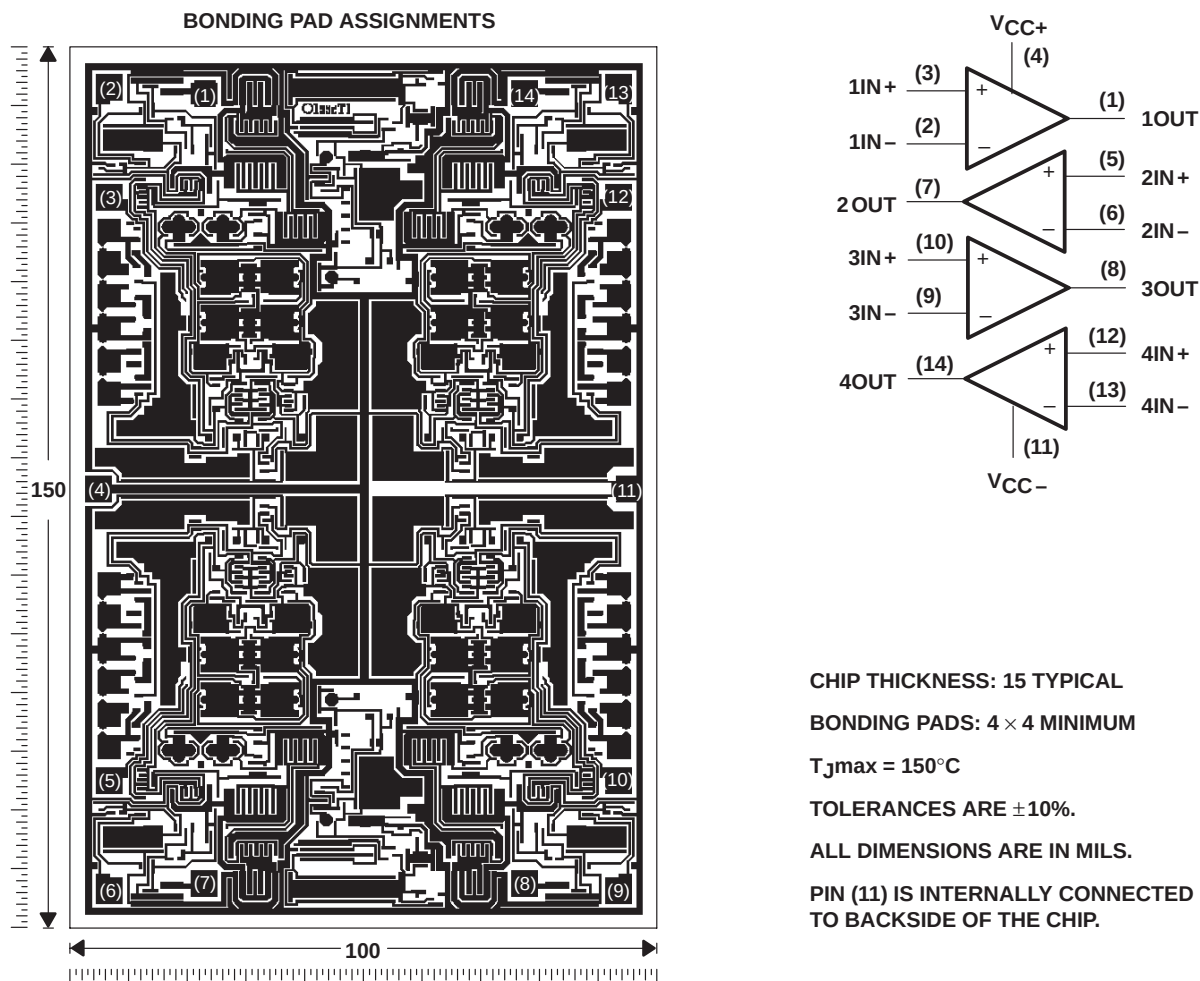


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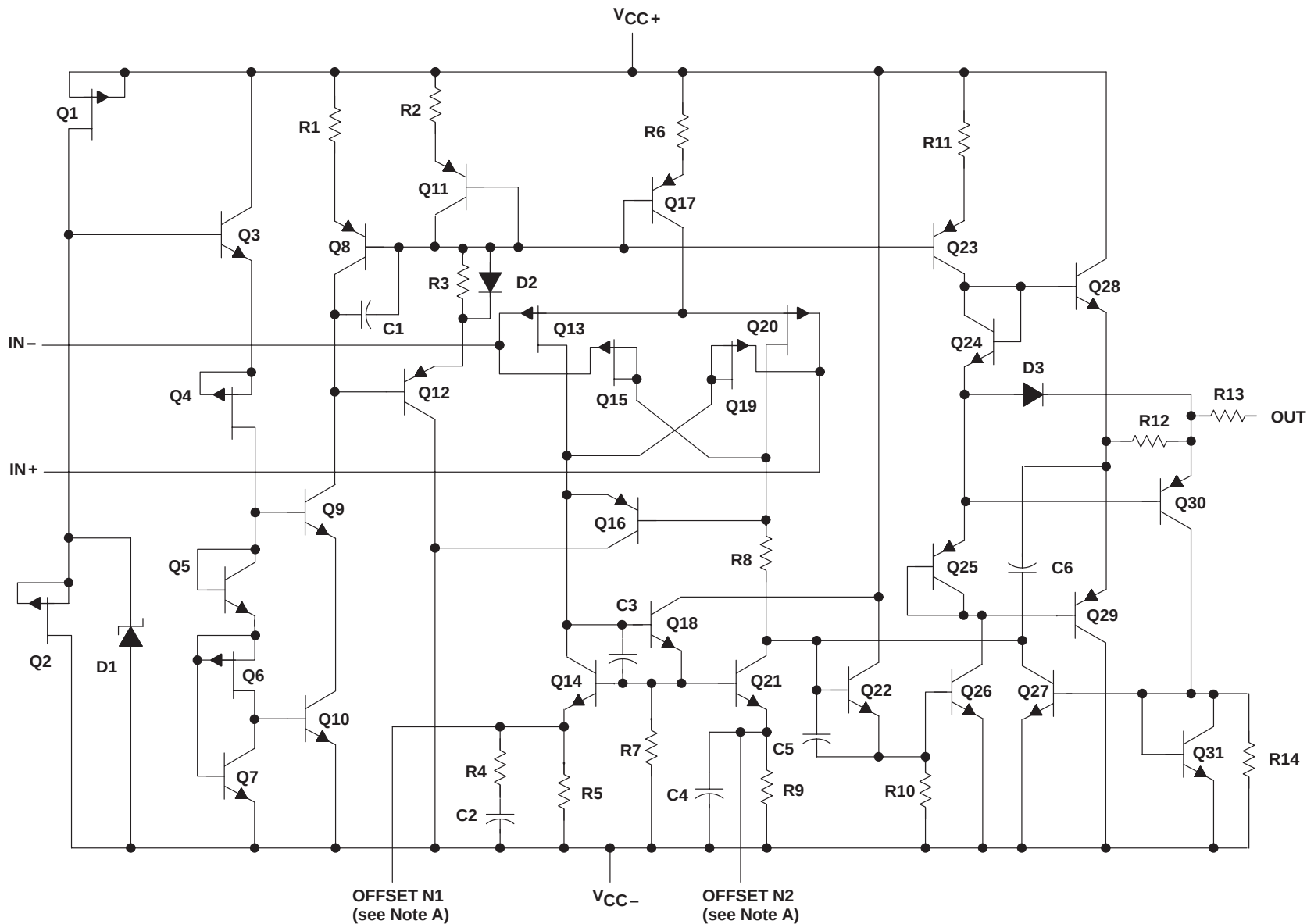
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TLE2074Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2074C. 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



NOTES: A. OFFSET N1 AND OFFSET N2 are only available on the TLE2071x devices.

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ACTUAL DEVICE COMPONENT COUNT			
COMPONENT	TLE2071	TLE2072	TLE2074
Transistors	33	57	114
Resistors	25	37	74
Diodes	8	5	10
Capacitors	6	11	22

equivalent schematic (continued)

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 the noninverting input with respect to the inverting input.
3. The output may 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	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
D	725 mW	5.8 mW/°C	464 mW	377 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	—

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}	$V_{CC\pm} = \pm 5$ V	–0.9	5	–0.8	5	–0.8	5	V
	$V_{CC\pm} = \pm 15$ 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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TLE2071C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2071C			TLE2071AC			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	4		0.3	2		mV
		Full range			6			4	
α_{VIO} Temperature coefficient of input offset voltage		Full range	3.2	29		3.2	29		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0,$ 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	$I_O = -200\ \mu\text{A}$	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	-3.5	-4.2		-3.5	-4.2		V
		Full range	-3.4			-3.4			
	$I_O = 2\text{ mA}$	25°C	-3.7	-4.1		-3.7	-4.1		
		Full range	-3.6			-3.6			
	$I_O = 20\text{ mA}$	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	$V_{IC} = 0,$ 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			

† Full range is 0°C to 70°C.



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TLE2071C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2071C			TLE2071AC			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	$V_O = 0$	$V_{ID} = 1$ V		–35			–35		mA
		$V_{ID} = -1$ V		45			45		

† Full range is 0°C to 70°C.

TLE2071C operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2071C			TLE2071AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = ±2.3 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	35			35			V/μs
				Full range	23			23			
SR −	Negative slew rate			25°C	38			38			V/μs
				Full range	23			23			
t _s	Settling time	A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.25			0.25			μs
			To 1 mV		0.4			0.4			
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28 55			28 55			nV/√Hz
	f = 10 kHz		11.6 17			11.6 17					
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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			fA/√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 kΩ,	25°C	0.013%			0.013%			
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, See Figure 2	25°C	9.4			9.4			MHz
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 4 V, R _L = 2 kΩ ,	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 kΩ, See Figure 2	25°C	56°			56°			

† Full range is 0°C to 70°C.



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TLE2071C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2071C			TLE2071AC			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	4		0.47	2		mV
		Full range			6			4	
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		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	$I_O = -200 \mu A$	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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TLE2071C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2071C			TLE2071AC			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	V _{ID} = 1 V	25°C	–30	–45		–30	–45	mA	
			V _{ID} = –1 V		30	48		30	48		

† Full range is 0°C to 70°C.

TLE2071C operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2071C			TLE2071AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = 10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	30	40		30	40		V/μs
				Full range	27			27			
SR −	Negative slew rate			25°C	30	45		30	45		V/μs
				Full range	27			27			
t _s	Settling time	A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.4			0.4			μs
			To 1 mV		1.5			1.5			
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28	55		28	55		nV√Hz
	f = 10 kHz		11.6		17	11.6	17				
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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			fA√Hz
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, A _{VD} = 10, f = 1 kHz, R _L = 2 kΩ, R _S = 25 Ω		25°C	0.008%			0.008%			
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, 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 kΩ, C _L = 25 pF		25°C	478	637		478	637		kHz
φ _m	Phase margin at unity gain	V _I = 10 mV, C _L = 25 pF, See Figure 2		25°C	57°			57°			

† Full range is 0°C to 70°C.



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TLE2071I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2071I			TLE2071AI			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	4		0.3	2		mV
		Full range			7.6			5.6	
α_{VIO} Temperature coefficient of input offset voltage		Full range	3.2	29		3.2	29		$\mu\text{V}/^\circ\text{C}$
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	$V_{IC} = 0, \text{See Figure 5}$	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			

† Full range is -40°C to 85°C .

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TLE2071I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2071I			TLE2071AI			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 –40°C to 85°C.

TLE2071I operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2071I			TLE2071AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = ±2.3 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	35			35			V/μs
	Full range			22			22				
SR −	Negative slew rate			25°C	38			38			V/μs
	Full range			22			22				
t _s	Settling time	A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.25			0.25			μs
			To 1 mV		0.4			0.4			
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28	55	28	55	nV/√Hz		
	f = 10 kHz		11.6		17	11.6	17				
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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			fA/√Hz
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 5 V, A _{VD} = 10, f = 1 kHz, R _L = 2 kΩ, R _S = 25 Ω		25°C	0.013%			0.013%			
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, 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 kΩ , 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 kΩ, See Figure 2		25°C	56°			56°			

† Full range is –40°C to 85°C.



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TLE2071I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2071I			TLE2071AI			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	4		0.47	2		mV
		Full range		7.6			5.6		
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		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			
	$I_O = -2 \text{ mA}$	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			80			

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



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TLE2071I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2071I			TLE2071AI			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	V _{ID} = 1 V	25°C	–30	–45		–30	–45	mA	
			V _{ID} = –1 V		30	48		30	48		

† Full range is –40°C to 85°C.

TLE2071I operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2071I			TLE2071AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = ±10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	30	40		30	40		V/μs
				Full range	24			24			
SR −	Negative slew rate			25°C	30	45		30	45		V/μs
				Full range	24			24			
t _s	Settling time	A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.4			0.4			μs
		To 1 mV	1.5			1.5					
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28	55		28	55		nV/√Hz
			f = 10 kHz		11.6	17		11.6	17		
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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			fA/√Hz
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, A _{VD} = 10, f = 1 kHz, R _L = 2 kΩ, R _S = 25 Ω		25°C	0.008%			0.008%			
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, 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 kΩ, C _L = 25 pF		25°C	478	637		478	637		kHz
φ _m	Phase margin at unity gain	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, See Figure 2	25°C	57°			57°			

† Full range is –40°C to 85°C.



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TLE2071M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2071M			TLE2071AM			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	4		0.3	2		mV
		Full range			9.2			7.2	
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	$V_{IC} = 0, V_O = 0,$ 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			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	$I_O = -200 \mu A$	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	$I_O = 200 \mu A$	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	$V_{IC} = V_{ICRmin}, V_O = 0,$ $R_S = 50 \Omega$	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			

*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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TLE2071M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2071M			TLE2071AM			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 V	25°C	−35			−35			mA
			V _{ID} = −1 V		45			45			

† Full range is –55°C to 125°C.

TLE2071M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2071M			TLE2071AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = ±2.3 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	35			35			V/μs
	Full range			20*			20*				
SR −	Negative slew rate			25°C	38			38			V/μs
	Full range			20*			20*				
t _s	Settling time	A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.25			0.25			μs
			To 1 mV		0.4			0.4			
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28	55*	28	55*	nV/√Hz		
	f = 10 kHz		11.6		17*	11.6	17*				
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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			fA/√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 kΩ, 25°C	0.013%			0.013%				
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF, R _L = 2 kΩ, See Figure 2	25°C	9.4			9.4			MHz	
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 4 V, R _L = 2 kΩ , 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 kΩ, 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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TLE2071M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2071M			TLE2071AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage	V _{IC} = 0, V _O = 0, R _S = 50 Ω		25°C	0.49 4			0.47 2			mV
				Full range	9.2			7.2			
αV _{IO}	Temperature coefficient of input offset voltage				Full range	3.2 29*			3.2 29*		
I _{IO}	Input offset current	V _{IC} = 0, V _O = 0, 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	60			60			nA
V _{ICR}	Common-mode input voltage range	R _S = 50 Ω		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 μA		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 μA		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 = ±10 V	R _L = 600 Ω	25°C	80 96			80 96			dB
				Full range	78			78			
			R _L = 2 kΩ	25°C	90 109			90 109			
				Full range	88			88			
			R _L = 10 kΩ	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 Ω		25°C	80 98			80 98			dB
				Full range	78			78			
k _{SVR}	Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO})	V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω		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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TLE2071M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2071M			TLE2071AM			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	V _{ID} = 1 V	25°C	−30	−45		−30	−45	mA	
			V _{ID} = −1 V		30	48		30	48		

† Full range is –55°C to 125°C.

TLE2071M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2071M			TLE2071AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = 10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	30	40		30	40		V/μs
	Full range			22		22					
SR −	Negative slew rate			25°C	30	45		30	45		V/μs
	Full range			22		22					
t _s	Settling time	A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.4		0.4		μs		
		To 1 mV	1.5		1.5						
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28	55*		28	55*	nV/√Hz	
	f = 10 kHz		11.6		17*		11.6	17*			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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		fA/√Hz		
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, A _{VD} = 10, f = 1 kHz, R _L = 2 kΩ, R _S = 25 Ω		25°C	0.008%		0.008%				
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, 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 kΩ, C _L = 25 pF		25°C	478*	637		478*	637	kHz	
φ _m	Phase margin at unity gain	V _I = 10 mV, 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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TLE2071Y electrical characteristics at $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLE2071Y			UNIT
		MIN	TYP	MAX	
V_{IO} Input offset voltage	$V_{IC} = 0$, $V_O = 0$, $R_S = 50\ \Omega$		0.49	4	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	$V_O = 0$, 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 ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 5\text{ V to } \pm 15\text{ V}$, $R_S = 50\ \Omega$, $V_O = 0$	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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TLE2072C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2072C			TLE2072AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage	V _{IC} = 0, R _S = 50 Ω	V _O = 0,	25°C	0.9		6	0.65		3.5	mV
				Full range	7.8		5.3				
α _{VIO}	Temperature coefficient of input offset voltage			Full range	2.3		25	2.3		25	μV/°C
I _{IO}	Input offset current	V _{IC} = 0, See Figure 4	V _O = 0,	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 Ω		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 μA	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 μA	25°C	-3.8	-4.2		-3.8	-4.2		V	
			Full range	-3.7			-3.7				
		I _O = 2 mA	25°C	-3.5	-4.1		-3.5	-4.1			
			Full range	-3.4			-3.4				
		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 = ± 2.3 V	R _L = 600 Ω	25°C	80	91		80	91	dB	
				Full range	79			79			
			R _L = 2 kΩ	25°C	90	100		90	100		
				Full range	89			89			
			R _L = 10 kΩ	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 Ω		25°C	70	89		70	89	dB	
				Full range	68			68			
k _{SVR}	Supply-voltage rejection ratio(ΔV _{CC±} /ΔV _{IO})	V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω		25°C	82	99		82	99	dB	
				Full range	80			80			

† Full range is 0°C to 70°C.

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TLE2072C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted)
(continued)

PARAMETER	TEST CONDITIONS	T_A	TLE2072C			TLE2072AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC} Supply current (both channels)	$V_O = 0$, No load	25°C	2.7	2.9	3.9	2.7	2.9	3.9	mA
		Full range			3.9			3.9	
a_x 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
				$V_{ID} = -1\text{ V}$			-35		
					45		45		

TLE2072C operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2072C			TLE2072AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = ±2.3 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	35			35			V/μs
	Full range			22			22				
SR −	Negative slew rate			25°C	38			38			V/μs
				Full range	22			22			
t _s	Settling time	A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.25			0.25			μs
			To 1 mV		0.4			0.4			
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28	55	28	55	nV/√Hz		
	f = 10 kHz		11.6		17	11.6	17				
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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			fA/√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 kΩ, 25°C	0.013%			0.013%				
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF, R _L = 2 kΩ, See Figure 2	25°C	9.4			9.4			MHz	
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 4 V, R _L = 2 kΩ, 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 kΩ, See Figure 2	25°C	56°			56°				

† Full range is 0°C to 70°C.



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TLE2072C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2072C			TLE2072AC			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	6		0.7	3.5		mV
		Full range			7.8			5.3	
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			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	$I_O = -200 \mu A$	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	$I_O = 200 \mu A$	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	81			81			

† Full range is 0°C to 70°C.

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TLE2072C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A	TLE2072C			TLE2072AC			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	
a_x 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			$V_{ID} = -1$ V			mA
			-30	-45		-30	-45		
			30	48		30	48		

TLE2072C operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2072C			TLE2072AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = 10 V, A _{VD} = −1, C _L = 100 pF, R _L = 2 kΩ, See Figure 1		25°C	28	40		28	40		V/μs
				Full range	25			25			
SR −	Negative slew rate			25°C	30	45		30	45		V/μs
				Full range	25			25			
t _s	Settling time	A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.4			0.4			μs
			To 1 mV		1.5			1.5			
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28			28			nV/√Hz
			f = 10 kHz		11.6			11.6			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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			fA/√Hz
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, f = 1 kHz, R _S = 25 Ω	A _{VD} = 10, R _L = 2 kΩ,	25°C	0.008%			0.008%			
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, See Figure 2	25°C	8	10		8	10		MHz
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 20 V, R _L = 2 kΩ,	A _{VD} = −1, C _L = 25 pF	25°C	478	637		478	637		kHz
ϕ _m	Phase margin at unity gain	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, See Figure 2	25°C	57°			57°			

† Full range is 0°C to 70°C.

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TLE2072I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2072I			TLE2072AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage	V _{IC} = 0, R _S = 50 Ω,	V _O = 0,	25°C	0.9		6	0.65		3.5	mV
				Full range			9.1			6.4	
αV _{IO}	Temperature coefficient of input offset voltage					Full range	2.4		25	2.4	
I _{IO}	Input offset current	V _{IC} = 0, See Figure 4	V _O = 0,	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 Ω		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 μA		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 μA		25°C	−3.8	−4.2		−3.8	−4.2		V
				Full range	−3.7			−3.7			
		I _O = 2 mA		25°C	−3.5	−4.1		−3.5	−4.1		
				Full range	−3.4			−3.4			
		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 = ± 2.3 V	R _L = 600 Ω	25°C	80	91		80	91		dB
				Full range	79			79			
			R _L = 2 kΩ	25°C	90	100		90	100		
				Full range	89			89			
			R _L = 10 kΩ	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 Ω		25°C	70	89		70	89		dB
				Full range	68			68			
k _{SVR}	Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO})	V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω		25°C	82	99		82	99		dB
				Full range	80			80			

† Full range is -40°C to 85°C .

