

- **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 EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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TLE2071 AVAILABLE OPTIONS

T _A	V _{IOmax} AT 25°C	PACKAGED DEVICES				
		SMALL OUTLINE† (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	CERAMIC FLAT PACK (U)
0°C to 70°C	2 mV 4 mV	TLE2071ACD TLE2071CD	—	—	TLE2071ACP TLE2071CP	—
–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	— —	TLE2071AMU TLE2071MU

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

TLE2072 AVAILABLE OPTIONS

T _A	V _{IOmax} AT 25°C	PACKAGED DEVICES				
		SMALL OUTLINE† (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	CERAMIC FLAT PACK (U)
0°C to 70°C	3.5 mV 6 mV	TLE2072ACD TLE2072CD	—	—	TLE2072ACP TLE2072CP	—
–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	—	TLE2072AMU TLE2072MU

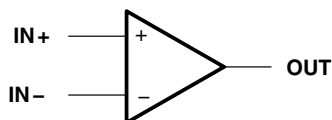
† The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2072ACDR).

TLE2074 AVAILABLE OPTIONS

T _A	V _{IOmax} AT 25°C	PACKAGED DEVICES				
		SMALL OUTLINE† (DW)	CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)	CERAMIC FLAT PACK (W)
0°C to 70°C	3 mV 5 mV	TLE2074ACDW TLE2074CDW	—	—	TLE2074ACN TLE2074CN	—
–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	—	TLE2074AMW TLE2074MW

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

symbol



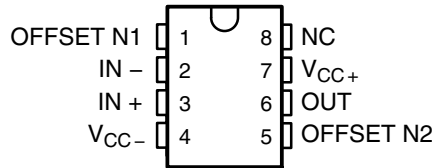
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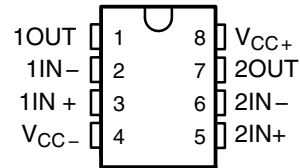
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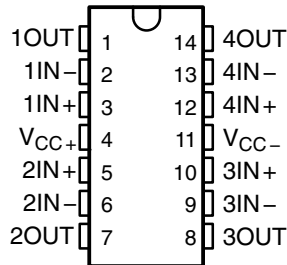
TLE2071 AND TLE2071A
D, JG, OR P PACKAGE
(TOP VIEW)



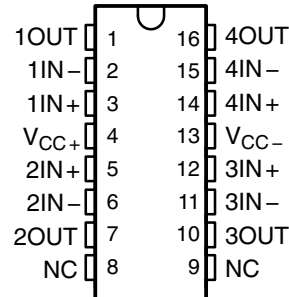
TLE2072 AND TLE2072A
D, JG, OR P PACKAGE
(TOP VIEW)



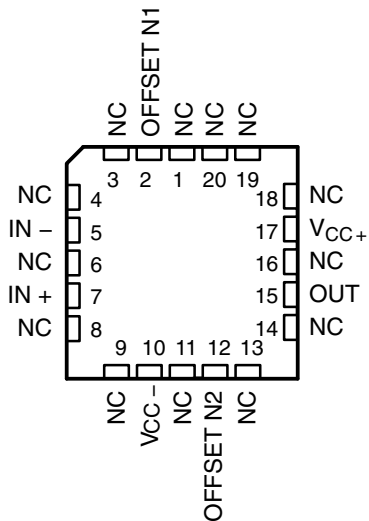
TLE2074 AND TLE2074A
J, N, OR W PACKAGE
(TOP VIEW)



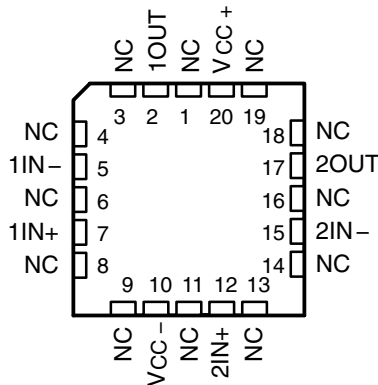
TLE2074 AND TLE2074A
DW PACKAGE
(TOP VIEW)



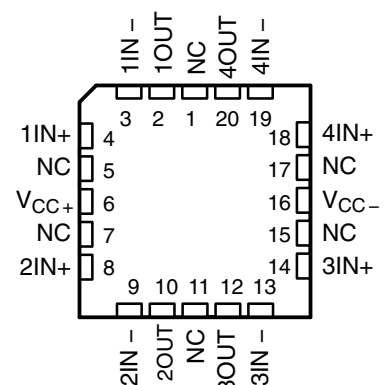
TLE2071M AND TLE2071AM
FK PACKAGE
(TOP VIEW)



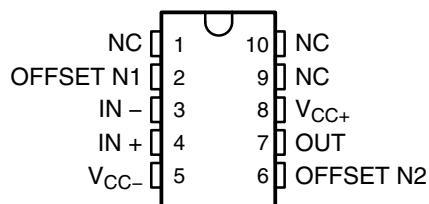
TLE2072M AND TLE2072AM
FK PACKAGE
(TOP VIEW)



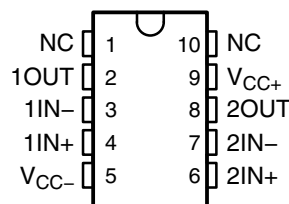
TLE2074M AND TLE2074AM
FK PACKAGE
(TOP VIEW)



TLE2071 AND TLE2071A
U PACKAGE
(TOP VIEW)