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TLE2072I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted) (continued)

PARAMETER	TEST CONDITIONS	T_A	TLE2072I			TLE2072AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
I_{CC} Supply current (both channels)	$V_O = 0$, No load	25°C	2.7	2.9	3.9	2.7	2.9	3.9	mA
		Full range			3.9			3.9	
a_x 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		–35			–35		mA
				45			45		

TLE2072I operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2072I			TLE2072AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = ±2.3 V, A _{VD} = −1, C _L = 100 pF, R _L = 2 kΩ, See Figure 1		25°C	35			35			V/μs
				Full range	20			20			
SR −	Negative slew rate			25°C	38			38			V/μs
				Full range	20			20			
t _s	Settling time	A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.25			0.25			μs
			To 1 mV		0.4			0.4			
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28	55	28	55	nV/√Hz		
			f = 10 kHz		11.6	17	11.6	17			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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			fA/√Hz
THD + N	Total harmonic distortion plus noise		V _{O(PP)} = 5 V, A _{VD} = 10, f = 1 kHz, R _L = 2 kΩ, R _S = 25 Ω	25°C	0.013%			0.013%			
B ₁	Unity-gain bandwidth	V _I = 10 mV, R _L = 2 kΩ, 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 kΩ , 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 kΩ, C _L = 25 pF, See Figure 2	25°C	56°			56°				

† Full range is 40°C to 85°C.



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TLE2072I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2072I			TLE2072AI			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	6		0.7	3.5		mV
		Full range			9.1			6.4	
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			
		$R_L = 2\ k\Omega$	25°C	90	109	90	109		
			Full range	89		89			
		$R_L = 10\ k\Omega$	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	$V_{IC} = 0,$ 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	79			79			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 5\ V\ to\ \pm 15\ V,$ $V_O = 0, R_S = 50\ \Omega$	25°C	82	99		82	99		dB
		Full range	80			80			

† Full range is –40°C to 85°C.

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TLE2072I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)
(continued)

PARAMETER		TEST CONDITIONS		T _A	TLE2072I			TLE2072AI			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				
a _x	Crosstalk attenuation	V _{IC} = 0, R _L = 2 kΩ	25°C	120			120			dB	
I _{OS}	Short-circuit output current	V _O = 0	25°C	-30	-45		-30	-45		mA	
		V _{ID} = -1 V		30	48		30	48			

TLE2072I operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2072I			TLE2072AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = ±10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	28	40		28	40		V/μs
	Full range			22			22				
SR −	Negative slew rate			25°C	30	45		30	45		V/μs
	Full range			22			22				
t _s	Settling time	A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.4		0.4		μs		
			To 1 mV		1.5		1.5				
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28	55	28	55	nV/√Hz		
			f = 10 kHz		11.6	17	11.6	17			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 0 Hz to 10 kHz	25°C	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		fA/√Hz		
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, A _{VD} = 10, f = 1 kHz, R _L = 2 kΩ, R _S = 25 Ω		25°C	0.008%		0.008%				
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF, See Figure 2	R _L = 2 kΩ, See Figure 2	25°C	8	10	8	10	MHz		
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 20 V, R _L = 2 kΩ, C _L = 25 pF	A _{VD} = −1, C _L = 25 pF	25°C	478	637	478	637	kHz		
φ _m	Phase margin at unity gain	V _I = 10 mV, C _L = 25 pF, See Figure 2	R _L = 2 kΩ, See Figure 2	25°C	57°		57°				

† Full range is -40°C to 85°C .

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TLE2072M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2072M			TLE2072AM			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	3.5	mV
		Full range			10.5			8	
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	$V_{IC} = 0, V_O = 0,$ 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	$I_O = -200 \mu A$	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			

*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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TLE2072M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2072M			TLE2072AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
k _{SVR}	Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO})	V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω		Full range	80			80			dB
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			
a _x	Crosstalk attenuation	V _{IC} = 0,	R _L = 2 kΩ	25°C	120			120			dB
I _{OS}	Short-circuit output current	V _O = 0	V _{ID} = 1 V	25°C	–35			–35			mA
			V _{ID} = –1 V		45			45			

† Full range is –55°C to 125°C.

TLE2072M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2072M			TLE2072AM			UNIT	
					MIN	TYP	MAX	MIN	TYP	MAX		
SR +	Positive slew rate	V _{O(PP)} = ±2.3 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	35			35			V/μs	
	Full range			18*			18*					
SR −	Negative slew rate				25°C	38			38			V/μs
					Full range	18*			18*			
t _s	Settling time	A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.25			0.25			μs	
			To 1 mV		0.4			0.4				
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28	55*	28	55*	nV/√Hz			
	f = 10 kHz		11.6		17*	11.6	17*					
V _{N(PP)}	Peak-to-peak equivalent input noise voltage			f = 10 Hz to 10 kHz	25°C	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			fA/√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 kΩ,	25°C	0.013%			0.013%				
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, See Figure 2	25°C	9.4			9.4			MHz	
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 4 V, R _L = 2 kΩ ,	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 kΩ, 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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TLE2072M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2072M			TLE2072AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage	V _{IC} = 0, R _S = 50 Ω	V _O = 0,	25°C	1.1		6	0.7		3.5	mV
				Full range			10.5			8	
αV _{IO}	Temperature coefficient of input offset voltage			Full range	2.4		25*	2.4		25*	μV/°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	nA
I _{IB}	Input bias current			25°C	20		175	20		175	pA
		Full range			60			60	nA		
V _{ICR}	Common-mode input voltage range	R _S = 50 Ω	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 μA	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 μA	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 = ± 10 V	R _L = 600 Ω	25°C	80	96	80		96	dB	
				Full range	78		78				
			R _L = 2 kΩ	25°C	90	109	90		109		
				Full range	89		89				
			R _L = 10 kΩ	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 Ω		25°C	80	98	80		98	dB	
				Full range	78		78				
k _{SVR}	Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO})	V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω		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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TLE2072M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2072M			TLE2072AM			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	
a_x Crosstalk attenuation	$V_{IC} = 0$, $R_L = 2$ k Ω	25°C	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.

TLE2072M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2072M			TLE2072AM			UNIT	
					MIN	TYP	MAX	MIN	TYP	MAX		
SR +	Positive slew rate	V _{O(PP)} = 10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	28	40		28	40		V/μs	
	Full range			20			20					
SR −	Negative slew rate			25°C	30	45		30	45		V/μs	
				Full range	20			20				
t _s	Settling time	A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.4			0.4			μs	
			To 1 mV		1.5			1.5				
V _n	Equivalent input noise voltage		f = 10 Hz	25°C	28			55*	28		55*	nV/√Hz
			f = 10 kHz		11.6			17*	11.6		17*	
V _{N(PP)}	Peak-to-peak equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz to 10 kHz	25°C	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			fA/√Hz	
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, A _{VD} = 10, f = 1 kHz, R _L = 2 kΩ, R _S = 25 Ω		25°C	0.008%			0.008%				
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, See Figure 2	25°C	8*	10		8*	10		MHz	
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 20 V, R _L = 2 kΩ,	A _{VD} = −1, C _L = 25 pF	25°C	478*	637		478*	637		kHz	
φ _m	Phase margin at unity gain	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, 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.



TLE2072Y electrical characteristics at $V_{CC\pm} = \pm 15\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TLE2072Y			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	$V_{IC} = 0$, 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 (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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PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLE2074C			TLE2074AC			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	5		-0.5	3		mV
		Full range		7.1			5.1		
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		1400			1400		
I_{IB} Input bias current		25°C	20	175		20	175		pA
		Full range		5000			5000		
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	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			

† Full range is 0°C to 70°C.

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TLE2074C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2074C			TLE2074AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
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			
Crosstalk attenuation		V _{IC} = 0,	R _L = 2 kΩ	25°C	120			120			dB
I _{OS}	Short-circuit output current	V _O = 0	V _{ID} = 1 V	25°C	−35			−35			mA
			V _{ID} = −1 V		45			45			

† Full range is 0°C to 70°C.

TLE2074C operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V

PARAMETER		TEST CONDITIONS		T _A †	TLE2074C			TLE2074AC			UNIT	
					MIN	TYP	MAX	MIN	TYP	MAX		
SR +	Positive slew rate	V _{O(PP)} = ±2.3 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	35			35			V/μs	
	Full range			22			22					
SR −	Negative slew rate				25°C	38			38			V/μs
					Full range	22			22			
t _s	Settling time	A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.25			0.25			μs	
			To 1 mV		0.4			0.4				
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28 55			28 55			nV/√Hz	
	f = 10 kHz		11.6 17			11.6 17						
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	6			6			μV	
			f = 0.1Hz 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/√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 kΩ,	25°C	0.013%			0.013%				
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, See Figure 2	25°C	9.4			9.4			MHz	
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 4 V, R _L = 2 kΩ ,	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 kΩ, See Figure 2	25°C	56°			56°				

† Full range is 0°C to 70°C.

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TLE2074C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER			TEST CONDITIONS		T _A [†]	TLE2074C			TLE2074AC			UNIT
						MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage		V _{IC} = 0, R _S = 50 Ω	V _O = 0,	25°C	−1.6		5	−0.5		3	mV
					Full range	7.1		5.1				
α _{VIO}	Temperature coefficient of input offset voltage				Full range	10.1		30	10.1		30	μV/°C
I _{IO}	Input offset current		V _{IC} = 0, See Figure 4	V _O = 0,	25°C	15		100	15		100	pA
					Full range	1400		1400				
I _{IB}	Input bias current				25°C	25		175	25		175	pA
					Full range	5000		5000				
V _{ICR}	Common-mode input voltage range		R _S = 50 Ω	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 μA	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 μA	25°C	−13.8	−14.2	−13.8		−14.2	V		
				Full range	−13.7		−13.7					
			I _O = 2 mA	25°C	−13.7	−14	−13.7		−14			
				Full range	−13.6		−13.6					
			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 = ± 10 V	R _L = 600 Ω	25°C	80	96	80		96	dB	
					Full range	79		79				
				R _L = 2 kΩ	25°C	90	109	90		109		
					Full range	89		89				
				R _L = 10 kΩ	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 Ω		25°C	80	98	80		98	dB	
					Full range	79		79				
k _{SVR}	Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO})		V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω		25°C	82	99	82		99	dB	
					Full range	81		81				

† Full range is 0°C to 70°C.



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TLE2074C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2074C			TLE2074AC			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I _{CC}	Supply current (four amplifiers)	V _O = 0,	No load	25°C	5.2	6.5	7.5	5.2	6.5	7.5	mA
				Full range	7.5			7.5			
Crosstalk attenuation		V _{IC} = 0,	R _L = 2 kΩ	25°C	120			120			dB
I _{OS}	Short-circuit output current	V _O = 0	V _{ID} = 1 V	25°C	-30	-45		-30	-45		mA
			V _{ID} = -1 V		30	48		30	48		

† Full range is 0°C to 70°C.

TLE2074C operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2074C			TLE2074AC			UNIT	
					MIN	TYP	MAX	MIN	TYP	MAX		
SR +	Positive slew rate	V _{O(PP)} = 10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	25	40		25	40		V/μs	
				Full range	22			22				
SR −	Negative slew rate			25°C	30	45		30	45		V/μs	
				Full range	25			25				
t _s	Settling time	A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.4			0.4			μs	
			To 1 mV		1.5			1.5				
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28			55	28		55	nV/√Hz
	f = 10 kHz		11.6			17	11.6		17			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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			fA/√Hz
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, A _{VD} = 10, f = 1 kHz, R _L = 2 kΩ, R _S = 25 Ω		25°C	0.008%				0.008%			
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, 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 kΩ, C _L = 25 pF		25°C	478	637		478	637		kHz	
φ _m	Phase margin at unity gain	V _I = 10 mV, C _L = 25 pF, See Figure 2		25°C	57°				57°			

† Full range is 0°C to 70°C.

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TLE2074I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted)

PARAMETER			TEST CONDITIONS	T _A [†]	TLE2074I			TLE2074AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage		V _{IC} = 0, V _O = 0, R _S = 50 Ω	25°C	−1.6		5	−0.5		3	mV
				Full range			9			7	
α _{VIO}	Temperature coefficient of input offset voltage			Full range	10.1		30	10.1		30	μV/°C
I _{IO}	Input offset current		V _{IC} = 0, V _O = 0, See Figure 4	25°C	15		100	15		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 Ω	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 μA	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 μA	25°C	−3.8	−4.2	−3.8		−4.2	V	
				Full range	−3.7		−3.7				
			I _O = 2 mA	25°C	−3.5	−4.1	−3.5		−4.1		
				Full range	−3.4		−3.4				
			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 = ± 2.3 V	R _L = 600 Ω	25°C	80	91	80		91	dB
					Full range	79		79			
				R _L = 2 kΩ	25°C	90	100	90		100	
					Full range	89		89			
				R _L = 10 kΩ	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, See Figure 5	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 Ω	25°C	70	89	70		89	dB	
				Full range	68		68				
k _{SVR}	Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO})		V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω	25°C	82	99	82		99	dB	
				Full range	80		80				

† Full range is -40°C to 85°C .

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TLE2074I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2074I			TLE2074AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
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			
Crosstalk attenuation		V _{IC} = 0,	R _L = 2 kΩ	25°C	120			120			dB
I _{OS}	Short-circuit output current	V _O = 0	V _{ID} = 1 V	25°C	−35			−35			mA
			V _{ID} = −1 V		45			45			

† Full range is -40°C to 85°C .

TLE2074I operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2074I			TLE2074AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = ±2.3 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	35			35			V/μs
				Full range	20			20			
SR −	Negative slew rate			25°C	38			38			V/μs
				Full range	20			20			
t _s	Settling time	A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.25			0.25			μs
			To 1 mV		0.4			0.4			
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28 55			28 55			nV/√Hz
			f = 10 kHz		11.6 17			11.6 17			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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			fA/√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 kΩ, 25°C	0.013%			0.013%				
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF, R _L = 2 kΩ, See Figure 2	25°C	9.4			9.4			MHz	
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 4 V, R _L = 2 kΩ , 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 kΩ, See Figure 2	25°C	56°			56°				

† Full range is -40°C to 85°C .



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TLE2074I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER			TEST CONDITIONS	T _A [†]	TLE2074I			TLE2074AI			UNIT	
					MIN	TYP	MAX	MIN	TYP	MAX		
V _{IO}	Input offset voltage		V _{IC} = 0, V _O = 0, R _S = 50 Ω	25°C	−1.6		5	−0.5		3	mV	
				Full range			9			7		
α _{VIO}	Temperature coefficient of input offset voltage			Full range	10.1		30	10.1		30	μV/°C	
I _{IO}	Input offset current		V _{IC} = 0, V _O = 0, See Figure 4	25°C	15		100	15		100	pA	
				Full range			5			5	nA	
I _{IB}	Input bias current			25°C	25		175	25		175	pA	
				Full range			10			10	nA	
V _{ICR}	Common-mode input voltage range		R _S = 50 Ω	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 μA	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 μA	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 = ± 10 V	R _L = 600 Ω	25°C	80		96	80		96	dB
					Full range	79				79		
				R _L = 2 kΩ	25°C	90		109	90		109	
					Full range	89				89		
				R _L = 10 kΩ	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 Ω	25°C	80		98	80		98	dB	
				Full range	79				79			
k _{SVR}	Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO})		V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω	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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TLE2074I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2074I			TLE2074AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I _{CC}	Supply current (four amplifiers)	V _O = 0,	No load	25°C	5.2	6.5	7.5	5.2	6.5	7.5	mA
				Full range	7.5			7.5			
Crosstalk attenuation		V _I C = 0,	R _L = 2 kΩ	25°C	120			120			dB
I _{OS}	Short-circuit output current	V _O = 0	V _{ID} = 1 V	25°C	−30	−45		−30	−45		mA
			V _{ID} = −1 V		30	48		30	48		

† Full range is –40°C to 85°C.

TLE2074I operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER		TEST CONDITIONS		T _A †	TLE2074I			TLE2074AI			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = ±10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	25	40		25	40		V/μs
	Full range			19			19				
SR −	Negative slew rate			25°C	30	45		30	45		V/μs
				Full range	22			22			
t _s	Settling time	A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.4		0.4		μs		
			To 1 mV		1.5		1.5				
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28	55		28	55	nV/√Hz	
	f = 10 kHz		11.6		17		11.6	17			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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		fA/√Hz		
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, A _{VD} = 10, f = 1 kHz, R _L = 2 kΩ, R _S = 25 Ω		25°C	0.008%		0.008%				
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, 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 kΩ, C _L = 25 pF		25°C	478	637		478	637	kHz	
φ _m	Phase margin at unity gain	V _I = 10 mV, C _L = 25 pF, R _L = 2 kΩ, See Figure 2		25°C	57°		57°				

† Full range is –40°C to 85°C.

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TLE2074M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A †	TLE2074M			TLE2074AM			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	$V_{IC} = 0$, $R_S = 50\Omega$, $V_O = 0$,	25°C	-1.6		5	-0.5		3	mV
			Full range			10.5			8.5	
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	$V_{IC} = 0$, $V_O = 0$, 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			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	$I_O = -200\mu A$	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	$I_O = 200\mu A$	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	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			

*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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TLE2074M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2074M			TLE2074AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
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			
Crosstalk attenuation		V _{IC} = 0,	R _L = 2 kΩ	25°C	120			120			dB
I _{OS}	Short-circuit output current	V _O = 0	V _{ID} = 1 V	25°C	−35			−35			mA
			V _{ID} = −1 V		45			45			

† Full range is –55°C to 125°C.

TLE2074M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2074M			TLE2074AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = ±2.3 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, See Figure 1		25°C	35			35			V/μs
				Full range	18*			18*			
SR −	Negative slew rate			25°C	38			38			V/μs
				Full range	18*			18*			
t _s	Settling time	A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.25			0.25			μs
			To 1 mV		0.4			0.4			
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28	55*	28	55*	nV/√Hz		
			f = 10 kHz		11.6	17*	11.6	17*			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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			fA/√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 kΩ, 25°C	0.013%			0.013%				
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF, R _L = 2 kΩ, See Figure 2	25°C	9.4			9.4			MHz	
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 4 V, R _L = 2 kΩ, A _{VD} = −1, C _L = 25 pF	25°C	2.8			2.8			MHz	
f _m	Phase margin at unity gain	V _I = 10 mV, C _L = 25 pF, R _L = 2 kΩ, 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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TLE2074M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted)

PARAMETER			TEST CONDITIONS	T _A [†]	TLE2074M			TLE2074AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage		V _{IC} = 0, V _O = 0, R _S = 50 Ω	25°C	−1.6 5			−0.5 3			mV
				Full range	10.5			8.5			
α _{VIO}	Temperature coefficient of input offset voltage			Full range	10.1 30*			10.1 30*			μV/°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	25 175			25 175			pA
				Full range	60			60			nA
V _{ICR}	Common-mode input voltage range		R _S = 50 Ω	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 μA	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 μA	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 = ± 10 V	R _L = 600 Ω	25°C	80	96	80		96	dB
					Full range	78	78				
				R _L = 2 kΩ	25°C	90	109	90		109	
					Full range	88	88				
				R _L = 10 kΩ	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, See Figure 5		25°C	7.5			7.5		pF
		Differential			25°C	2.5			2.5		
z ₀	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 Ω		25°C	80	98	80		98	dB
					Full range	78	78				
k _{SVR}	Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO})		V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω		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 $125^\circ C$.

TLE2074M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2074M			TLE2074AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
I _{CC}	Supply current (four amplifiers)	V _O = 0,	No load	25°C	5.2	6.5	7.5	5.2	6.5	7.5	mA
				Full range	7.5			7.5			
Crosstalk attenuation		V _{IC} = 0,	R _L = 2 kΩ	25°C	120			120			dB
I _{OS}	Short-circuit output current	V _O = 0	V _{ID} = 1 V	25°C	−30	−45		−30	−45		mA
			V _{ID} = −1 V		30	48		30	48		

† Full range is –55°C to 125°C.

TLE2074M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2074M			TLE2074AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
SR +	Positive slew rate	V _{O(PP)} = 10 V, A _{VD} = −1, R _L = 2 kΩ, See Figure 1		25°C	25	40		25	40		V/μs
				Full range	17			17			
SR −	Negative slew rate			25°C	30	45		30	45		V/μs
				Full range	20			20			
t _s	Settling time	A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF	To 10 mV	25°C	0.4		0.4		μs		
			To 1 mV		1.5		1.5				
V _n	Equivalent input noise voltage	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	28	55*		28	55*	nV/√Hz	
	f = 10 kHz		11.6		17*		11.6	17*			
V _{N(PP)}	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	25°C	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		fA/√Hz		
THD + N	Total harmonic distortion plus noise	V _{O(PP)} = 20 V, f = 1 kHz, R _S = 25 Ω	A _{VD} = 10, R _L = 2 kΩ,	25°C	0.008%		0.008%				
B ₁	Unity-gain bandwidth	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, See Figure 2	25°C	8*	10		8*	10	MHz	
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 20 V, R _L = 2 kΩ,	A _{VD} = −1, C _L = 25 pF	25°C	478*	637		478*	637	kHz	
φ _m	Phase margin at unity gain	V _I = 10 mV, C _L = 25 pF,	R _L = 2 kΩ, 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.

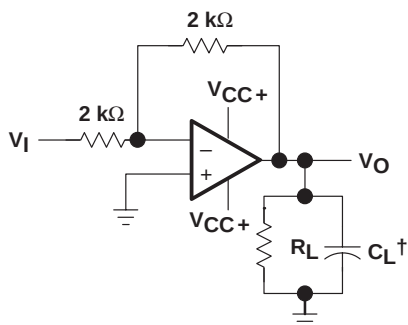
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TLE2074Y electrical characteristics at $V_{CC\pm} = \pm 15$ V, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

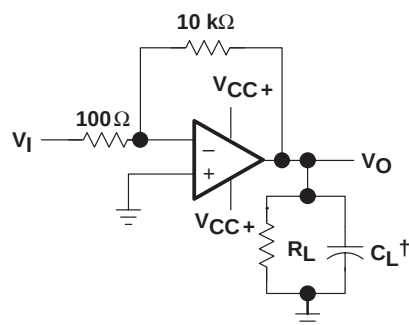
PARAMETER		TEST CONDITIONS	TLE2074Y			UNIT
			MIN	TYP	MAX	
V_{IO}	Input offset voltage	$V_{IC} = 0$, $R_S = 50\ \Omega$ $V_O = 0$			5	mV
I_{IO}	Input offset current	$V_{IC} = 0$, $V_O = 0$		15	100	pA
I_{IB}	Input bias current	See Figure 4		25	175	pA
V_{ICR}	Common-mode input voltage range	$R_S = 50\ \Omega$	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	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	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$ $V_O = 0$	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	

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

PARAMETER MEASUREMENT INFORMATION

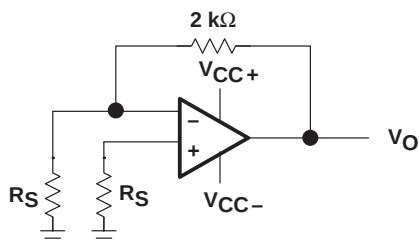


Figure 3. Noise-Voltage Test Circuit

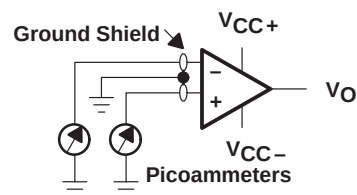


Figure 4. Input-Bias and Offset-Current Test Circuit

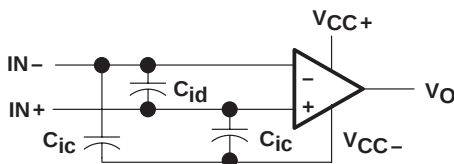


Figure 5. Internal Input Capacitance

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 TLE207x and TLE207xA, accurate measurement of the bias current 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.

TLE207x, TLE207xA, TLE207xY

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS

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$CMRR$	Common-mode rejection ratio	vs Frequency vs Free-air temperature	30 31
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TYPICAL CHARACTERISTICS