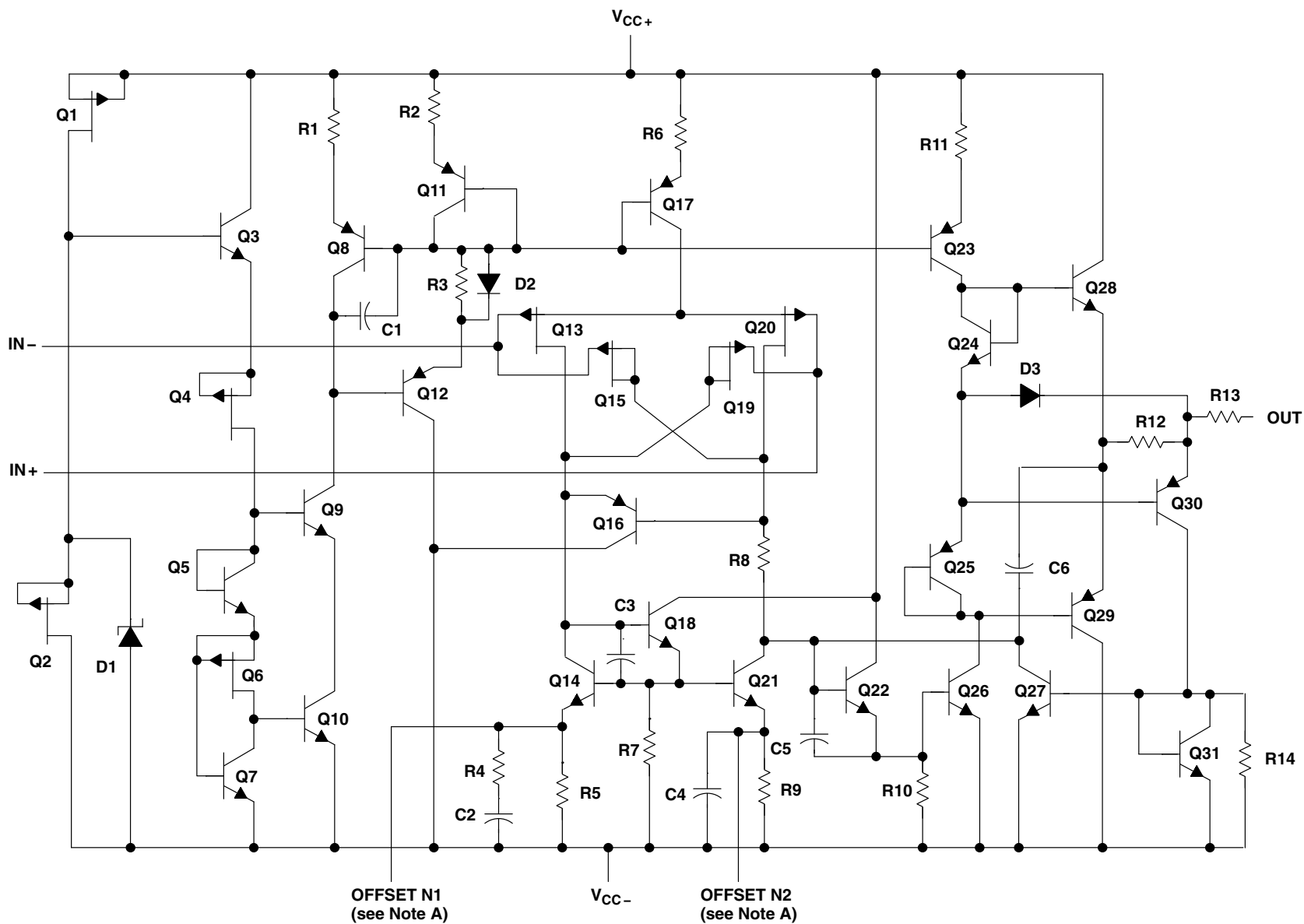


TLE2072 AND TLE2072A
U PACKAGE
(TOP VIEW)



NC – No internal connection

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

equivalent schematic (continued)

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

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

Supply voltage, V_{CC+} (see Note 1)	19 V
Supply voltage, V_{CC-} (see Note 1)	–19 V
Differential input voltage range, V_{ID} (see Note 2)	V_{CC+} to V_{CC-}
Input voltage range, V_I (any input)	V_{CC+} to V_{CC-}
Input current, I_I (each input)	±1 mA
Output current, I_O (each output)	±80 mA
Total current into V_{CC+}	160 mA
Total current out of V_{CC-}	160 mA
Duration of short-circuit current at (or below) 25°C (see Note 3)	unlimited
Package thermal impedance, θ_{JA} (see Notes 4 and 5):	
D package	97.1°C/W
DW package	57.3°C/W
N package	79.7°C/W
P package	84.6°C/W
Package thermal impedance, θ_{JC} (see Notes 4 and 5):	
FK package	5.6°C/W
J package	15.1°C/W
JG package	14.5°C/W
U package	14.7°C/W
W package	10°C/W
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, JG, U, or W 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.
 4. Maximum power dissipation is a function of $T_J(\text{max})$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
 5. The package thermal impedance is calculated in accordance with JESD 51-7 (plastic) or MIL-STD-883 Method 1012 (ceramic).

recommended operating conditions

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



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	$V_{IC} = 0, V_O = 0, \text{See Figure 4}$	25°C		5	100		5	100	pA
		Full range			1.4			1.4	nA
I_{IB} Input bias current		25°C		15	175		15	175	pA
		Full range			5			5	nA
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9		V
		Full range	5 to -0.9			5 to -0.9			
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200\ \mu\text{A}$	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	$V_{IC} = 0, \text{See Figure 5}$	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 0°C to 70°C.

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EXCALIBUR LOW-NOISE HIGH-SPEED

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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, 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	48	85	48	85	nV/√Hz		
			f = 10 kHz		12	17	12	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 0°C to 70°C.



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

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2071C			TLE2071AC			UNIT	
					MIN	TYP	MAX	MIN	TYP	MAX		
V _{IO}	Input offset voltage	V _{IC} = 0, R _S = 50 Ω	V _O = 0,	25°C	0.49		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
I _{IO}	Input offset current	V _{IC} = 0, See Figure 4	V _O = 0,	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 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	−13.5	−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	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	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			81				

† Full range is 0°C to 70°C.