DISTRIBUTION OF TLE2071
INPUT OFFSET VOLTAGE

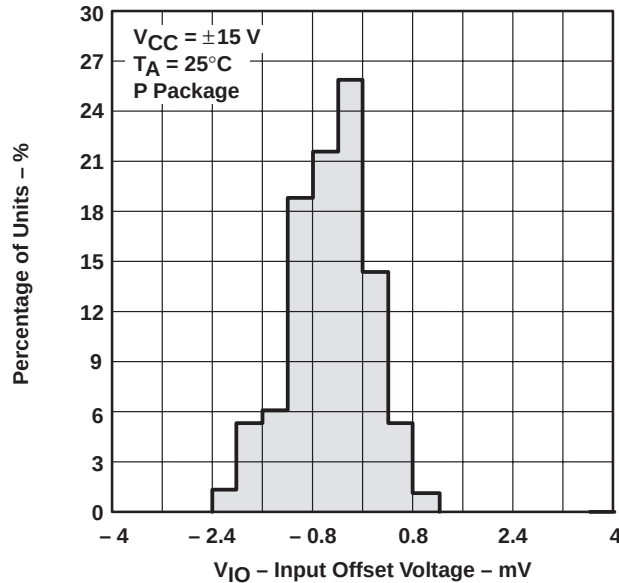


Figure 6

DISTRIBUTION OF TLE2072
INPUT OFFSET VOLTAGE

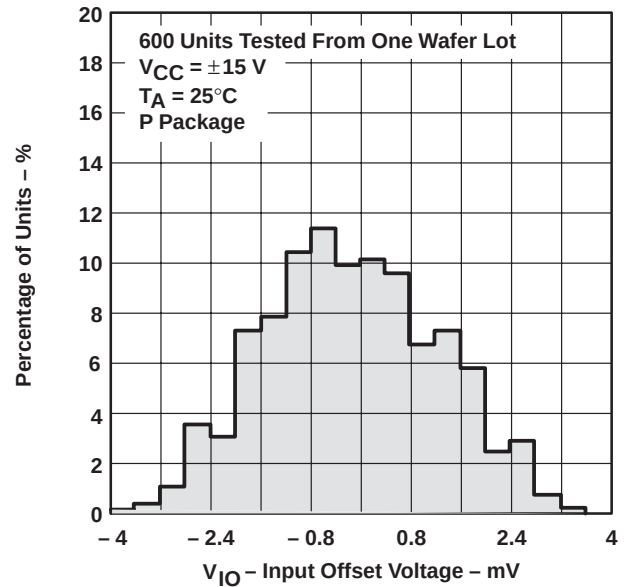


Figure 7

DISTRIBUTION OF TLE2074
INPUT OFFSET VOLTAGE

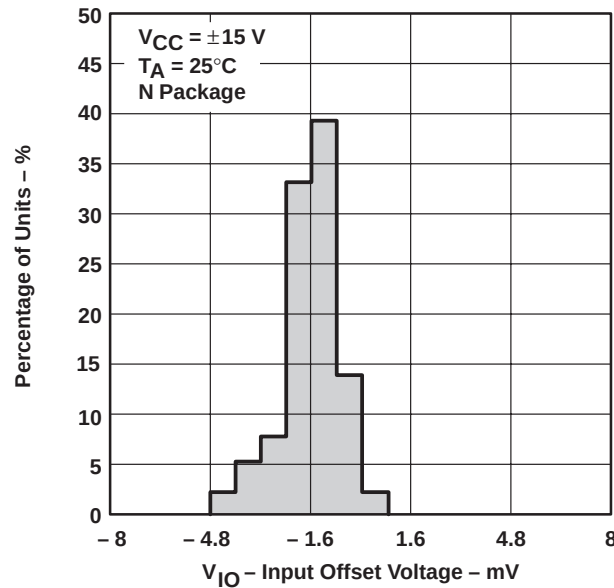


Figure 8

DISTRIBUTION OF TLE2071 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT

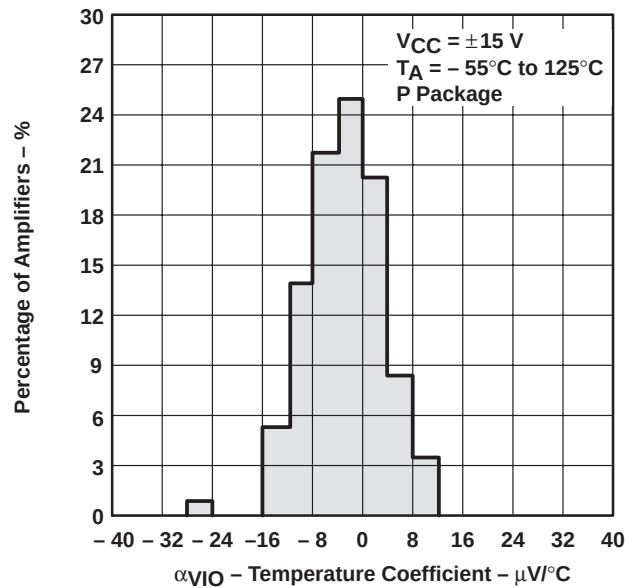


Figure 9

TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS

DISTRIBUTION OF TLE2072 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT

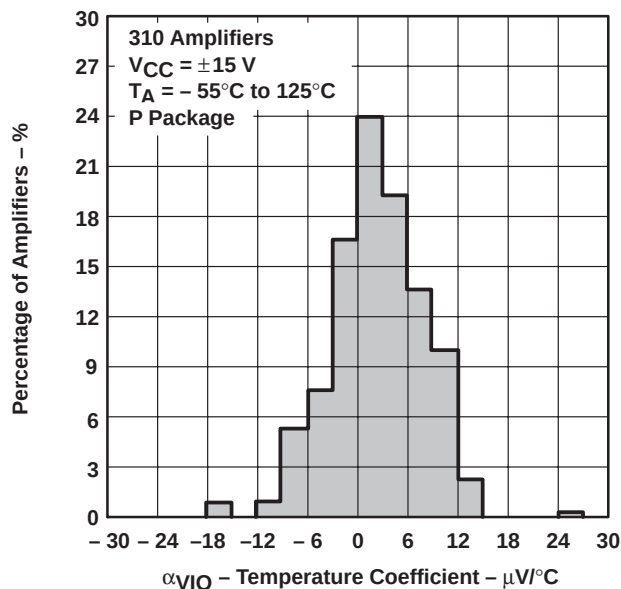


Figure 10

DISTRIBUTION OF TLE2074 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT

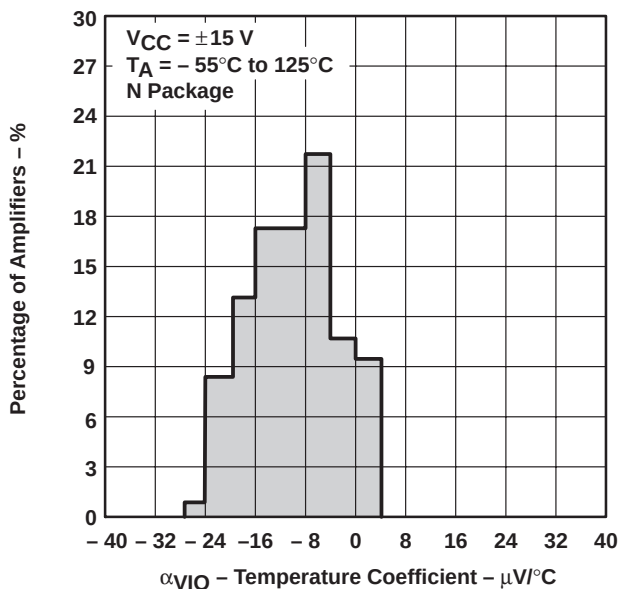


Figure 11

INPUT BIAS CURRENT AND
INPUT OFFSET CURRENT†
VS
FREE-AIR TEMPERATURE

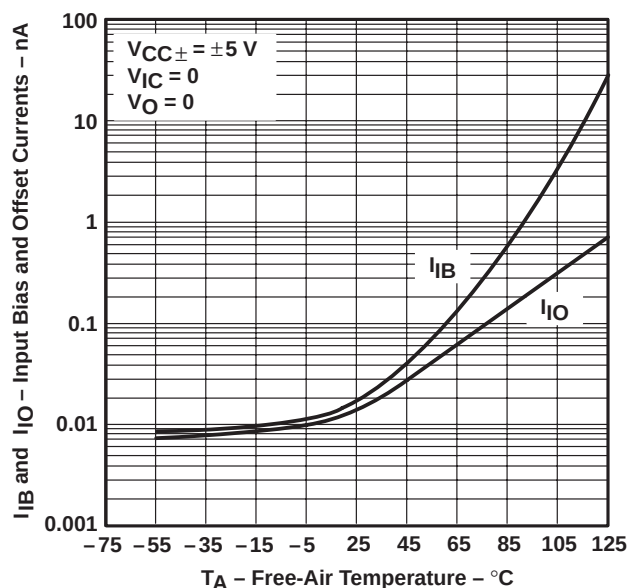


Figure 12

INPUT BIAS CURRENT AND
INPUT OFFSET CURRENT†
VS
FREE-AIR TEMPERATURE

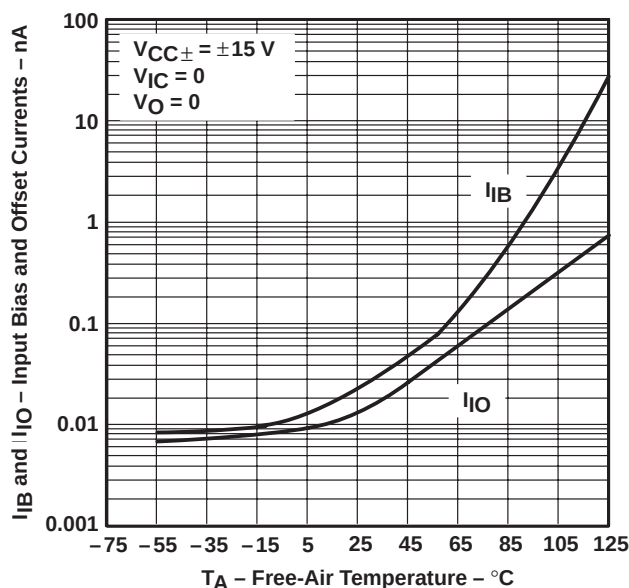


Figure 13

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

TYPICAL CHARACTERISTICS

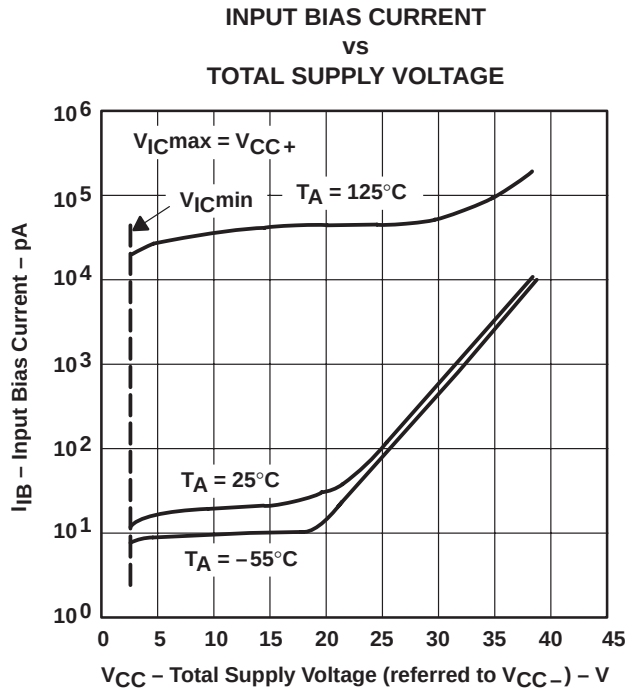


Figure 14

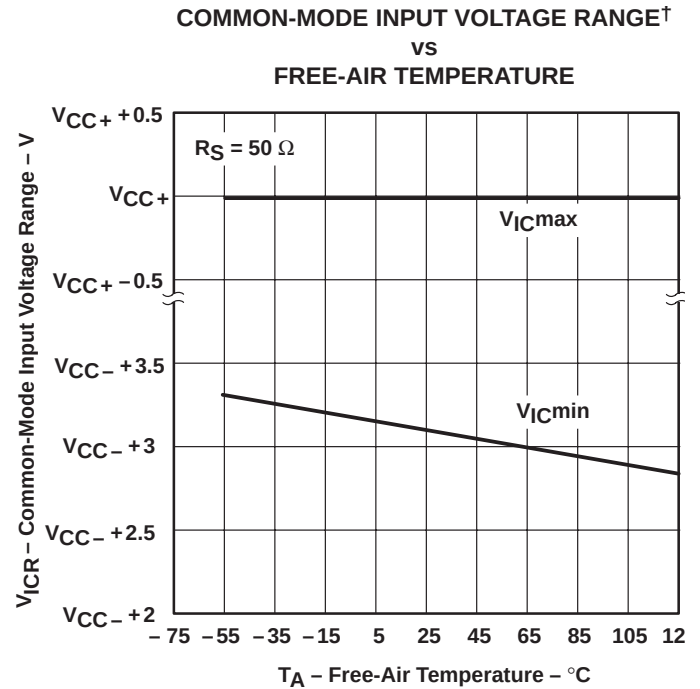


Figure 15

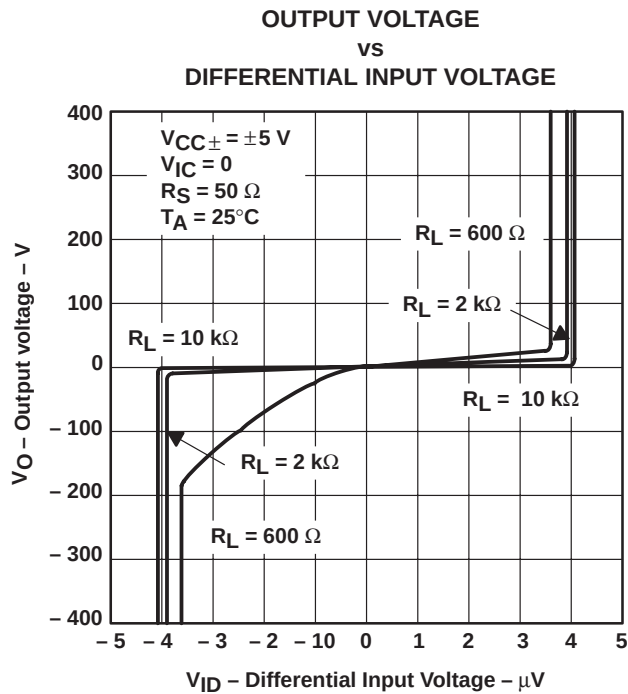


Figure 16

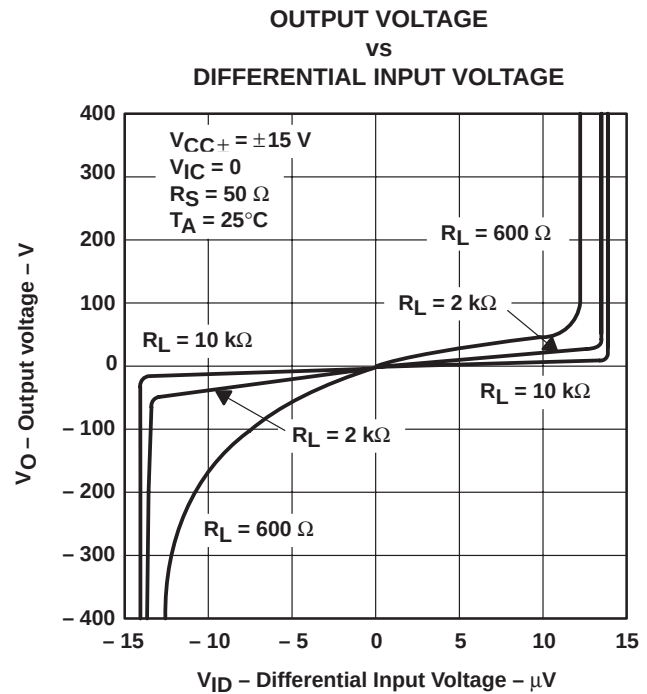


Figure 17

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

TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS

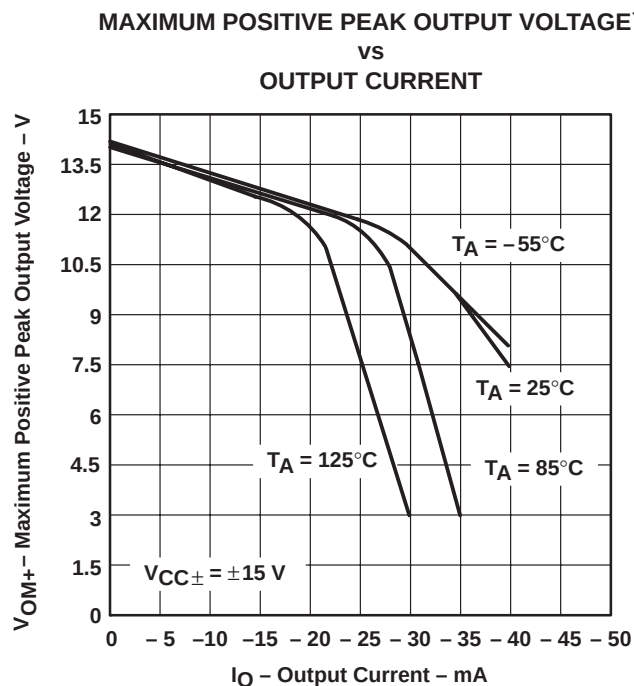


Figure 18

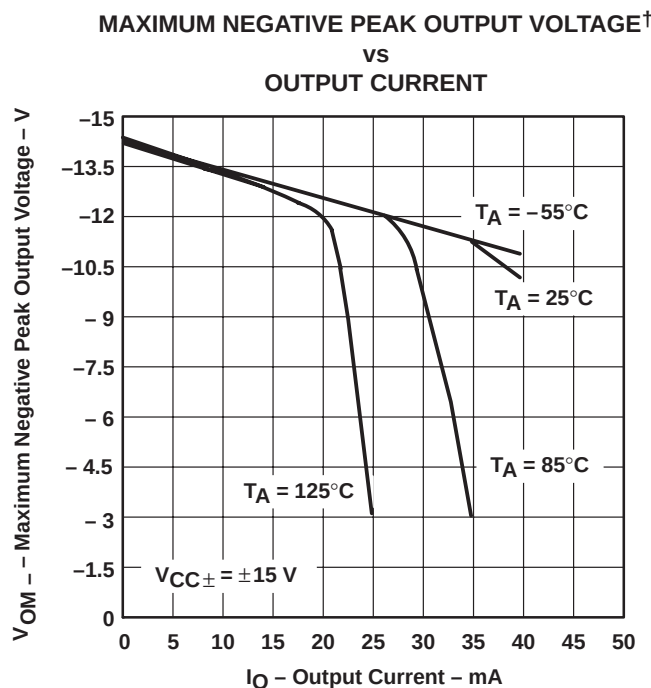


Figure 19

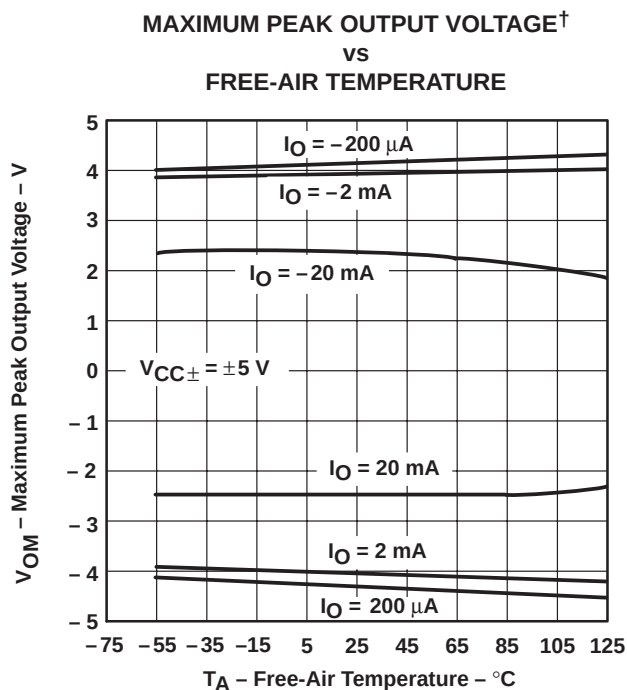


Figure 20

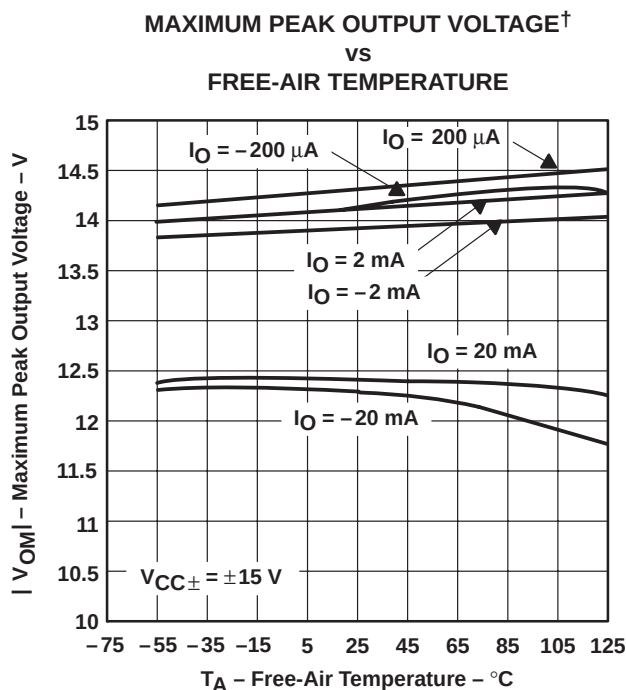


Figure 21

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

TYPICAL CHARACTERISTICS

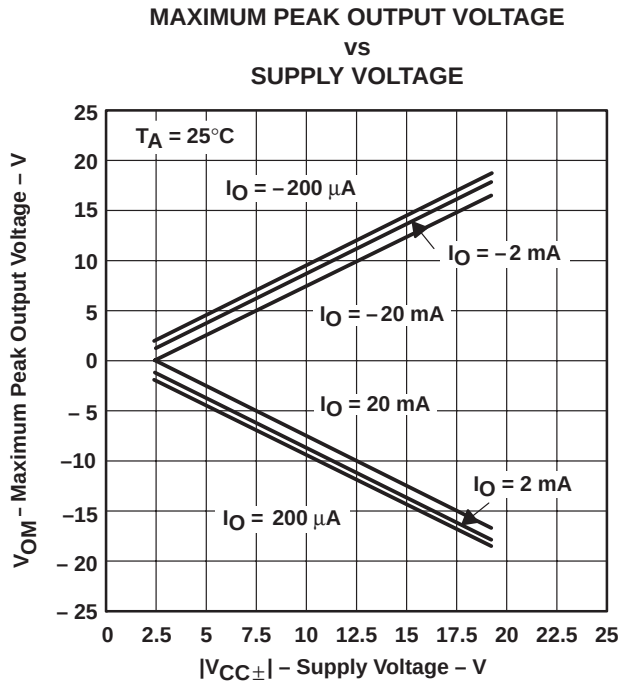


Figure 22

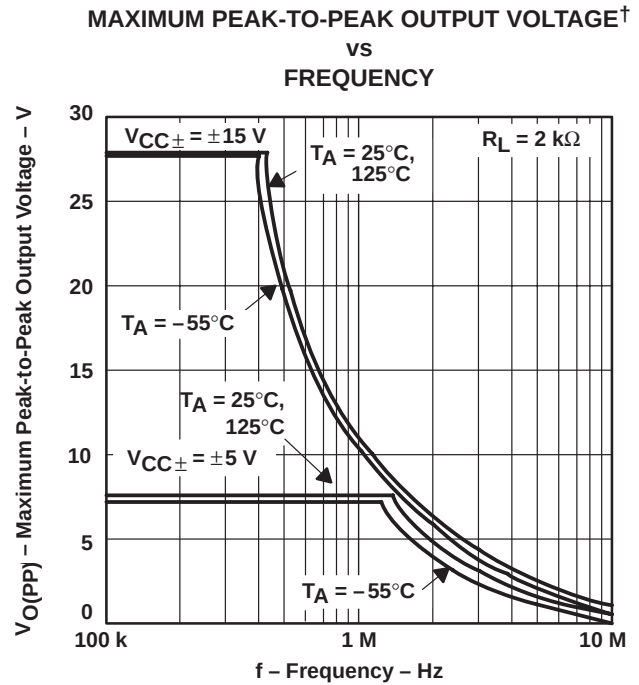


Figure 23

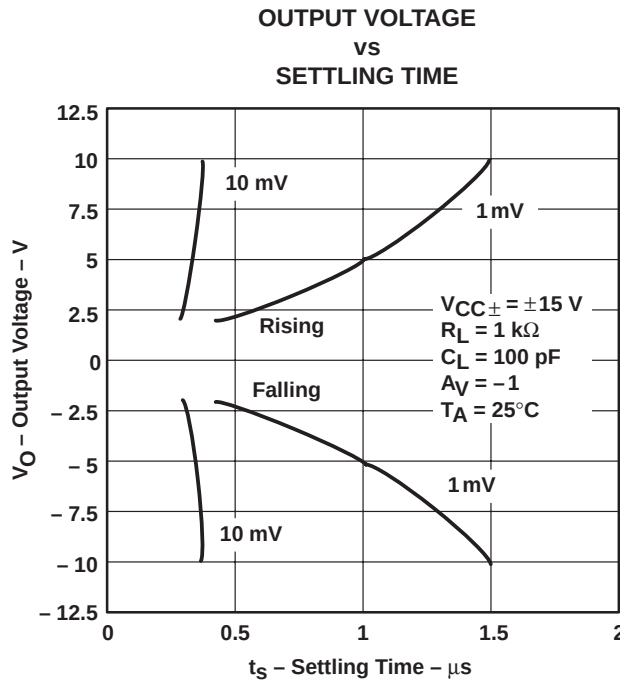


Figure 24

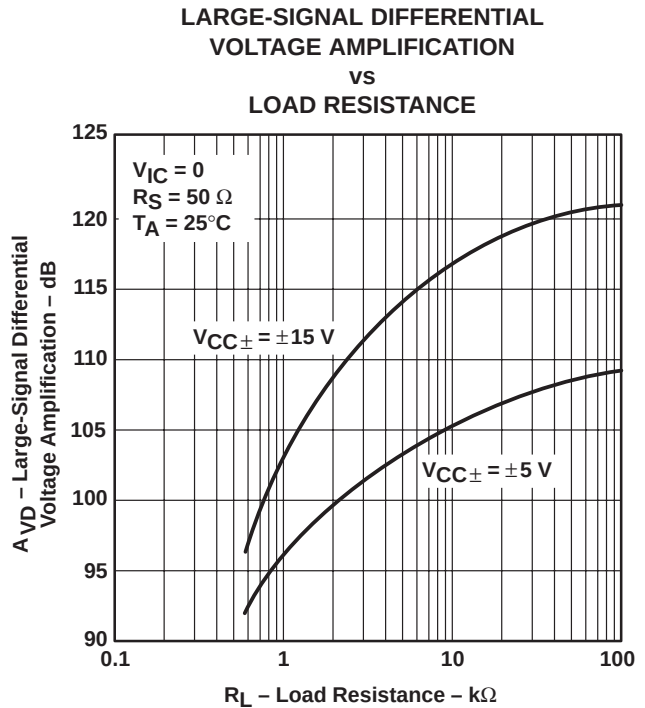


Figure 25

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

TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS

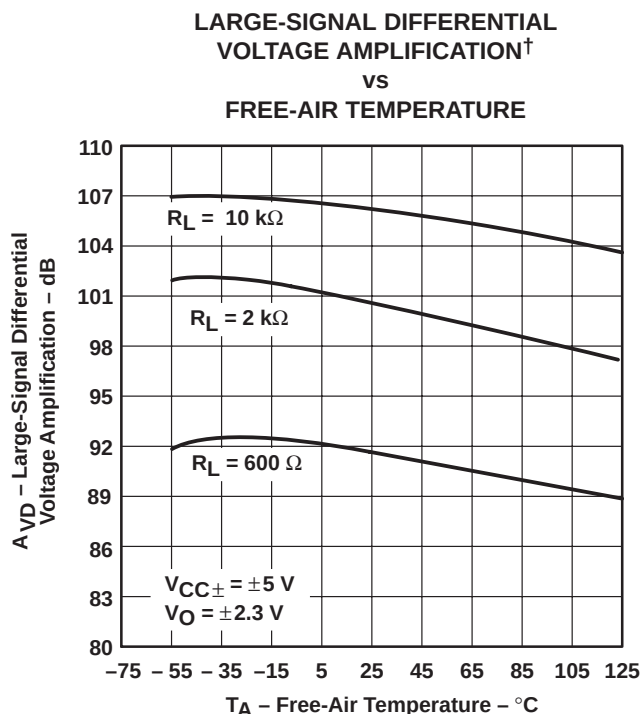


Figure 26

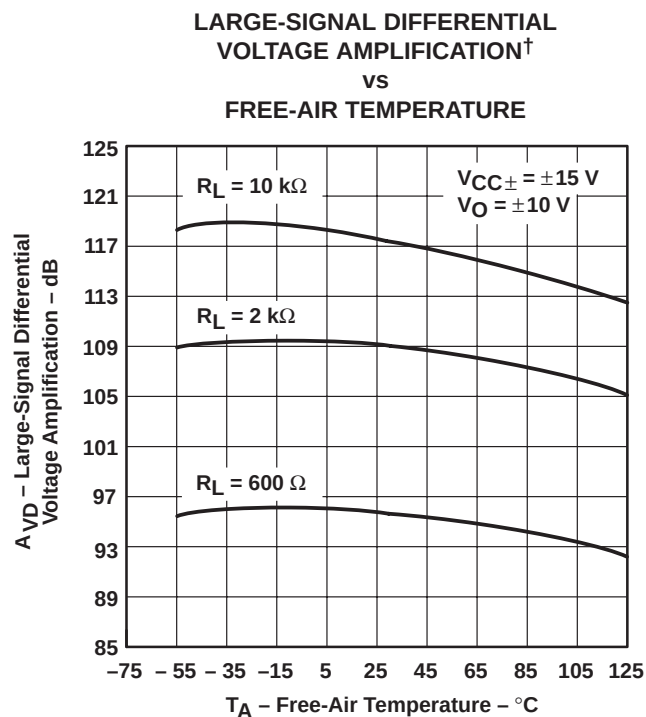


Figure 27

[†] 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

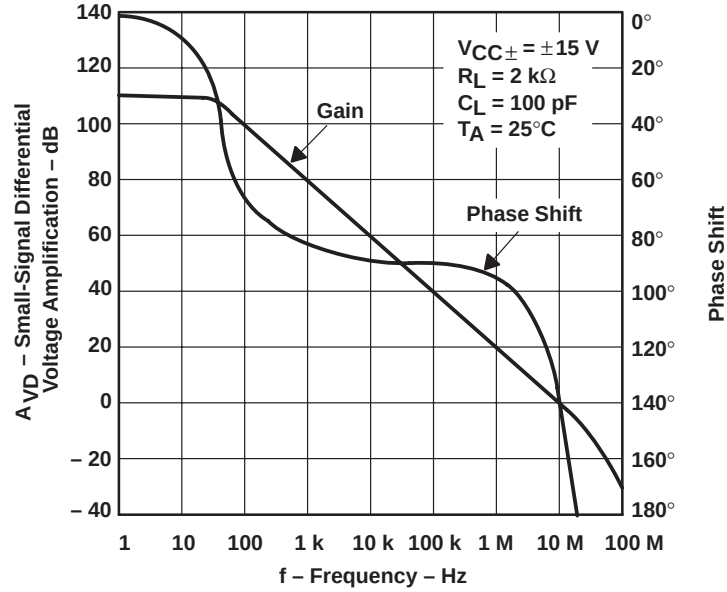


Figure 28

SMALL-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT

vs

FREQUENCY

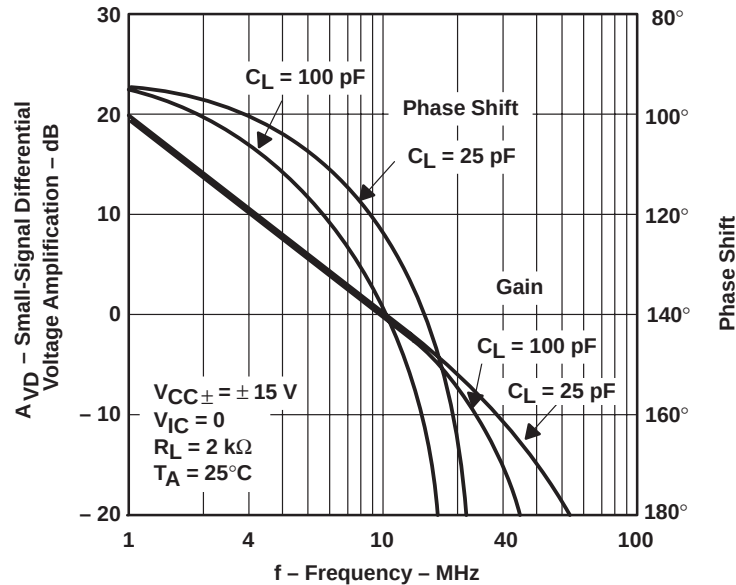


Figure 29

TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS

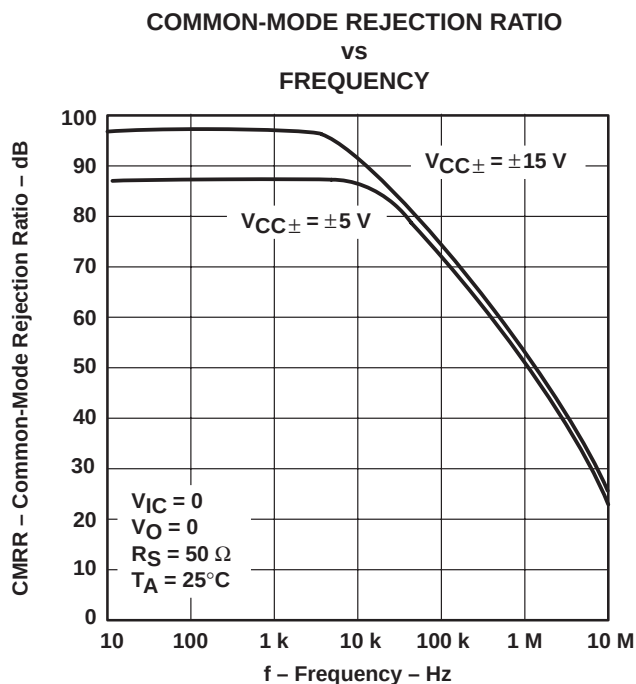


Figure 30

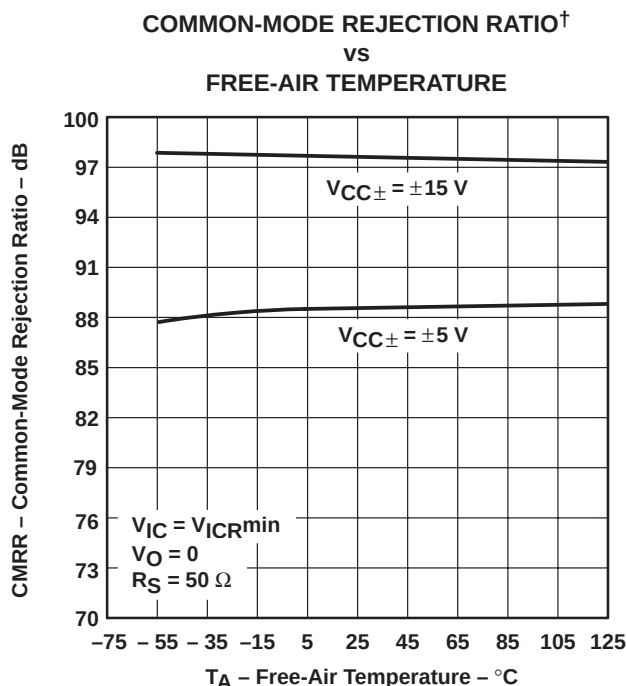


Figure 31

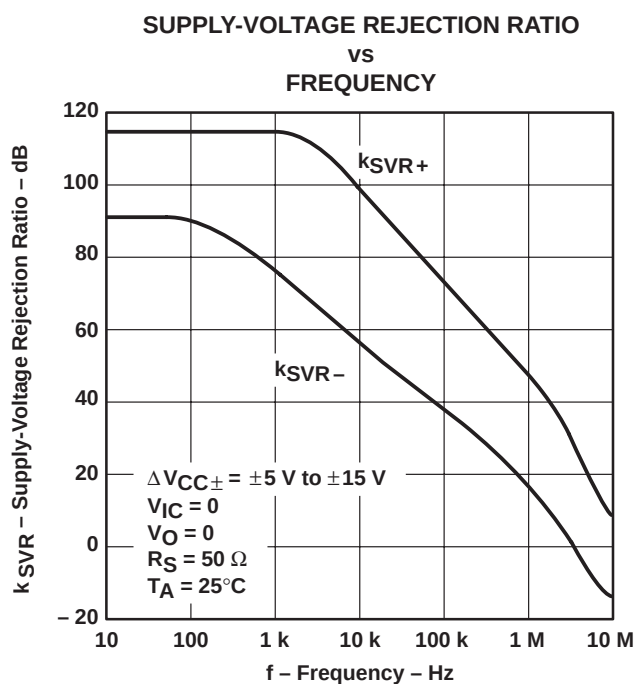


Figure 32

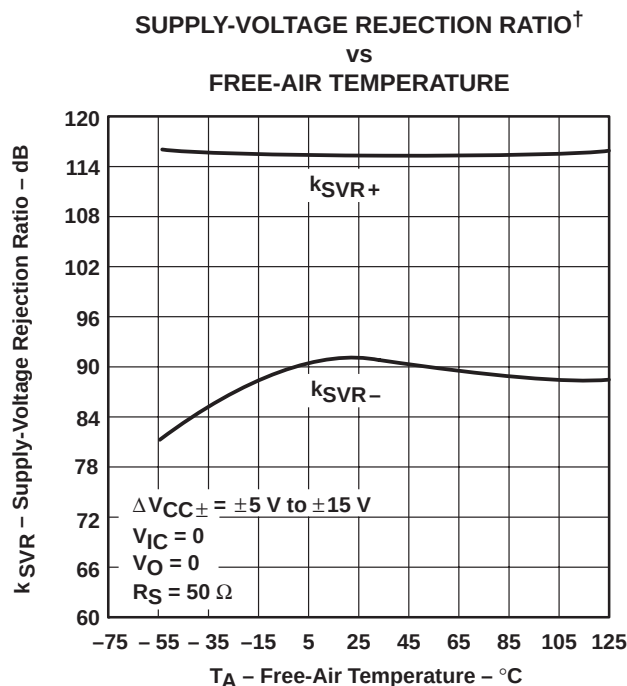


Figure 33

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

TYPICAL CHARACTERISTICS

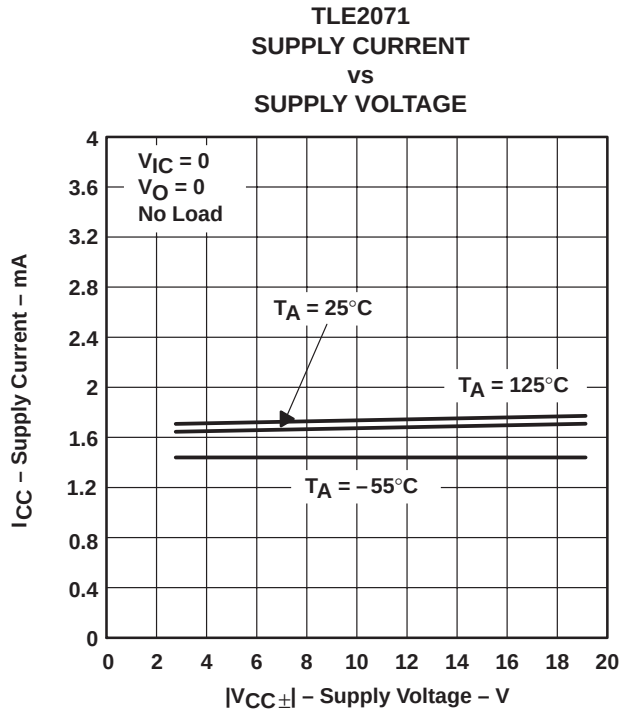


Figure 34

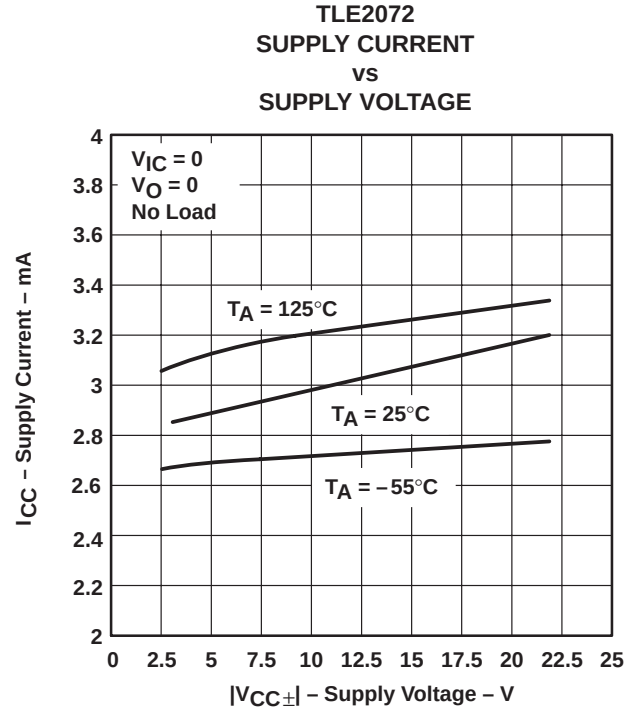


Figure 35

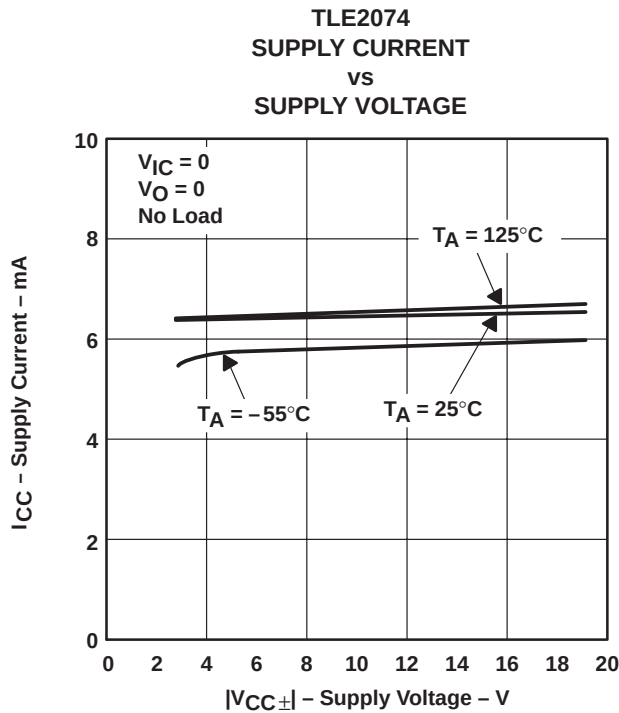


Figure 36

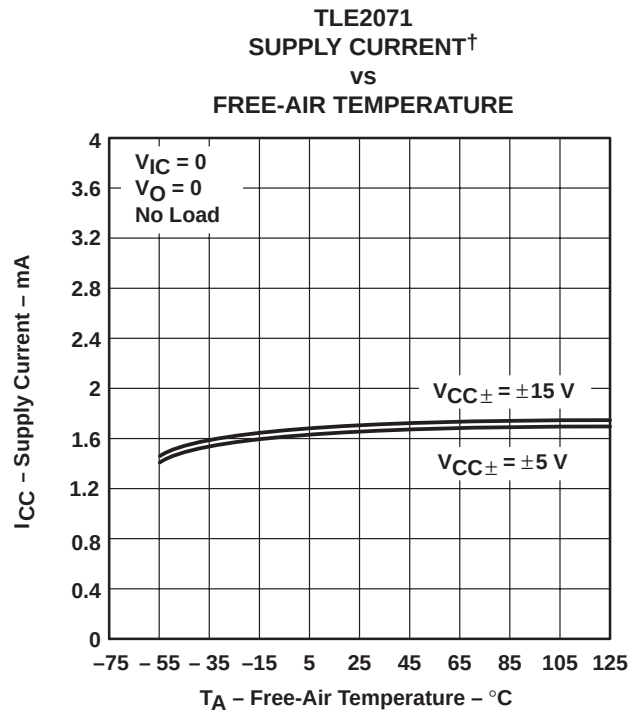


Figure 37

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

TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS

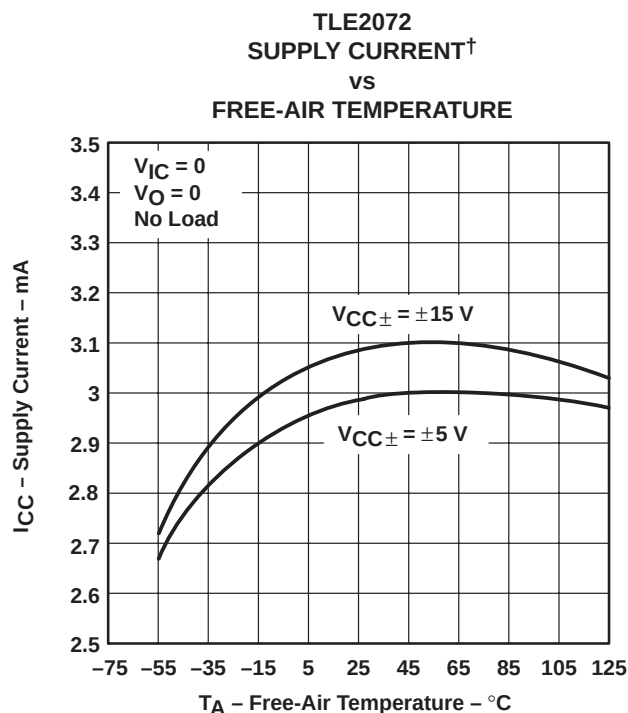


Figure 38

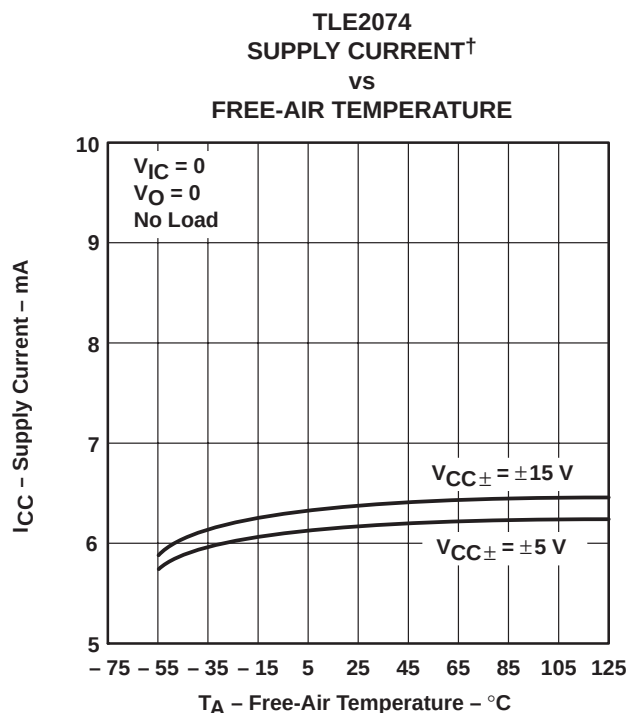


Figure 39

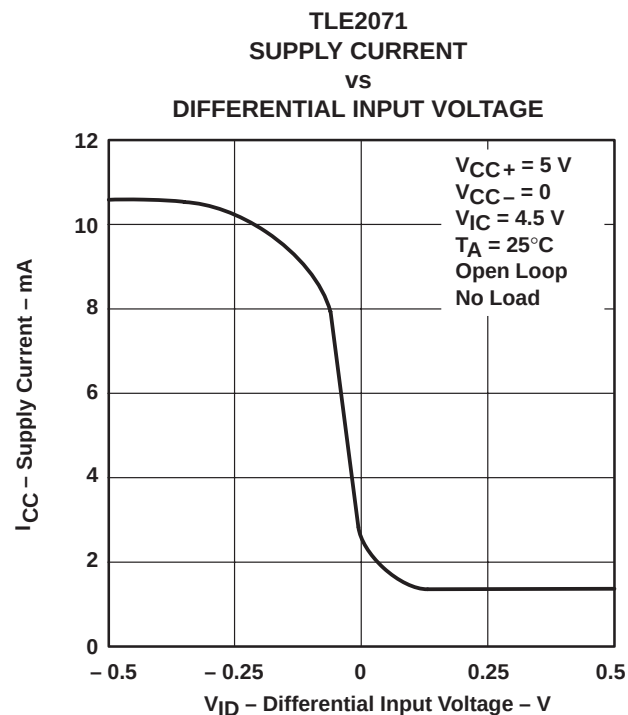


Figure 40

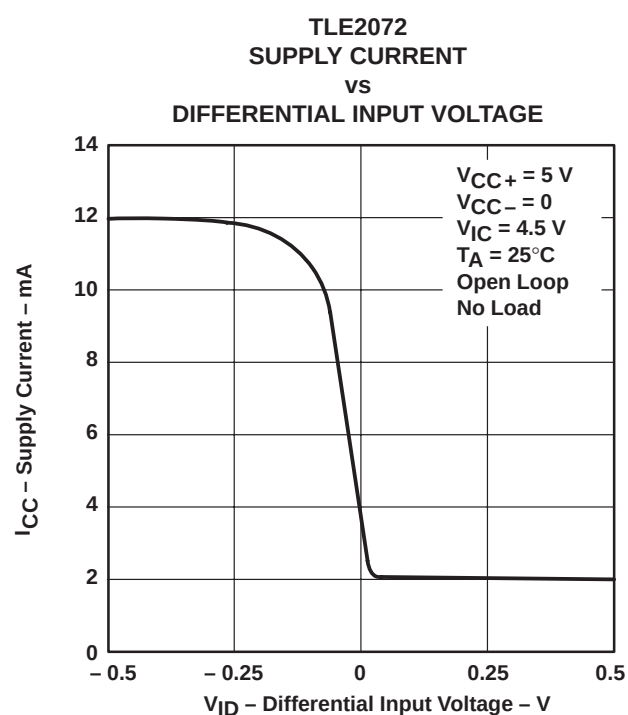


Figure 41

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

TYPICAL CHARACTERISTICS

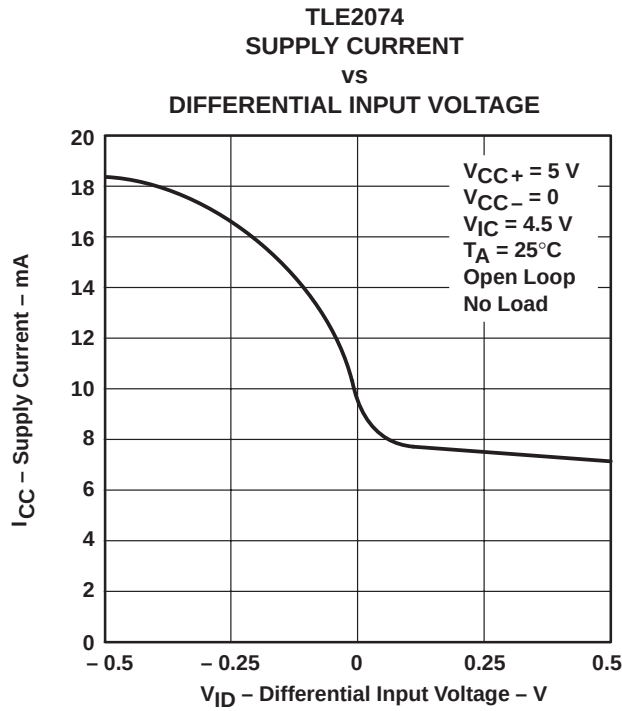


Figure 42

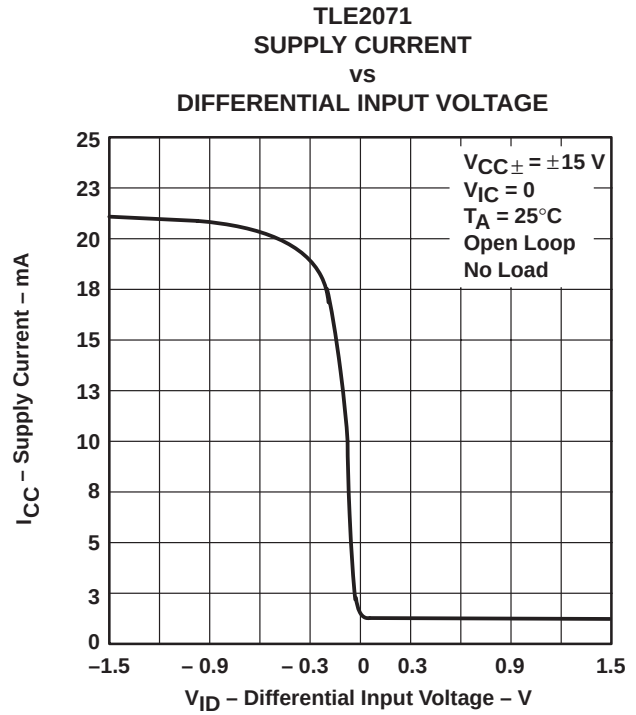


Figure 43

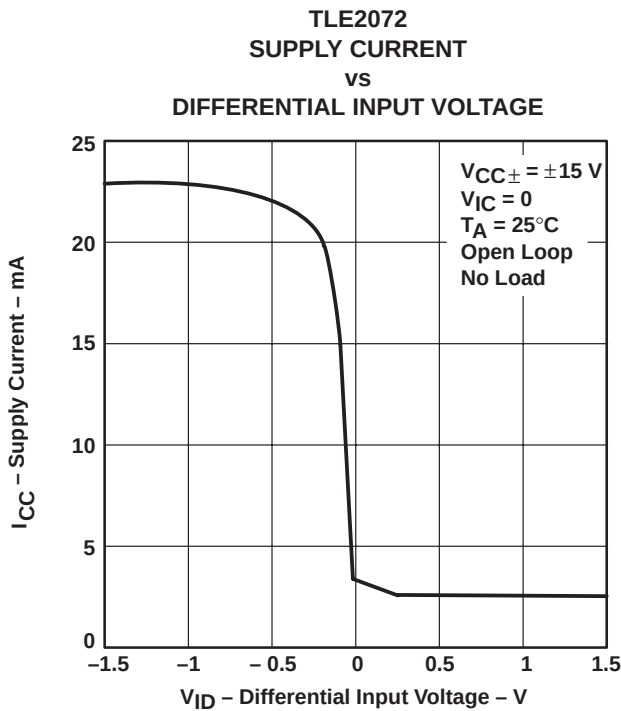


Figure 44

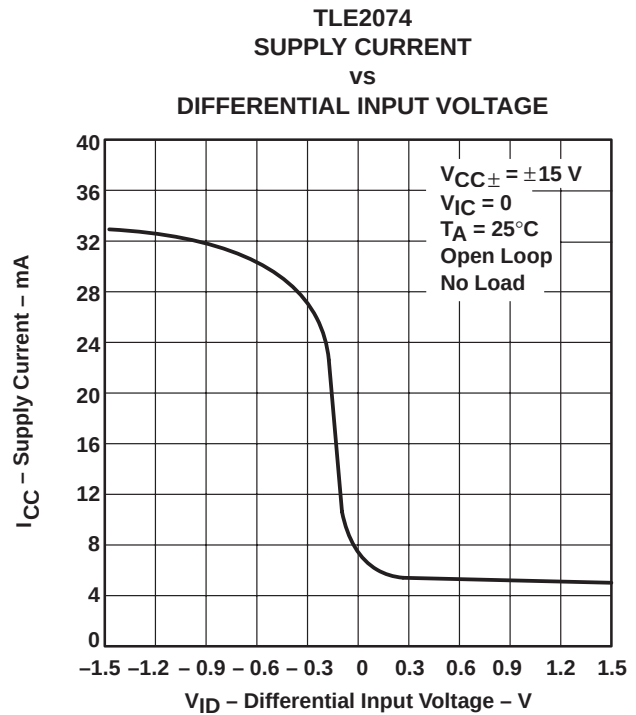


Figure 45

TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS

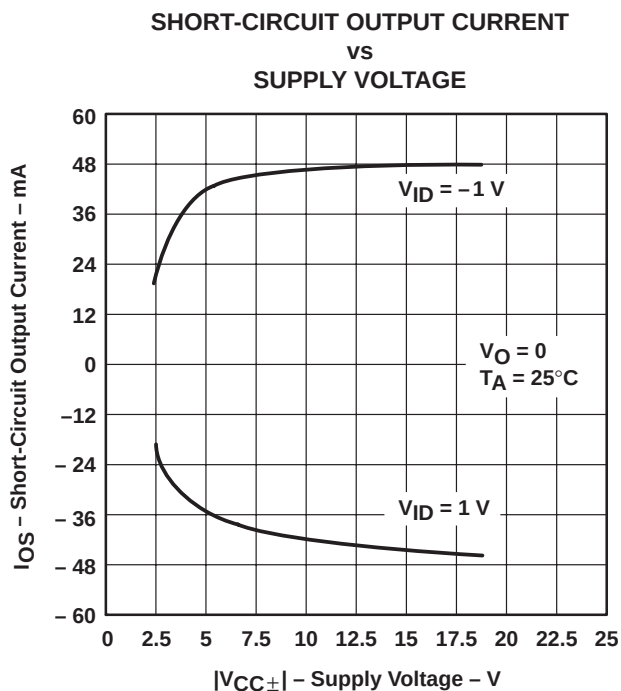


Figure 46