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EXCALIBUR LOW-NOISE HIGH-SPEED

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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^\dagger	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	-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	48	85		48	85		nV√Hz
			f = 10 kHz		12	17		12	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, R _L = 2 kΩ, C _L = 25 pF, See Figure 2		25°C	8	10		8	10		MHz
B _{OM}	Maximum output-swing bandwidth	V _{O(PP)} = 20 V, 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, R _L = 2 kΩ, C _L = 25 pF, See Figure 2		25°C	57°			57°			

† Full range is 0°C to 70°C.



TLE2071I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ 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	$\mu V/^\circ C$
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0$, See Figure 4	25°C		5	100		5	100	pA
		Full range			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	$I_O = -200 \mu A$	25°C	3.8	4.1		3.8	4.1		V
		Full range	3.7			3.7			
	$I_O = -2 \text{ mA}$	25°C	3.5	3.9		3.5	3.9		
		Full range	3.4			3.4			
	$I_O = -20 \text{ mA}$	25°C	1.5	2.3		1.5	2.3		
		Full range	1.5			1.5			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200 \mu A$	25°C	-3.8	-4.2		-3.8	-4.2		V
		Full range	-3.7			-3.7			
	$I_O = 2 \text{ mA}$	25°C	-3.5	-4.1		-3.5	-4.1		
		Full range	-3.4			-3.4			
	$I_O = 20 \text{ mA}$	25°C	-1.5	-2.4		-1.5	-2.4		
		Full range	-1.5			-1.5			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 2.3 \text{ V}$	$R_L = 600 \Omega$	25°C	80	91	80	91		dB
			Full range	79		79			
		$R_L = 2 \text{ k}\Omega$	25°C	90	100	90	100		
			Full range	89		89			
		$R_L = 10 \text{ k}\Omega$	25°C	95	106	95	106		
			Full range	94		94			
r_i Input resistance	$V_{IC} = 0$	25°C		10^{12}			10^{12}		Ω
c_i Input capacitance	$V_{IC} = 0$, 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 $-40^\circ C$ to $85^\circ C$.

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TLE2071I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ 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	$V_O = 0$	$V_{ID} = 1$ V		–35			–35		mA
		$V_{ID} = -1$ V		45			45		

† Full range is –40°C to 85°C.

TLE2071I operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ 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	48 85			48 85			nV/√Hz
	f = 10 kHz		12 17			12 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, 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 _I = 25 pF,	R _L = 2 kΩ, See Figure 2	25°C	56°			56°			

† Full range is –40°C to 85°C.



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	$V_{IC} = 0, V_O = 0$, See Figure 4	25°C		6	100		6	100	pA
		Full range			5			5	nA
I_{IB} Input bias current		25°C		20	175		20	175	pA
		Full range			10			10	nA
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	15 to –11	15 to –11.9		15 to –11	15 to –11.9		V
		Full range	15 to –10.8			15 to –10.8			
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200 \mu A$	25°C	13.8	14.1		13.8	14.1		V
		Full range	13.7			13.7			
	$I_O = -2$ mA	25°C	13.5	13.9		13.5	13.9		
		Full range	13.4			13.4			
	$I_O = -20$ mA	25°C	11.5	12.3		11.5	12.3		
		Full range	11.5			11.5			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200 \mu A$	25°C	–13.8	–14.2		–13.8	–14.2		V
		Full range	–13.7			–13.7			
	$I_O = 2$ mA	25°C	–13.5	–14		–13.5	–14		
		Full range	–13.4			–13.4			
	$I_O = 20$ mA	25°C	–11.5	–12.4		–11.5	–12.4		
		Full range	–11.5			–11.5			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10$ V	$R_L = 600 \Omega$	25°C	80	96	80	96		dB
			Full range	79		79			
		$R_L = 2$ k Ω	25°C	90	109	90	109		
			Full range	89		89			
		$R_L = 10$ k Ω	25°C	95	118	95	118		
			Full range	94		94			
r_i Input resistance	$V_{IC} = 0$	25°C		10^{12}			10^{12}		Ω
c_i Input capacitance	$V_{IC} = 0$, 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 ± 15 V, $V_O = 0$, $R_S = 50 \Omega$	25°C	82	99		82	99		dB
		Full range	80			80			

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

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TLE2071I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ 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	1.7	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	–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	48	85		48	85	nV/√Hz	
	f = 10 kHz		12		17		12	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°			

† Full range is –40°C to 85°C.



TLE2071M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (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 [‡]		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0,$ See Figure 4	25°C	5	100		5	100		pA
		Full range			20			20	nA
I_{IB} Input bias current		25°C	15	175		15	175		pA
		Full range			60			60	nA
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9		V
		Full range	5 to -0.8			5 to -0.8			
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200\ \mu\text{A}$	25°C	3.8	4.1		3.8	4.1		V
		Full range	3.6			3.6			
	$I_O = -2\text{ mA}$	25°C	3.5	3.9		3.5	3.9		
		Full range	3.3			3.3			
	$I_O = -20\text{ mA}$	25°C	1.5	2.3		1.5	2.3		
		Full range	1.4			1.4			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200\ \mu\text{A}$	25°C	-3.8	-4.2		-3.8	-4.2		V
		Full range	-3.6			-3.6			
	$I_O = 2\text{ mA}$	25°C	-3.5	-4.1		-3.5	-4.1		
		Full range	-3.3			-3.3			
	$I_O = 20\text{ mA}$	25°C	-1.5	-2.4		-1.5	-2.4		
		Full range	-1.4			-1.4			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 2.3\text{ V}$	$R_L = 600\ \Omega$	25°C	80	91	80	91		dB
			Full range	78		78			
		$R_L = 2\text{ k}\Omega$	25°C	90	100	90	100		
			Full range	88		88			
		$R_L = 10\text{ k}\Omega$	25°C	95	106	95	106		
			Full range	93		93			
r_i Input resistance	$V_{IC} = 0$	25°C		10^{12}			10^{12}		Ω
c_i Input capacitance	$V_{IC} = 0,$ 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 -55°C to 125°C.

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

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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	
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 –55°C to 125°C.

TLE2071M operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ 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, 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	48	85 [‡]	48	85 [‡]	nV/√Hz		
			f = 10 kHz		12	17 [‡]	12	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 –55°C to 125°C.