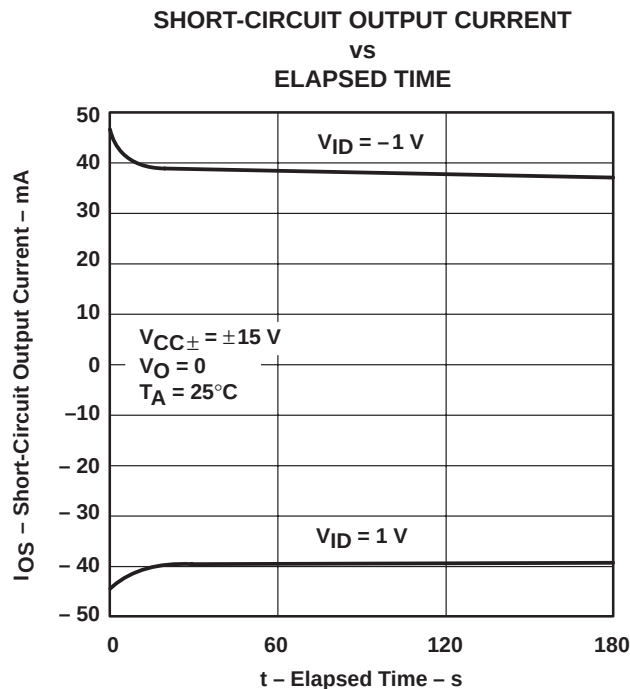


Figure 47

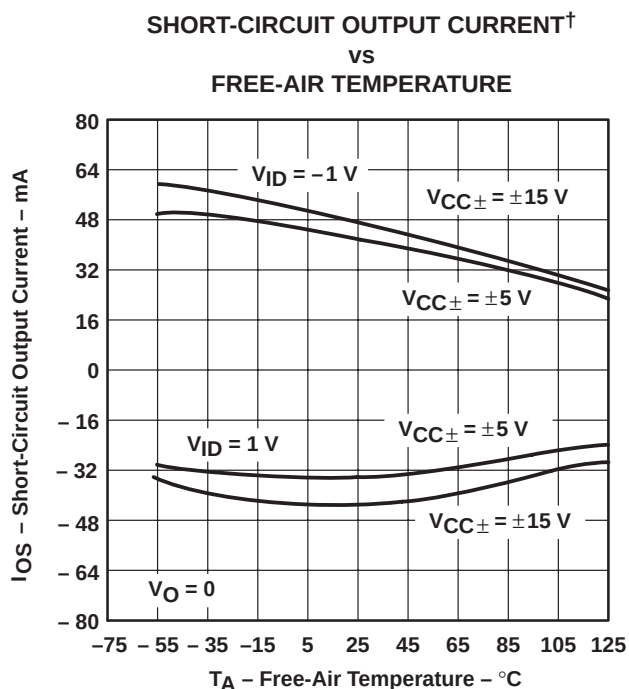


Figure 48

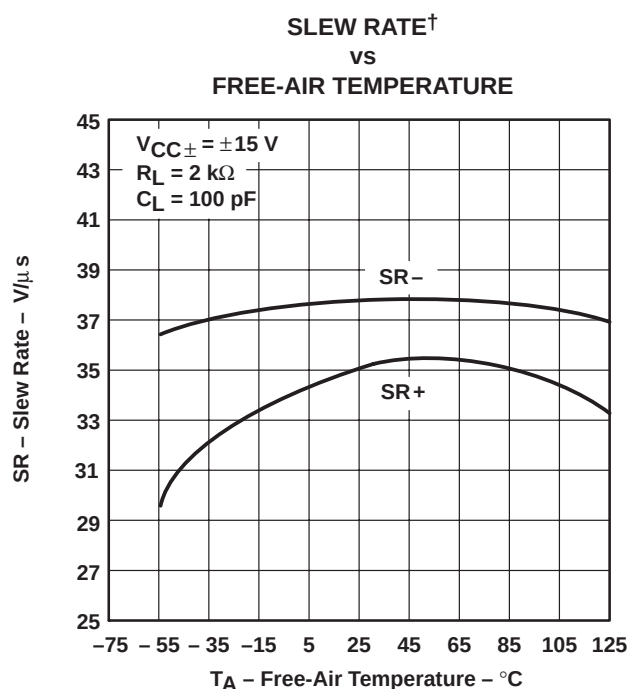


Figure 49

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

TYPICAL CHARACTERISTICS

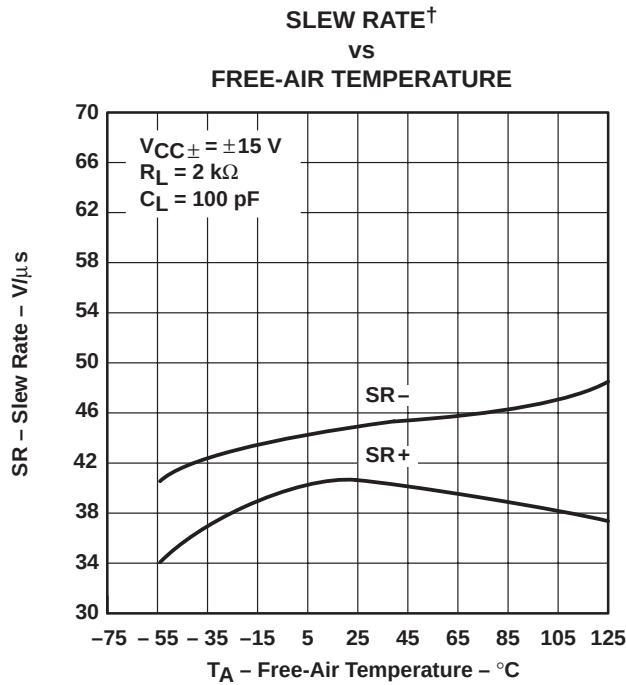


Figure 50

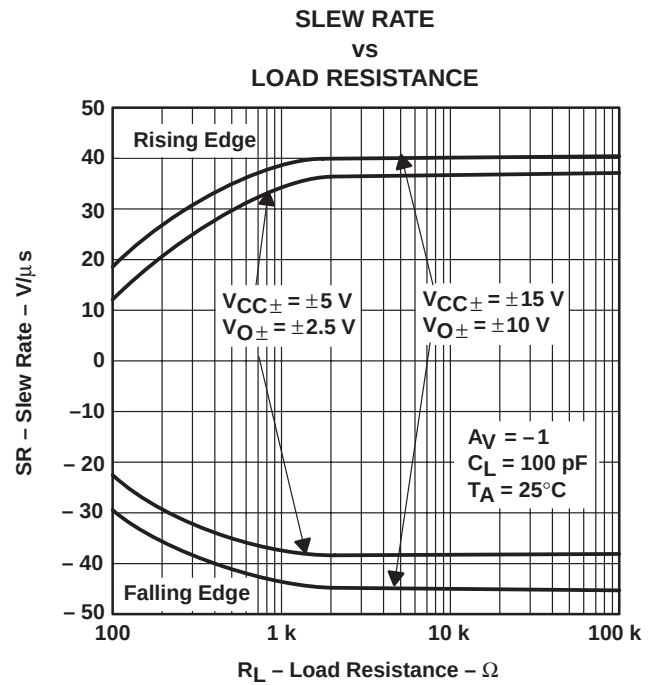


Figure 51

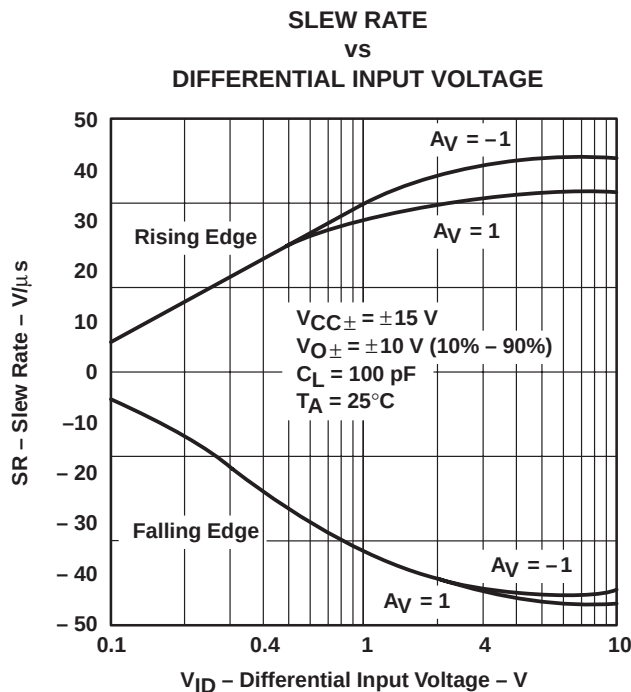


Figure 52

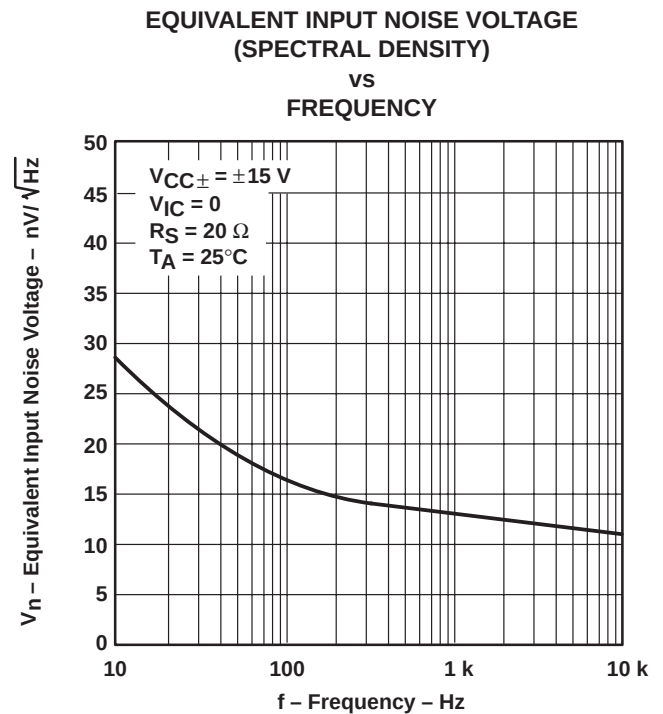


Figure 53

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

TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS

INPUT-REFERRED NOISE VOLTAGE
VS
NOISE BANDWIDTH

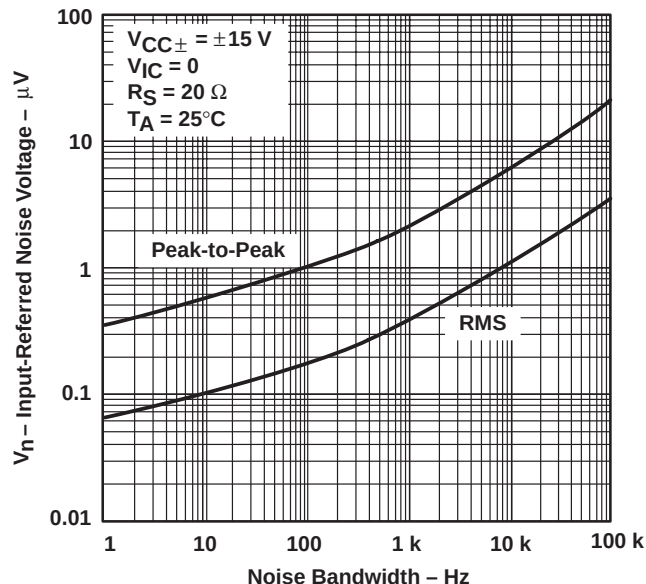


Figure 54

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

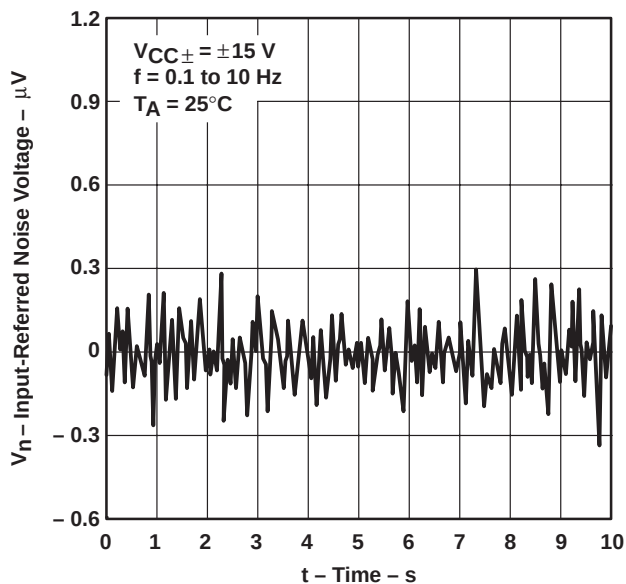


Figure 55

THIRD-OCTAVE SPECTRAL NOISE DENSITY
VS
FREQUENCY BANDS

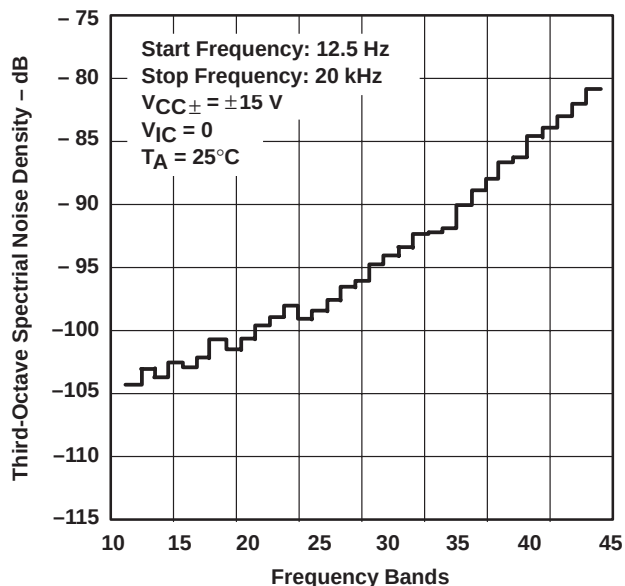


Figure 56

TOTAL HARMONIC DISTORTION PLUS NOISE
VS
FREQUENCY

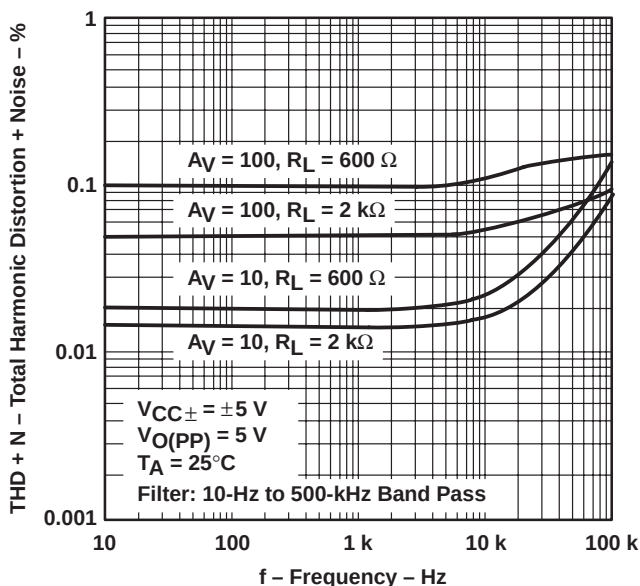


Figure 57

TYPICAL CHARACTERISTICS

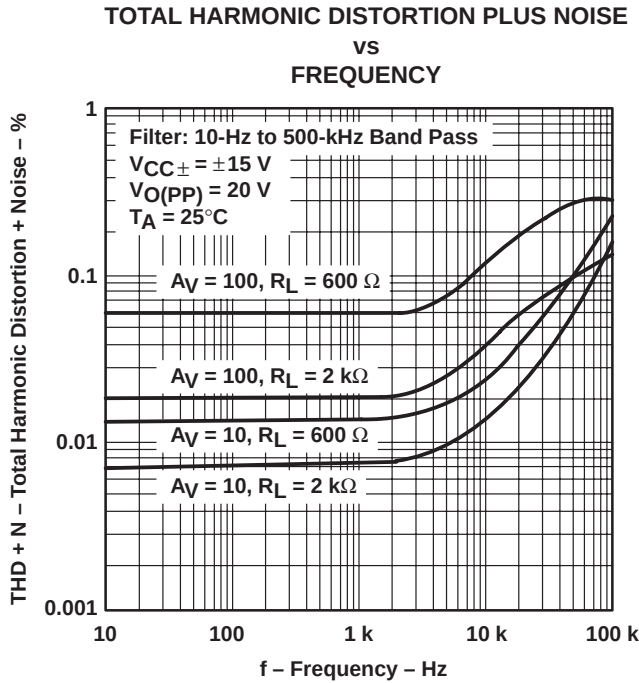


Figure 58

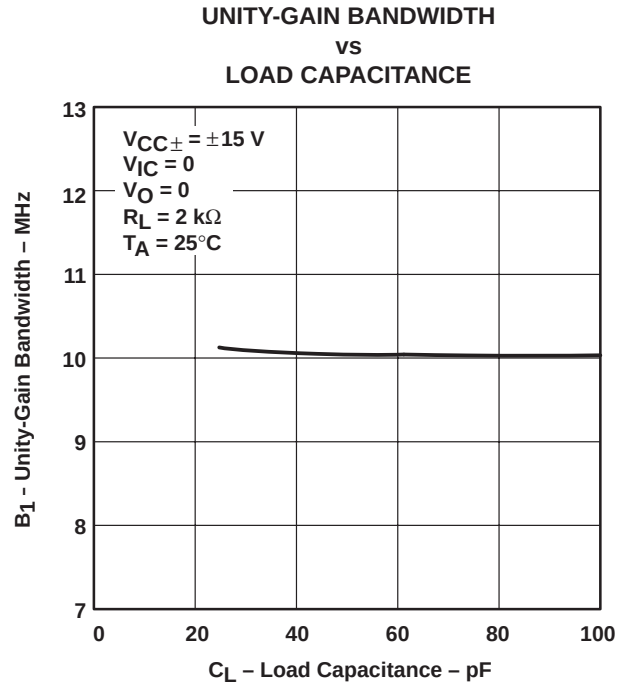


Figure 59

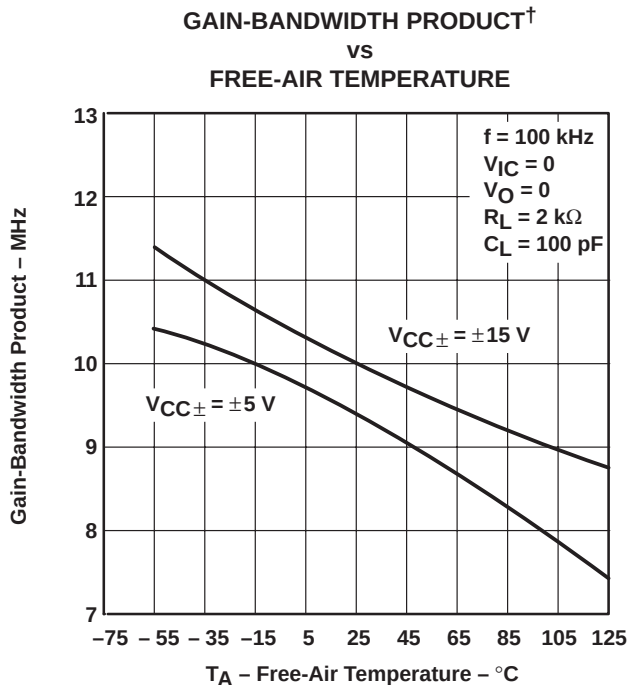


Figure 60

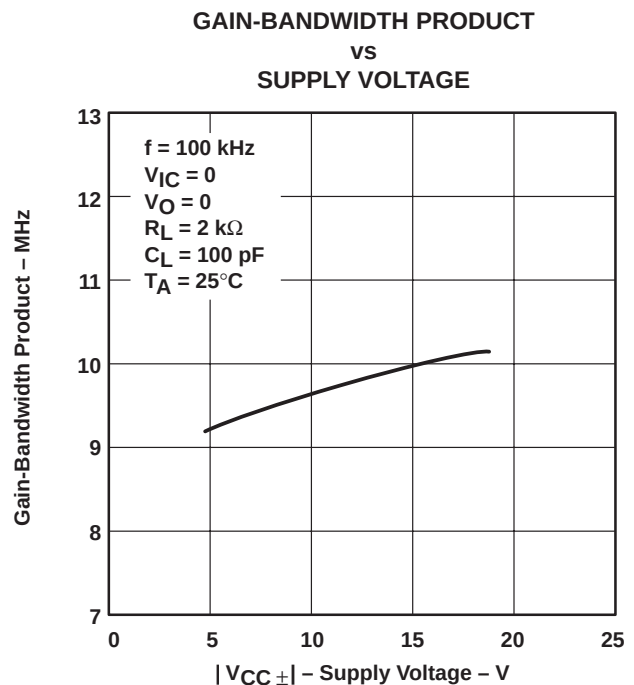


Figure 61

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

TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS

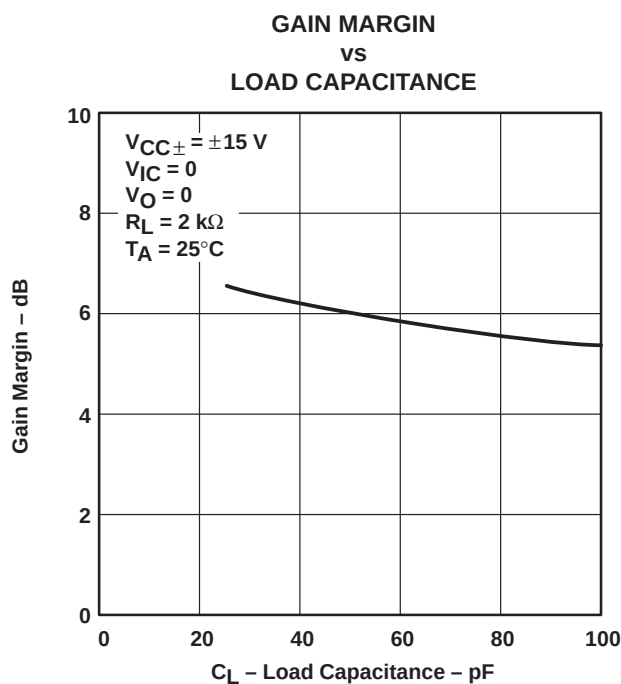


Figure 62

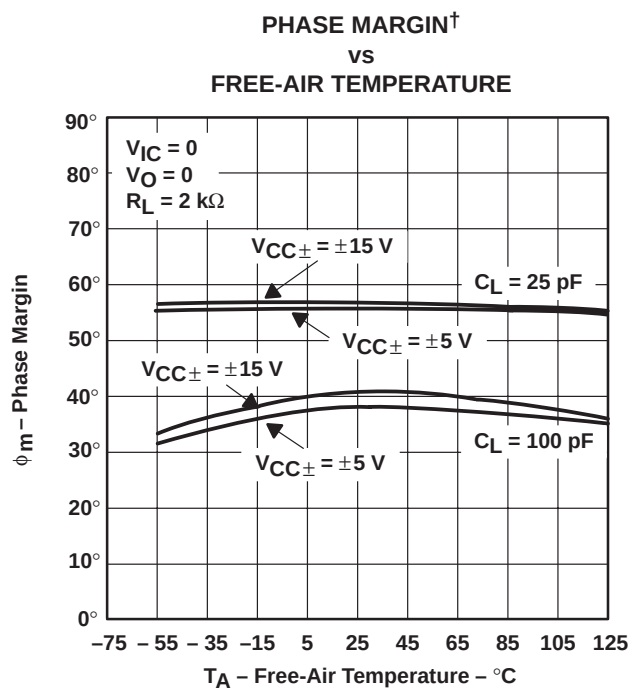


Figure 63

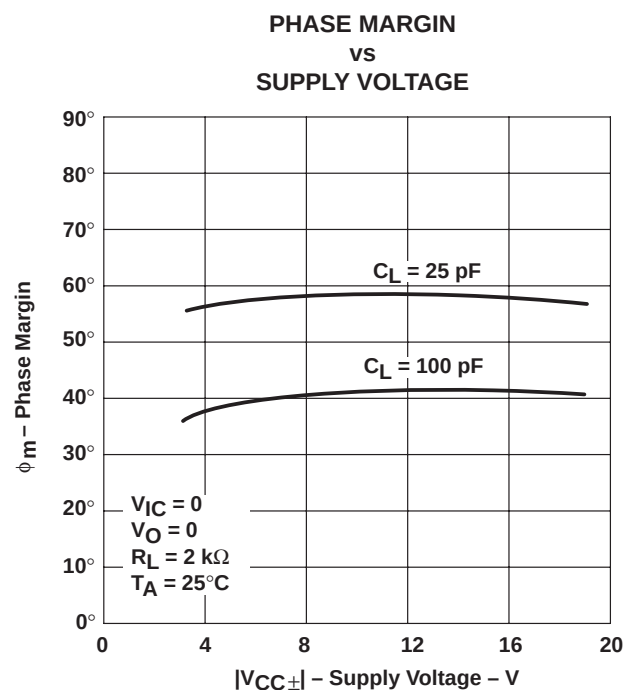


Figure 64

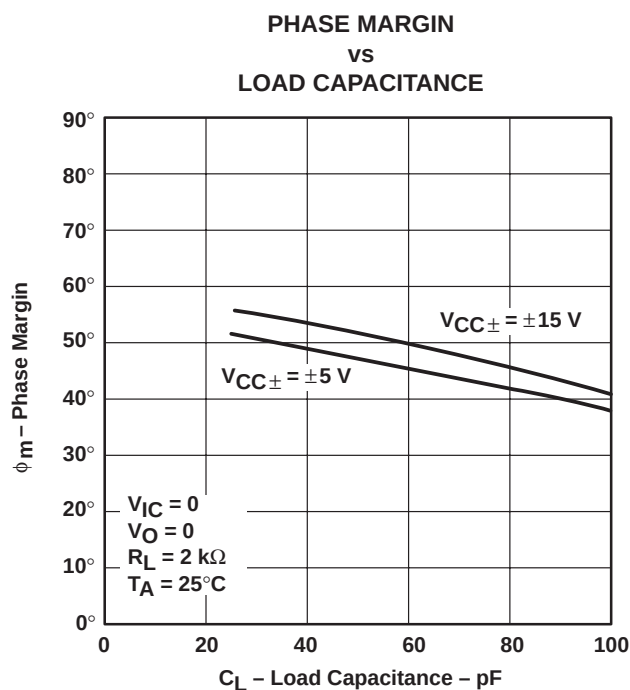


Figure 65

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

TYPICAL CHARACTERISTICS

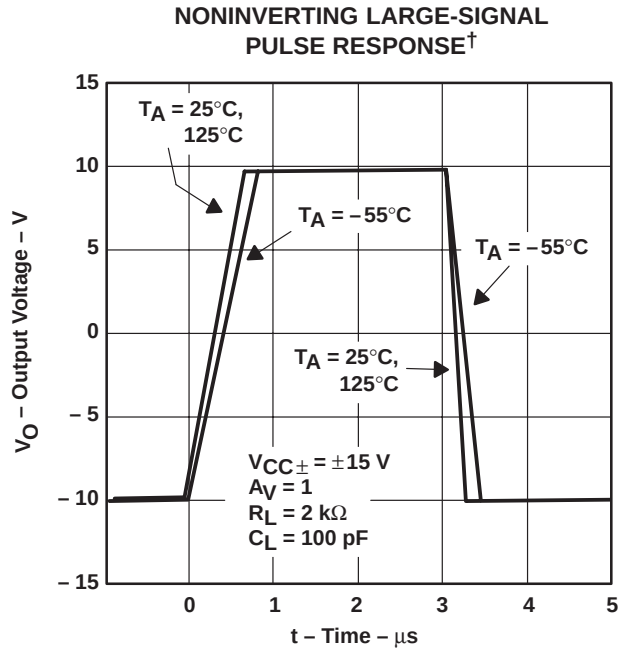


Figure 66

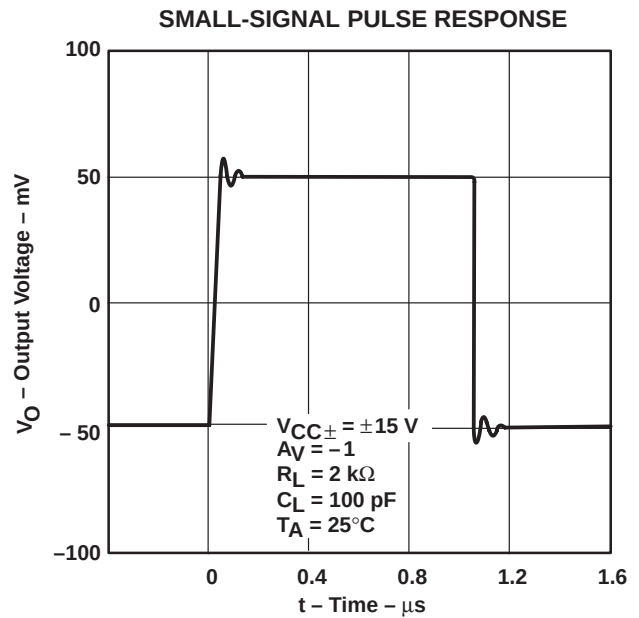


Figure 67

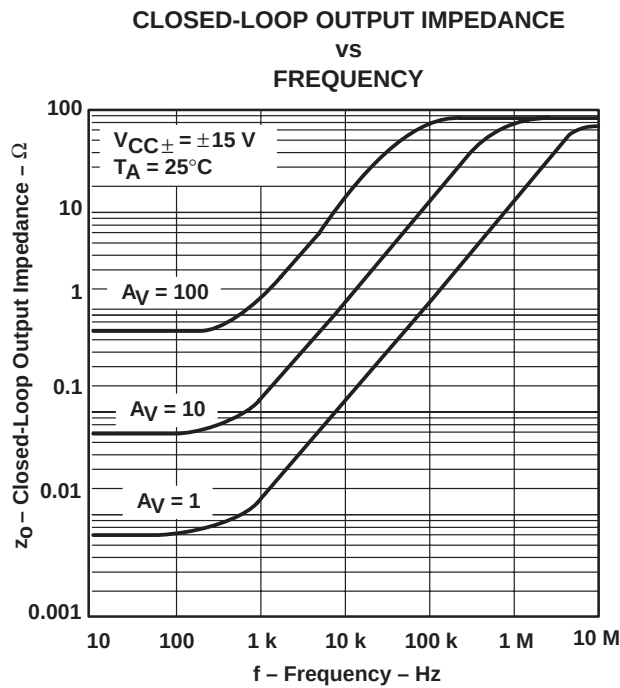


Figure 68

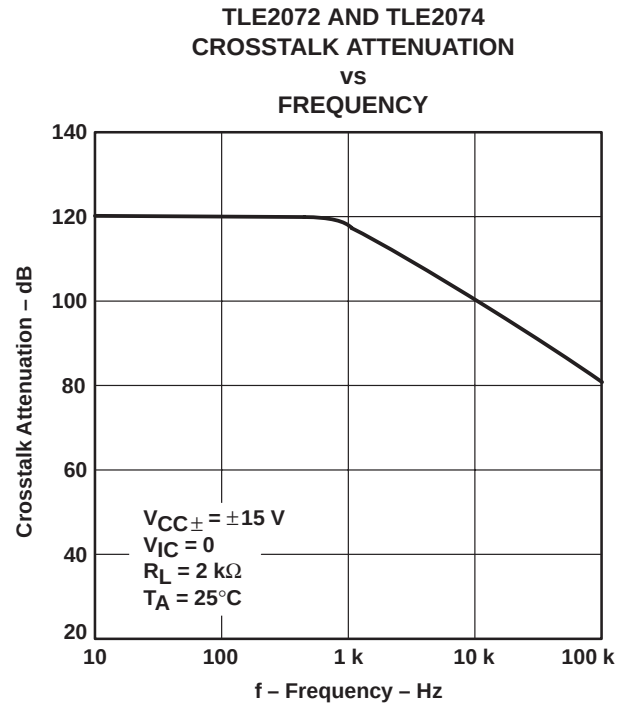


Figure 69