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



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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	
α _{VIO}	Temperature coefficient of input offset voltage			Full range	3.2		29*	3.2		29*	μV/°C
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^\dagger	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	–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	48	85*	48	85*	nV/√Hz		
			f = 10 kHz		12	17*	12	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.



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		

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS181C – FEBRUARY 1997 – REVISED DECEMBER 2009

TLE2072C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ 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	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		$\mu V/^\circ C$
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0, \text{See Figure 4}$	25°C	5	100		5	100		pA
		Full range		1.4			1.4		nA
I_{IB} Input bias current		25°C	15	175		15	175		pA
		Full range		5			5		nA
V_{ICR} Common-mode input voltage range	$R_S = 50 \Omega$	25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9		V
		Full range	5 to -0.9			5 to -0.9			
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200 \mu A$	25°C	3.8	4.1		3.8	4.1		V
		Full range	3.7			3.7			
	$I_O = -2 \text{ mA}$	25°C	3.5	3.9		3.5	3.9		
		Full range	3.4			3.4			
	$I_O = -20 \text{ mA}$	25°C	1.5	2.3		1.5	2.3		
		Full range	1.5			1.5			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200 \mu A$	25°C	-3.8	-4.2		-3.8	-4.2		V
		Full range	-3.7			-3.7			
	$I_O = 2 \text{ mA}$	25°C	-3.5	-4.1		-3.5	-4.1		
		Full range	-3.4			-3.4			
	$I_O = 20 \text{ mA}$	25°C	-1.5	-2.4		-1.5	-2.4		
		Full range	-1.5			-1.5			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 2.3 \text{ V}$	$R_L = 600 \Omega$	25°C	80	91	80	91		dB
			Full range	79		79			
		$R_L = 2 \text{ k}\Omega$	25°C	90	100	90	100		
			Full range	89		89			
		$R_L = 10 \text{ k}\Omega$	25°C	95	106	95	106		
			Full range	94		94			
r_i Input resistance	$V_{IC} = 0$	25°C	10^{12}			10^{12}			Ω
c_i Input capacitance	$V_{IC} = 0, \text{See Figure 5}$	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 0°C to 70°C.



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 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			

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, C _L = 100 pF, R _L = 2 kΩ, 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	48	85	48	85	nV/√Hz		
			f = 10 kHz		12	17	12	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.

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS181C – FEBRUARY 1997 – REVISED DECEMBER 2009

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.



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 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		

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	48	85		48	85	nV/√Hz	
			f = 10 kHz		12	17		12	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°			

[†] Full range is 0°C to 70°C.



TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

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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^\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		0.9	6		0.65	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	$\mu\text{V}/^\circ\text{C}$
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 .



TLE2072I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ 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	$V_{IC} = 0$, $R_L = 2$ k Ω	25°C		120			120		dB
I_{OS} Short-circuit output current	$V_O = 0$	25°C		$V_{ID} = 1$ V			-35		mA
				$V_{ID} = -1$ V			-35		
					45			45	

TLE2072I operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ 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, 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	48 85			48 85			nV/√Hz
			f = 10 kHz		12 17			12 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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EXCALIBUR LOW-NOISE HIGH-SPEED

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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	$V_{IC} = 0, V_O = 0, \text{See Figure 4}$	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 $85^\circ C$.



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	V _{ID} = 1 V	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, C _L = 100 pF, R _L = 2 kΩ, 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	48			85	48	85	nV/√Hz
	f = 10 kHz		12			17	12	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, 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 –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 [†]	TLE2072M			TLE2072AM			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage	V _{IC} = 0, V _O = 0, R _S = 50 Ω,		25°C	0.9		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*	μV/°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 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	3.6		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 μA		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 = ±2.3 V	R _L = 600 Ω	25°C	80		91	80		91	dB
				Full range	78		78				
			R _L = 2 kΩ	25°C	90		100	90		100	
				Full range	88		88				
			R _L = 10 kΩ	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 Ω		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°C to 125°C.

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

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, 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	48	85*	48	85*	nV/√Hz		
			f = 10 kHz		12	17*	12	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°				

*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, V _O = 0, R _S = 50 Ω		25°C	1.1		6	0.7		3.5	mV
				Full range			10.5			8	
α _{VIO}	Temperature coefficient of input offset voltage			Full range	2.4		25*	2.4		25*	μV/°C
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 −10.8		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°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	
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 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 .

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	R _S = 20 Ω, See Figure 3	f = 10 Hz	25°C	48			85*	48	85*	nV/√Hz
	f = 10 kHz		12			17*	12	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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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	$V_{IC} = V_{ICRmin}$, $V_O = 0$, $R_S = 50\ \Omega$	80	98		dB
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 5\text{ V to } \pm 15\text{ V}$, $R_S = 50\ \Omega$, $V_O = 0$	82	99		dB
I_{CC} Supply current (both channels)	$V_O = 0$, No load	2.7	3.1	3.9	mA
I_{OS} Short-circuit output current	$V_O = 0$	$V_{ID} = 1\text{ V}$	-30	-45	mA
		$V_{ID} = -1\text{ V}$	30	48	

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

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	$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0, \text{See Figure 4}$	25°C		15	100		15	100	pA
		Full range			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	$I_O = -200\ \mu\text{A}$	25°C	3.8	4.1		3.8	4.1		V
		Full range	3.7			3.7			
	$I_O = -2\text{ mA}$	25°C	3.5	3.9		3.5	3.9		
		Full range	3.4			3.4			
	$I_O = -20\text{ mA}$	25°C	1.5	2.3		1.5	2.3		
		Full range	1.5			1.5			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200\ \mu\text{A}$	25°C	-3.8	-4.2		-3.8	-4.2		V
		Full range	-3.7			-3.7			
	$I_O = 2\text{ mA}$	25°C	-3.5	-4.1		-3.5	-4.1		
		Full range	-3.4			-3.4			
	$I_O = 20\text{ mA}$	25°C	-1.5	-2.4		-1.5	-2.4		
		Full range	-1.5			-1.5			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 2.3\text{ V}$	$R_L = 600\ \Omega$	25°C	80	91		80	91	dB
			Full range	79			79		
		$R_L = 2\text{ k}\Omega$	25°C	90	100		90	100	
			Full range	89			89		
		$R_L = 10\text{ k}\Omega$	25°C	95	106		95	106	
			Full range	94			94		
r_i Input resistance	$V_{IC} = 0$	25°C		10^{12}			10^{12}		Ω
c_i Input capacitance	Common mode	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.

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

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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^\dagger	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	$V_{IC} = 0$, $R_L = 2$ k Ω	25°C		120			120		dB
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.

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	48 85			48 85			nV/√Hz
			f = 10 kHz		12 17			12 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.



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

PARAMETER		TEST CONDITIONS	T_A^\dagger	TLE2074C			TLE2074AC			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	$V_{IC} = 0,$ $R_S = 50\ \Omega$	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	$V_{IC} = 0,$ $V_O = 0,$ See Figure 4	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	$R_S = 50\ \Omega$	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			
		$I_O = -2\ mA$	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	-13.7	-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	$V_O = \pm 10\ V$	$R_L = 600\ \Omega$	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	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	81			81			

† Full range is 0°C to 70°C.

TLE207x, TLE207xA

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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^\dagger	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	$V_{IC} = 0$, $R_L = 2$ 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 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	48 85			48 85			nV/√Hz
			f = 10 kHz		12 17			12 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°			

† Full range is 0°C to 70°C.

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

PARAMETER		TEST CONDITIONS	T_A^\dagger	TLE2074I			TLE2074AI			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	$V_{IC} = 0, \quad V_O = 0, \quad R_S = 50 \, \Omega$	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	$\mu V/^\circ C$
I_{IO}	Input offset current	$V_{IC} = 0, \quad V_O = 0, \quad \text{See Figure 4}$	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	$R_S = 50 \, \Omega$	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	3.7			3.7			
		$I_O = -2 \, mA$	25°C	3.5	3.9		3.5	3.9		
			Full range	3.4			3.4			
		$I_O = -20 \, mA$	25°C	1.5	2.3		1.5	2.3		
			Full range	1.5			1.5			
V_{OM-}	Maximum negative peak output voltage swing	$I_O = 200 \, \mu A$	25°C	-3.8	-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	$V_O = \pm 2.3 \, V$	$R_L = 600 \, \Omega$	25°C	80	91	80	91		dB
				Full range	79		79			
			$R_L = 2 \, k\Omega$	25°C	90	100	90	100		
				Full range	89		89			
			$R_L = 10 \, k\Omega$	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	$f = 1 \, MHz$	25°C		80			80		Ω
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, \quad V_O = 0, \quad R_S = 50 \, \Omega$	25°C	70	89		70	89		dB
			Full range	68			68			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 5 \, V \text{ to } \pm 15 \, V, \quad V_O = 0, \quad R_S = 50 \, \Omega$	25°C	82	99		82	99		dB
			Full range	80			80			

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

TLE207x, TLE207xA

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

PARAMETER	TEST CONDITIONS	T_A^\dagger	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	$V_{IC} = 0$, $R_L = 2$ k Ω	25°C		120			120		dB
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 –40°C to 85°C.

TLE2074I operating characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ 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, 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	48 85			48 85			nV/√Hz
			f = 10 kHz		12 17			12 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.



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

PARAMETER		TEST CONDITIONS	T_A^\dagger	TLE2074I			TLE2074AI			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			9			7	
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		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	$R_S = 50 \Omega$	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	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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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 _{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 -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, 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	48	85		48	85		nV/√Hz
	f = 10 kHz		12		17	12	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°			

† Full range is -40°C to 85°C.



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

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLE2074M			TLE2074AM			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		10.5			8.5		
α_{VIO} Temperature coefficient of input offset voltage		Full range	10.1	30 [‡]		10.1	30 [‡]		$\mu\text{V}/^\circ\text{C}$
I_{IO} Input offset current	$V_{IC} = 0, V_O = 0,$ See Figure 4	25°C	15	100		15	100		pA
		Full range		20			20		nA
I_{IB} Input bias current		25°C	20	175		20	175		pA
		Full range		60			60		nA
V_{ICR} Common-mode input voltage range	$R_S = 50\Omega$	25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9		V
		Full range	5 to -0.8			5 to -0.8			
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200\mu\text{A}$	25°C	3.8	4.1		3.8	4.1		V
		Full range	3.6			3.6			
	$I_O = -2\text{ mA}$	25°C	3.5	3.9		3.5	3.9		
		Full range	3.3			3.3			
	$I_O = -20\text{ mA}$	25°C	1.5	2.3		1.5	2.3		
		Full range	1.4			1.4			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200\mu\text{A}$	25°C	-3.8	-4.2		-3.8	-4.2		V
		Full range	-3.6			-3.6			
	$I_O = 2\text{ mA}$	25°C	-3.5	-4.1		-3.5	-4.1		
		Full range	-3.3			-3.3			
	$I_O = 20\text{ mA}$	25°C	-1.5	-2.4		-1.5	-2.4		
		Full range	-1.4			-1.4			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 2.3\text{ V}$	$R_L = 600\Omega$	25°C	80	91	80	91		dB
			Full range	78		78			
		$R_L = 2\text{ k}\Omega$	25°C	90	100	90	100		
			Full range	88		88			
		$R_L = 10\text{ k}\Omega$	25°C	95	106	95	106		
			Full range	93		93			
r_i Input resistance	$V_{IC} = 0$	25°C		10^{12}			10^{12}		Ω
c_i Input capacitance	Common mode	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 -55°C to 125°C.

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

TLE207x, TLE207xA

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

PARAMETER	TEST CONDITIONS	T_A^\dagger	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	$V_{IC} = 0$, $R_L = 2$ k Ω	25°C		120			120		dB
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 –55°C to 125°C.