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

TLE207x, TLE207xA, TLE207xB EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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APPLICATION INFORMATION

input characteristics

The TLE207x, TLE207xA, and TLE207xB 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 TLE207x, TLE207xA, and TLE207xB 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 70). These guards should be driven from a low-impedance source at the same voltage level as the common-mode input.

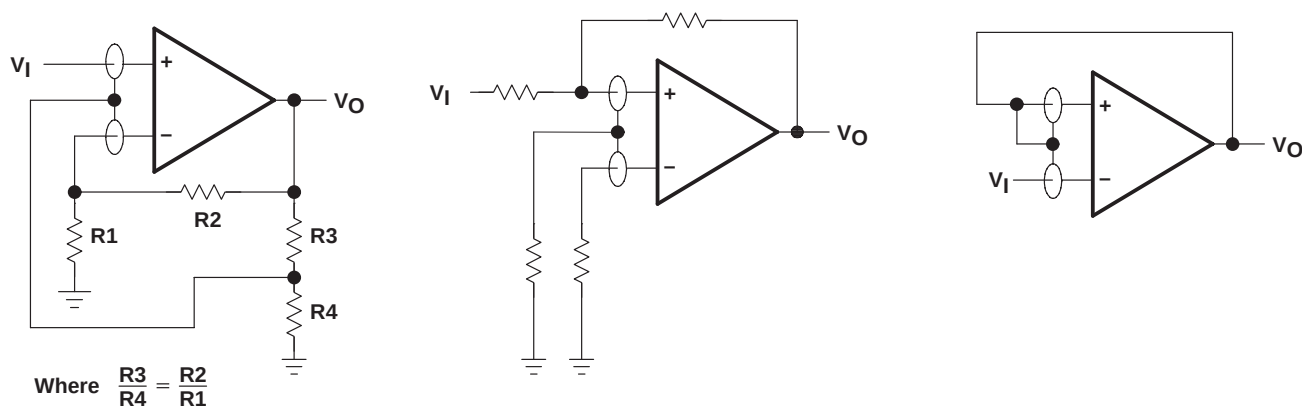


Figure 70. Use of Guard Rings

TLE2071 input offset voltage nulling

The TLE2071 series offers external null pins that can be used to further reduce the input offset voltage. The circuit of Figure 71 can be connected as shown if the feature is desired. When external nulling is not needed, the null pins may be left unconnected.

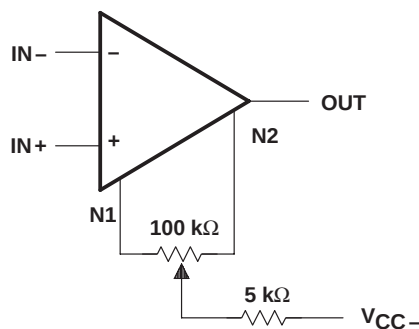


Figure 71. Input Offset Voltage Nulling

APPLICATION INFORMATION

macromodel information

Macromodel information provided was derived using *PSpice™ Parts™* model generation software. The Boyle macromodel (see Note 4) and subcircuit Figure 72 were generated using the TLE207x 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).

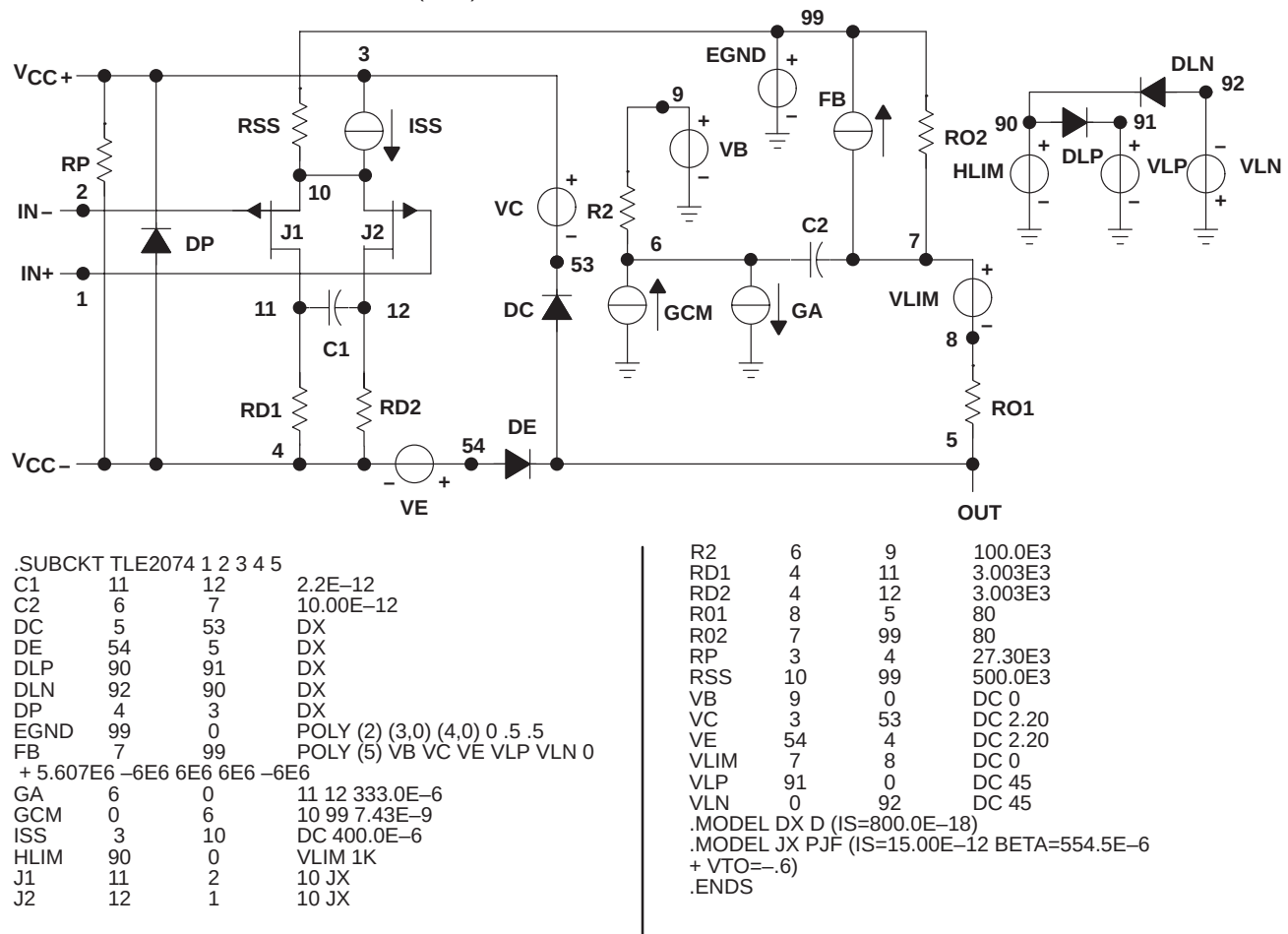


Figure 72. Boyle Macromodel and Subcircuit

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TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

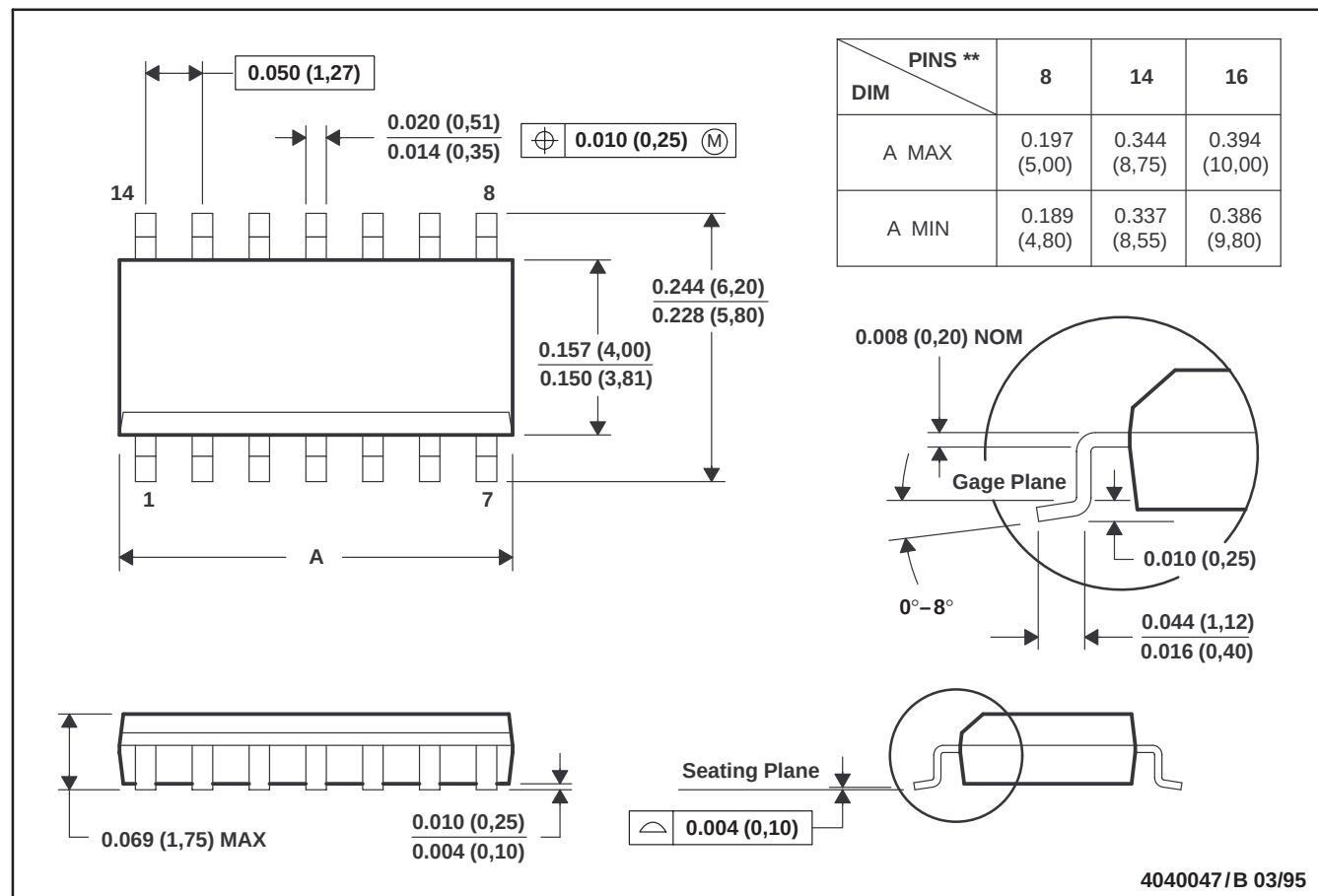
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MECHANICAL INFORMATION

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

TLE207x, TLE207xA, TLE207xY
EXCALIBUR LOW-NOISE HIGH-SPEED
JFET-INPUT OPERATIONAL AMPLIFIERS

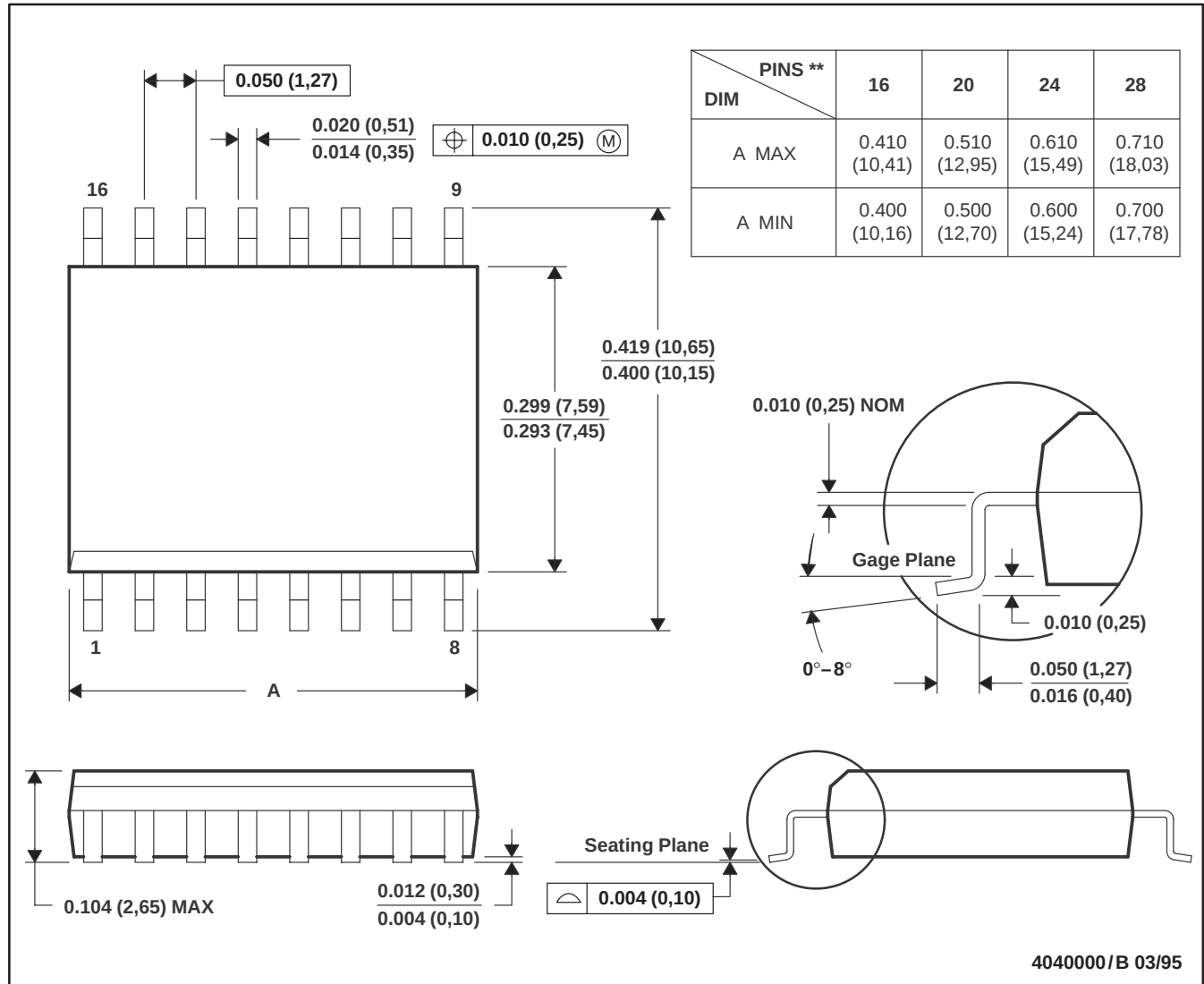
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MECHANICAL INFORMATION