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

PARAMETER		TEST CONDITIONS		T _A [†]	TLE2074M		TLE2074AM		UNIT
					MIN	TYP	MAX	MIN	
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	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	48	85 [‡]	48	85 [‡]	nV/√Hz
			f = 10 kHz		12	17 [‡]	12	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°		

† Full range is –55°C to 125°C.

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



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

PARAMETER	TEST CONDITIONS	T_A^\dagger	TLE2074M			TLE2074AM			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			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	25	175		25	175		pA
		Full range			60			60	nA
V_{ICR} Common-mode input voltage range	$R_S = 50\ \Omega$	25°C	15 to -11	15 to -11.9		15 to -11	15 to -11.9		V
		Full range	15 to -10.8			15 to -10.8			
V_{OM+} Maximum positive peak output voltage swing	$I_O = -200\ \mu A$	25°C	13.8	14.1		13.8	14.1		V
		Full range	13.6			13.6			
	$I_O = -2\text{ mA}$	25°C	13.5	13.9		13.5	13.9		
		Full range	13.3			13.3			
	$I_O = -20\text{ mA}$	25°C	11.5	12.3		11.5	12.3		
		Full range	11.4			11.4			
V_{OM-} Maximum negative peak output voltage swing	$I_O = 200\ \mu A$	25°C	-13.8	-14.2		-13.8	-14.2		V
		Full range	-13.6			-13.6			
	$I_O = 2\text{ mA}$	25°C	-13.5	-14		-13.5	-14		
		Full range	-13.3			-13.3			
	$I_O = 20\text{ mA}$	25°C	-11.5	-12.4		-11.5	-12.4		
		Full range	-11.4			-11.4			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10\text{ V}$	$R_L = 600\ \Omega$	25°C	80	96		80	96	dB
			Full range	78			78		
		$R_L = 2\text{ k}\Omega$	25°C	90	109		90	109	
			Full range	88			88		
		$R_L = 10\text{ k}\Omega$	25°C	95	118		95	118	
			Full range	93			93		
r_i Input resistance	$V_{IC} = 0$	25°C		10^{12}			10^{12}		Ω
c_i Input capacitance	Common mode	25°C		7.5			7.5		pF
	Differential	25°C		2.5			2.5		
z_o Open-loop output impedance	$f = 1\text{ MHz}$	25°C		80			80		Ω
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50\ \Omega$	25°C	80	98		80	98		dB
		Full range	78			78			
k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm} / \Delta V_{IO}$)	$V_{CC\pm} = \pm 5\text{ V to } \pm 15\text{ V}, V_O = 0, R_S = 50\ \Omega$	25°C	82	99		82	99		dB
		Full range	80			80			

[†] Full range is -55°C to 125°C.

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

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

PARAMETER	TEST CONDITIONS	T_A^\dagger	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	$V_{IC} = 0$, $R_L = 2$ 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.

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, C _L = 100 pF, 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	48	85 [‡]		48	85 [‡]		nV/√Hz
			f = 10 kHz		12	17 [‡]		12	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°				

† Full range is –55°C to 125°C.

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



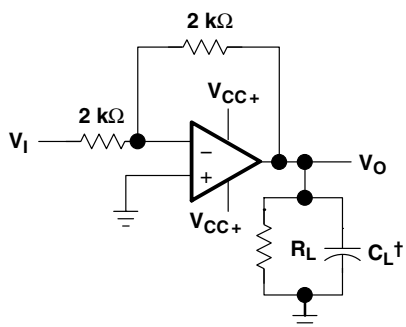
TLE2074Y electrical characteristics at $V_{CC\pm} = \pm 15$ V, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	TLE2074Y			UNIT
			MIN	TYP	MAX	
V_{IO}	Input offset voltage	$V_{IC} = 0$, $R_S = 50\ \Omega$			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		7.5		pF
		Differential		2.5		
z_o	Open-loop output impedance	$f = 1\ \text{MHz}$		80		Ω
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$	80	98		dB
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$)	$V_{CC\pm} = \pm 5\ \text{V to } \pm 15\ \text{V}$, $V_O = 0$, $R_S = 50\ \Omega$	82	99		dB
I_{CC}	Supply current (four amplifiers)	$V_O = 0$, No load	5.2	6.5	7.5	mA
I_{OS}	Short-circuit output current	$V_O = 0$	$V_{ID} = 1\ \text{V}$	–30	–45	mA
			$V_{ID} = -1\ \text{V}$	30	48	

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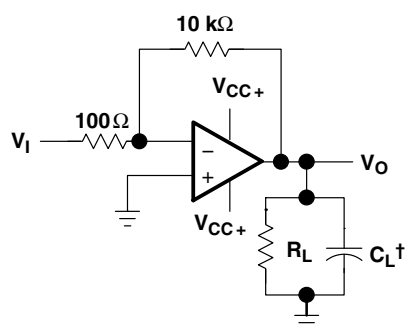
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PARAMETER MEASUREMENT INFORMATION



† Includes fixture capacitance

Figure 1. Slew-Rate Test Circuit



† Includes fixture capacitance

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

PARAMETER MEASUREMENT INFORMATION

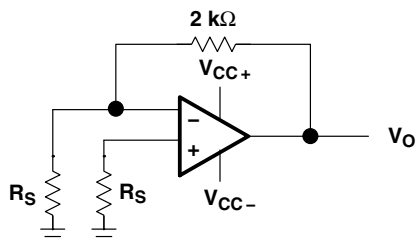


Figure 3. Noise-Voltage Test Circuit

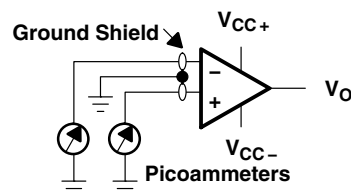


Figure 4. Input-Bias and Offset-Current Test Circuit

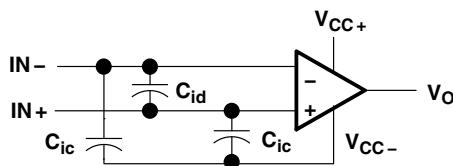


Figure 5. Internal Input Capacitance

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.

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TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
V_{IO}	Input offset voltage	Distribution	6, 7, 8
α_{VIO}	Temperature coefficient of input offset voltage	Distribution	9, 10, 11
I_{IO}	Input offset current	vs Free-air temperature	12, 13
I_{IB}	Input bias current	vs Free-air temperature vs Total supply voltage	12, 13 14
V_{ICR}	Common-mode input voltage range	vs Free-air temperature	15
V_O	Output voltage	vs Differential input voltage	16, 17
V_{OM+}	Maximum positive peak output voltage	vs Output current	18
V_{OM-}	Maximum negative peak output voltage	vs Output current	19
V_{OM}	Maximum peak output voltage	vs Free-air temperature vs Supply voltage	20, 21 22
$V_{O(PP)}$	Maximum peak-to-peak output voltage	vs Frequency	23
V_O	Output voltage	vs Settling time	24
A_{VD}	Large-signal differential voltage amplification	vs Load resistance vs Free-air temperature	25 26, 27
A_{VD}	Small-signal differential voltage amplification	vs Frequency	28, 29
CMRR	Common-mode rejection ratio	vs Frequency vs Free-air temperature	30 31
k_{SVR}	Supply-voltage rejection ratio	vs Frequency vs Free-air temperature	32 33
I_{CC}	Supply current	vs Supply voltage vs Free-air temperature vs Differential input voltage	34, 35, 36 37, 38, 39 40 – 45
I_{OS}	Short-circuit output current	vs Supply voltage vs Elapsed time vs Free-air temperature	46 47 48
SR	Slew rate	vs Free-air temperature vs Load resistance vs Differential input voltage	49, 50 51 52
V_n	Equivalent Input noise voltage (spectral density)	vs Frequency	53
V_n	Input referred noise voltage	vs Noise bandwidth Over a 10-second time interval	54 55
	Third-octave spectral noise density	vs Frequency bands	56
THD + N	Total harmonic distortion plus noise	vs Frequency	57, 58
B_1	Unity-gain bandwidth	vs Load capacitance	59
	Gain-bandwidth product	vs Free-air temperature vs Supply voltage	60 61
	Gain margin	vs Load capacitance	62
ϕ_m	Phase margin	vs Free-air temperature vs Supply voltage vs Load capacitance	63 64 65
	Phase shift	vs Frequency	28, 29
	Noninverting large-signal pulse response	vs Time	66
	Small-signal pulse response	vs Time	67
z_o	Closed-loop output impedance	vs Frequency	68
	Crosstalk attenuation	vs Frequency	69