DW (R-PDSO-G)**

PLASTIC SMALL-OUTLINE PACKAGE

16 PIN SHOWN



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - Falls within JEDEC MS-013

TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

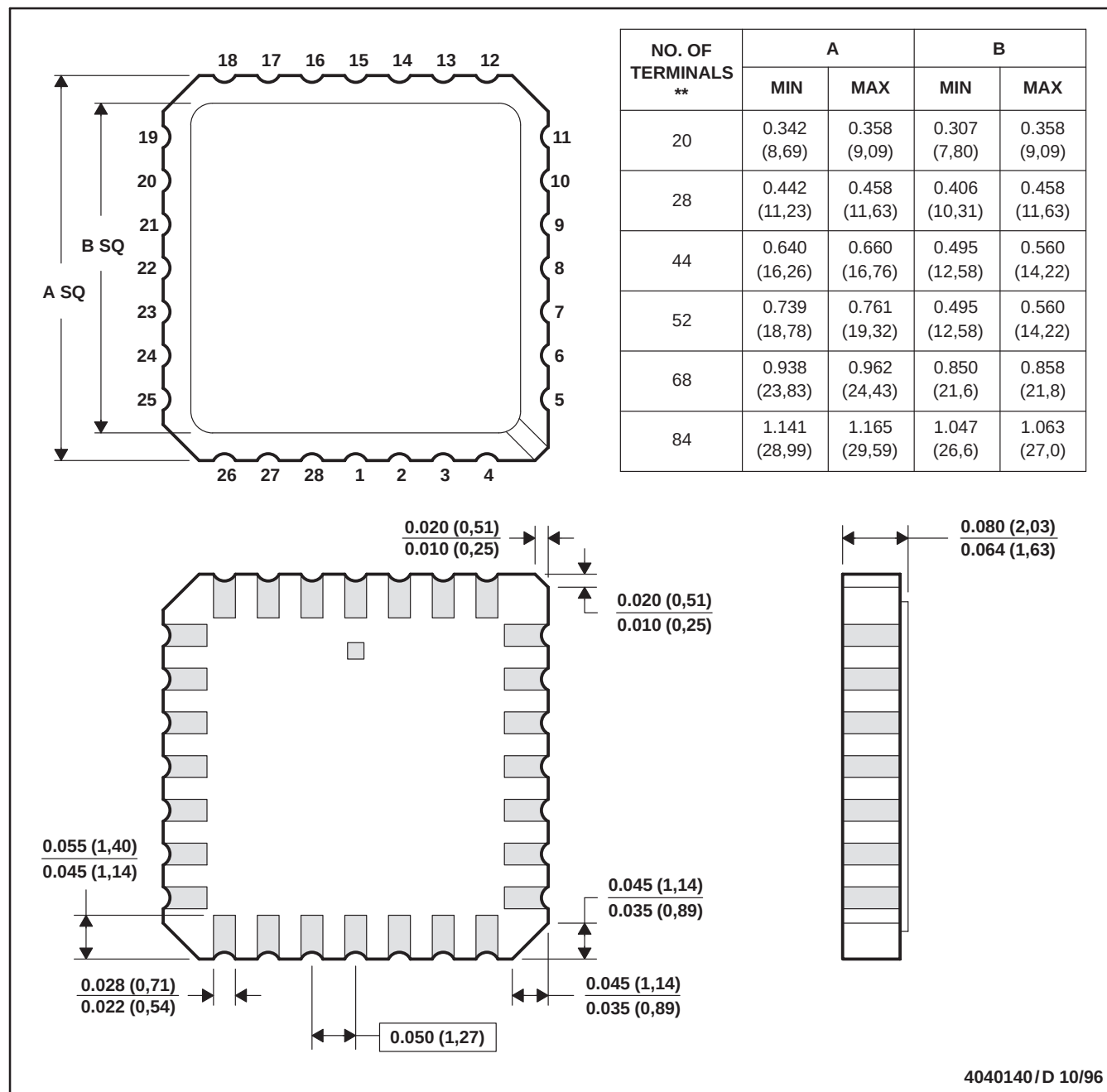
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MECHANICAL INFORMATION

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a metal lid.
 - D. The terminals are gold plated.
 - E. Falls within JEDEC MS-004

TLE207x, TLE207xA, TLE207xY
EXCALIBUR LOW-NOISE HIGH-SPEED
JFET-INPUT OPERATIONAL AMPLIFIERS

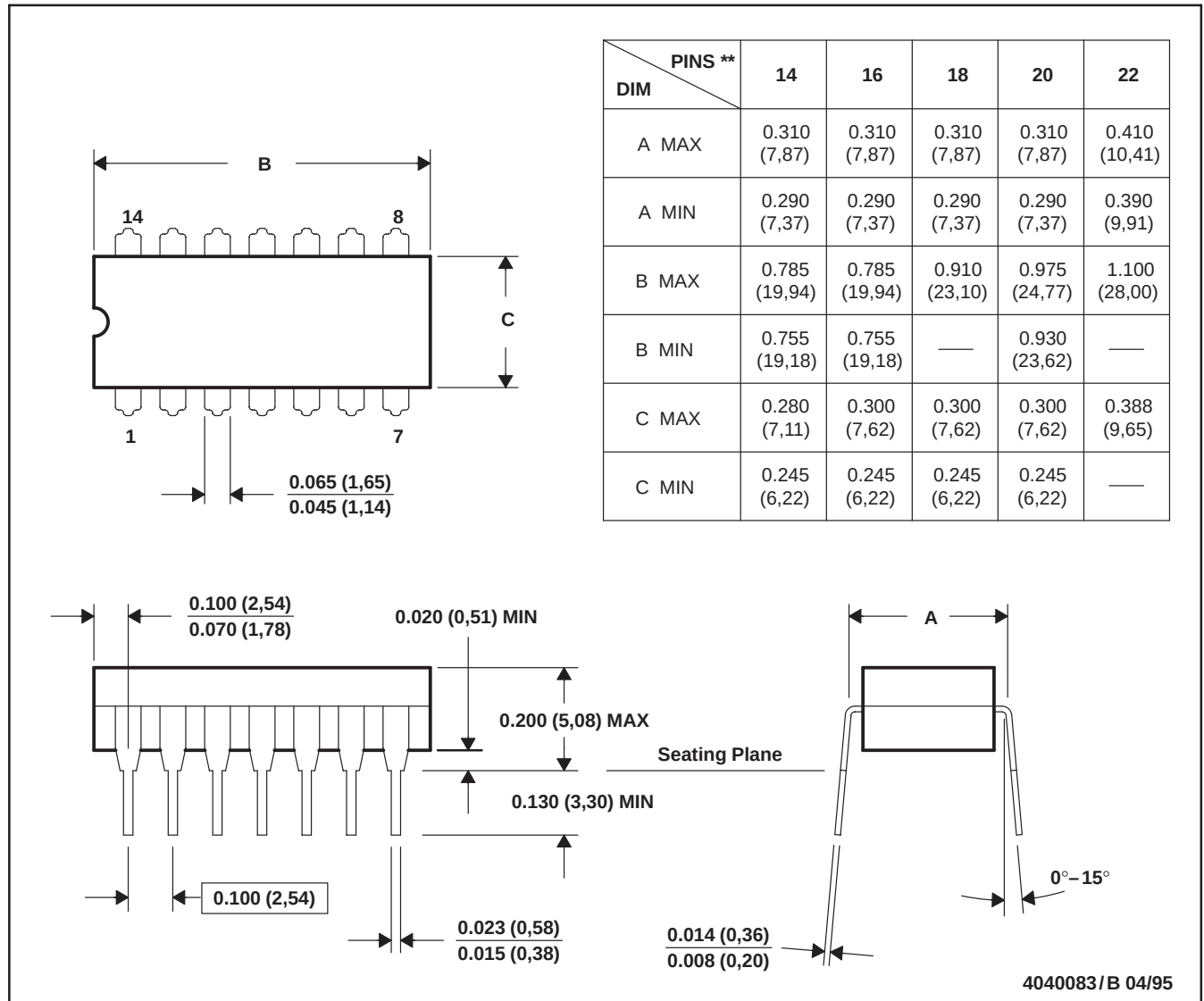
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MECHANICAL INFORMATION

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

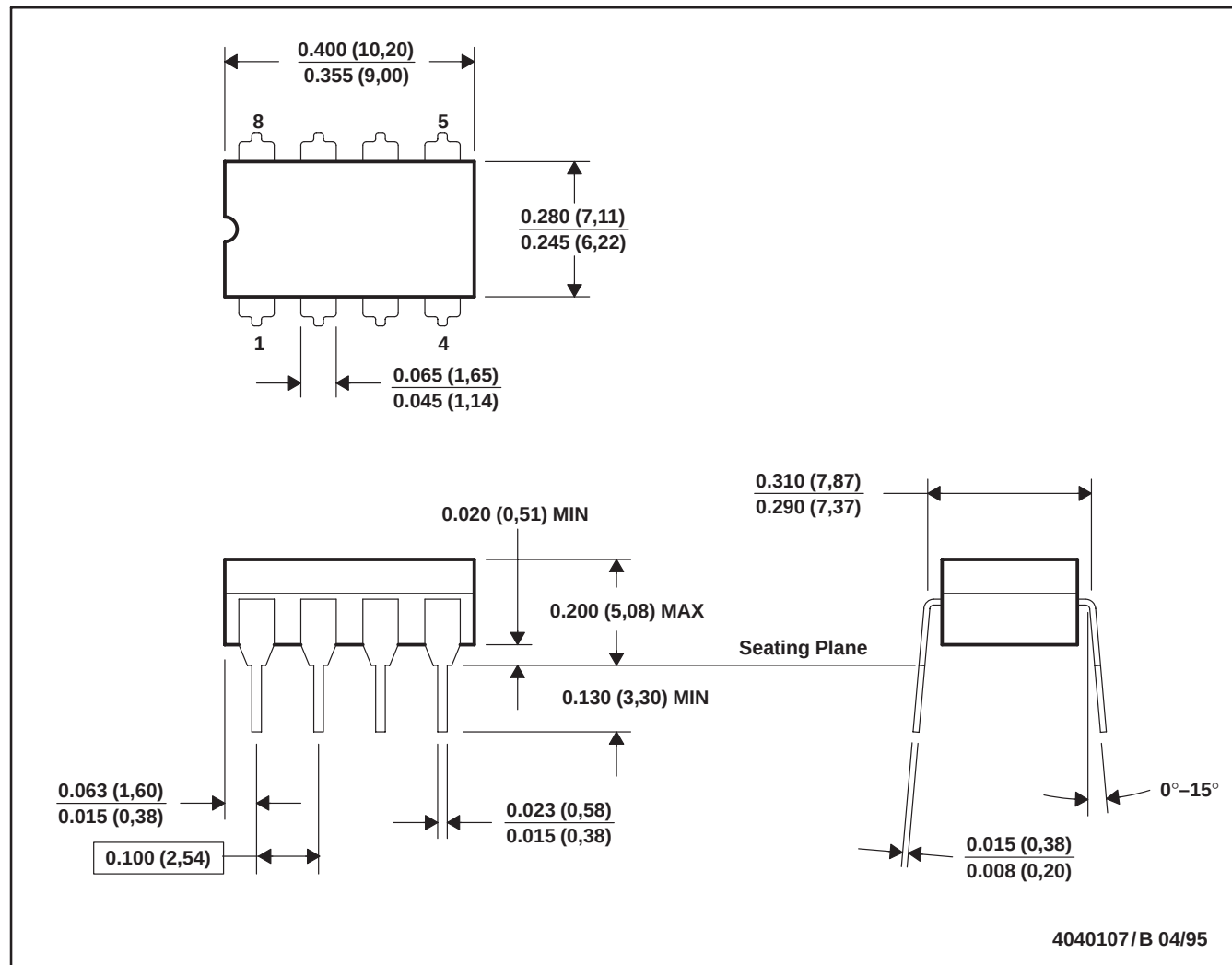
TLE207x, TLE207xA, TLE207xY
EXCALIBUR LOW-NOISE HIGH-SPEED
JFET-INPUT OPERATIONAL AMPLIFIERS

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MECHANICAL INFORMATION

JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE PACKAGE



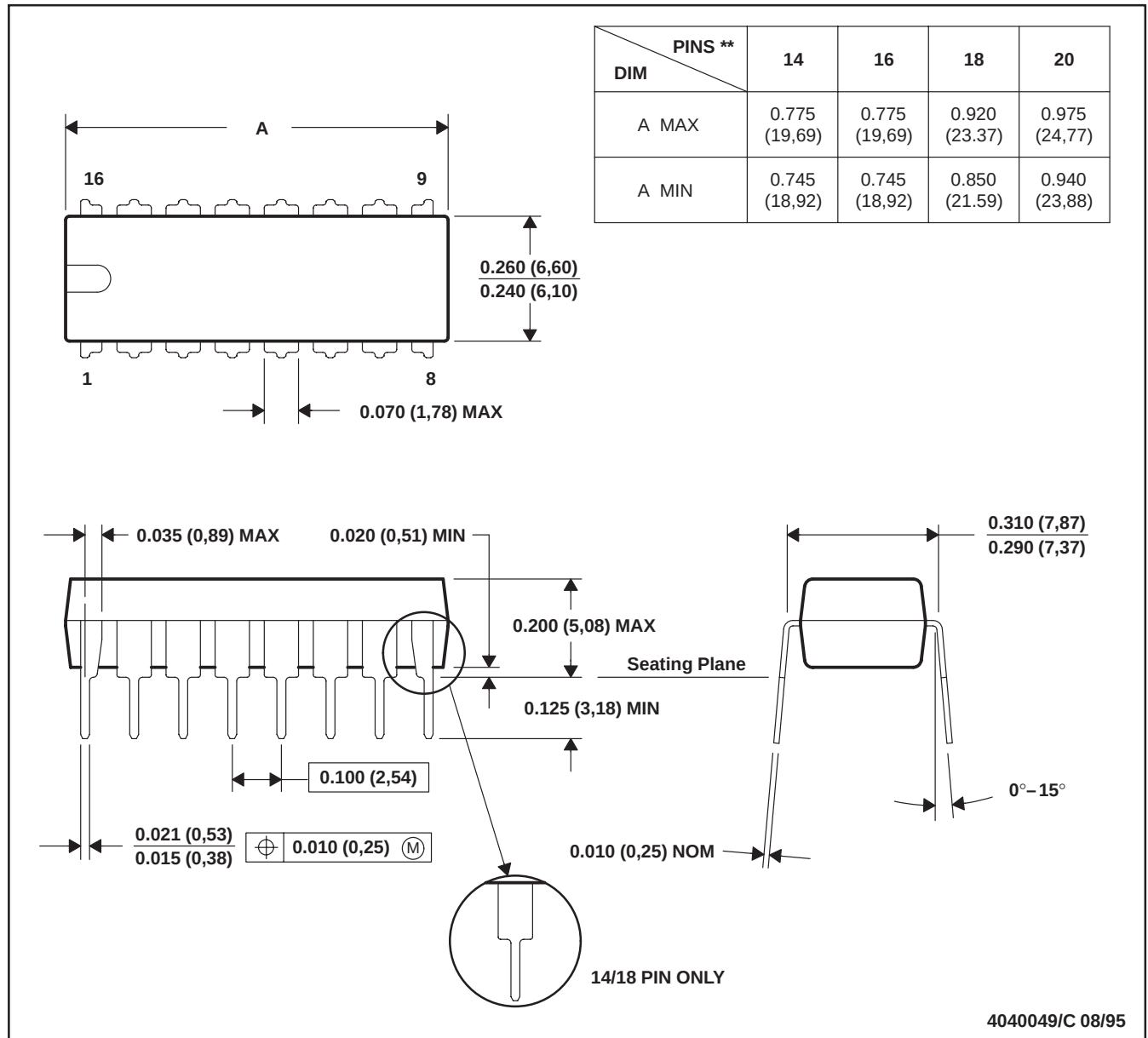
- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. This package can be hermetically sealed with a ceramic lid using glass frit.
 D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only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

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.)

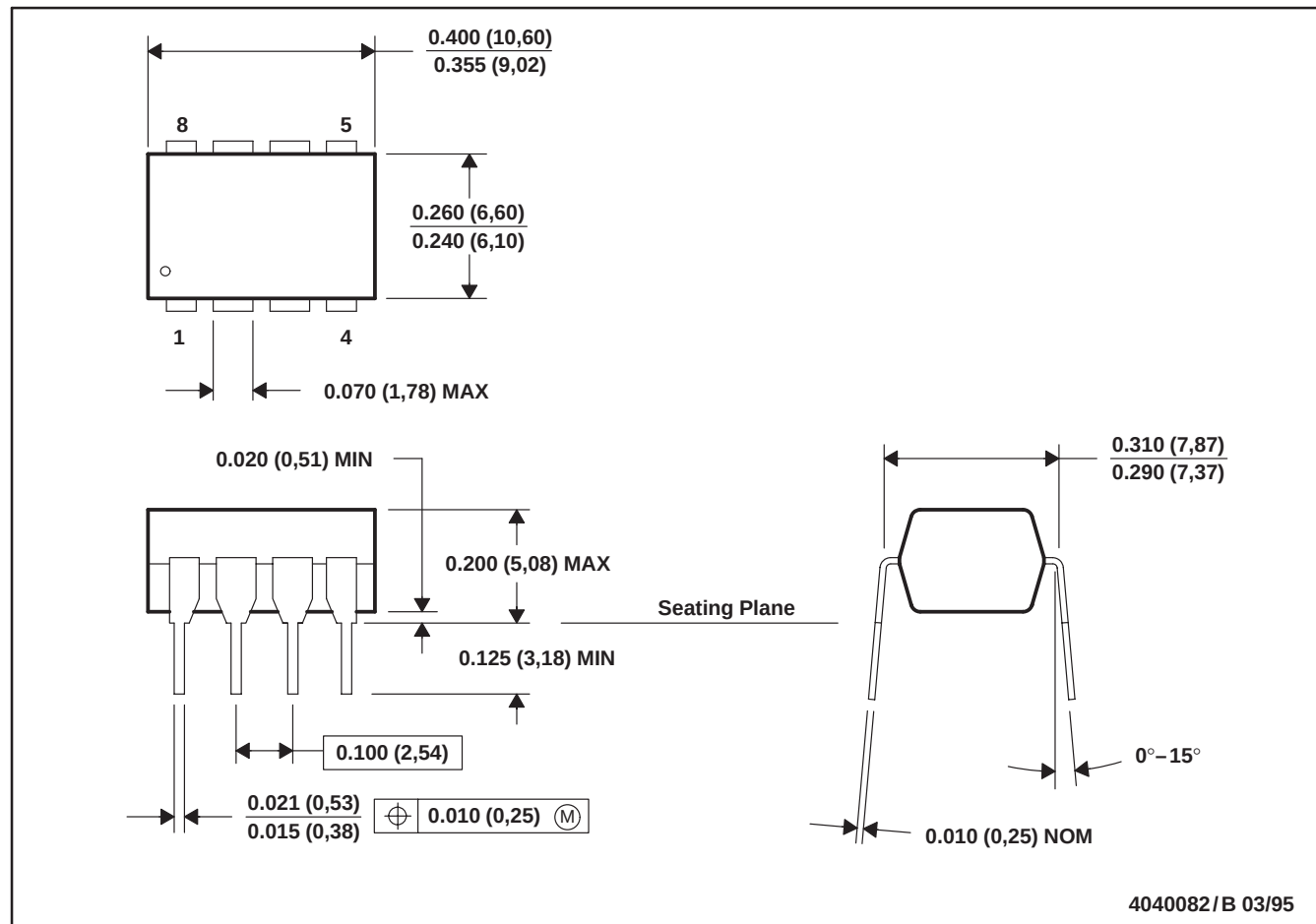
TLE207x, TLE207xA, TLE207xY
EXCALIBUR LOW-NOISE HIGH-SPEED
JFET-INPUT OPERATIONAL AMPLIFIERS

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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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