TYPICAL CHARACTERISTICS

**DISTRIBUTION OF TLE2071
INPUT OFFSET VOLTAGE**

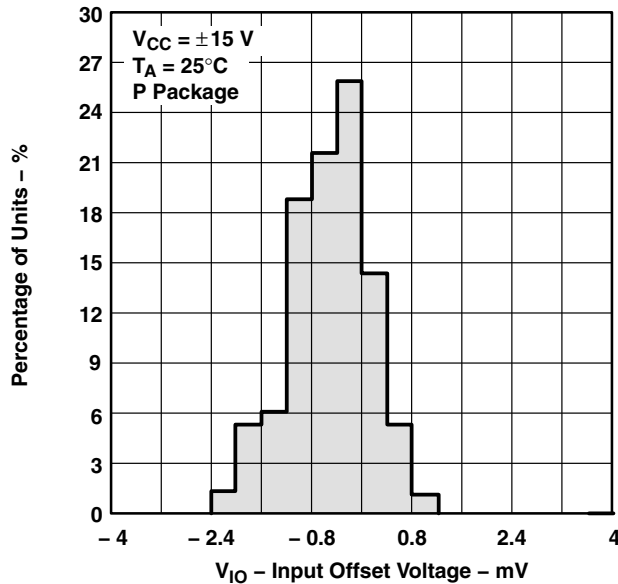


Figure 6

**DISTRIBUTION OF TLE2072
INPUT OFFSET VOLTAGE**

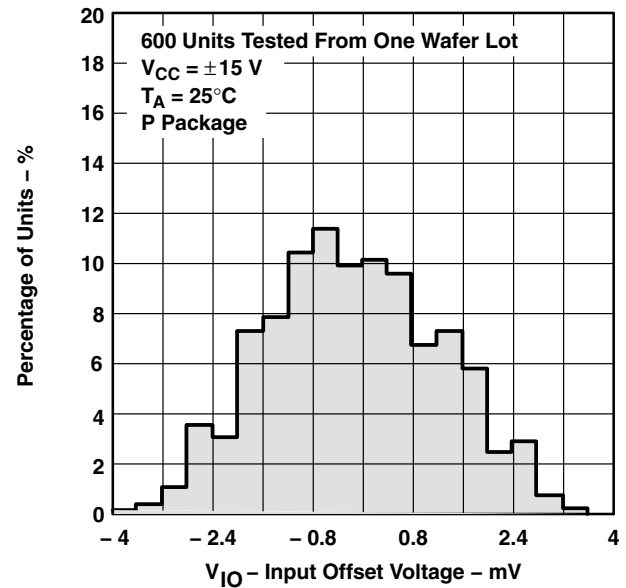


Figure 7

**DISTRIBUTION OF TLE2074
INPUT OFFSET VOLTAGE**

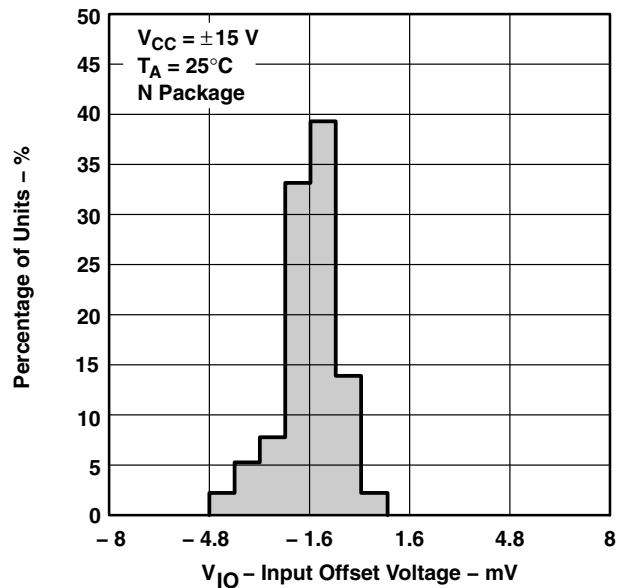


Figure 8

**DISTRIBUTION OF TLE2071 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT**

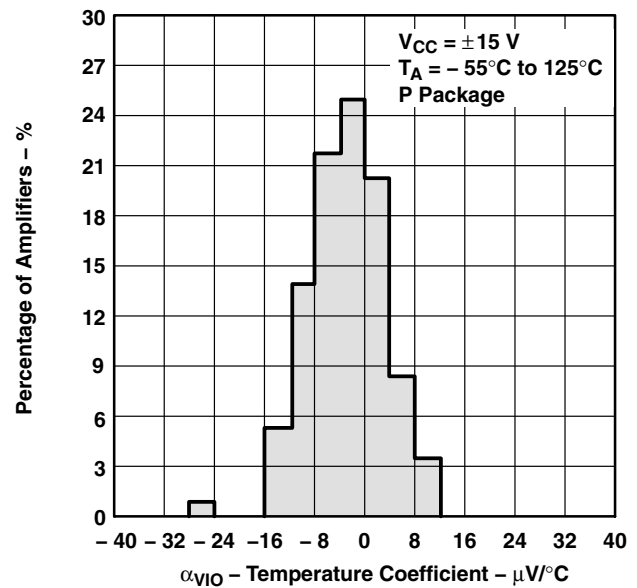


Figure 9

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

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TYPICAL CHARACTERISTICS

**DISTRIBUTION OF TLE2072 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT**

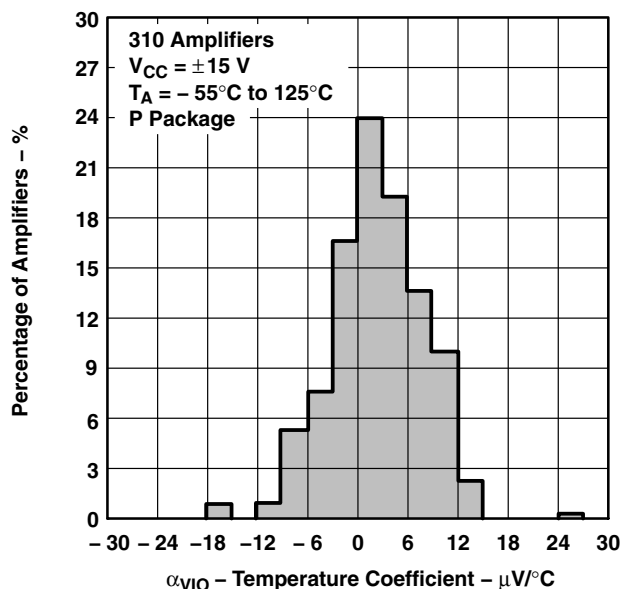


Figure 10

**DISTRIBUTION OF TLE2074 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT**

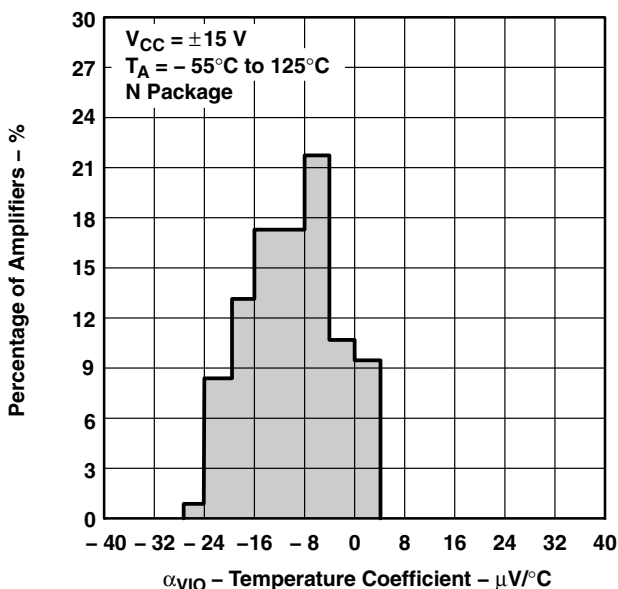


Figure 11

**INPUT BIAS CURRENT AND
INPUT OFFSET CURRENT†
vs
FREE-AIR TEMPERATURE**

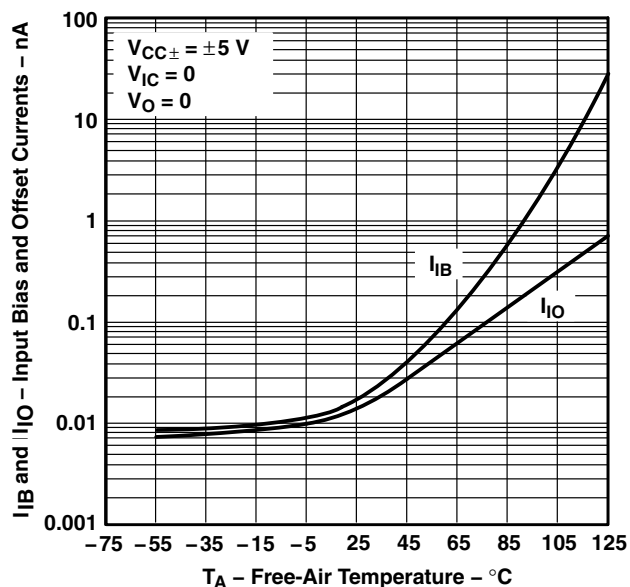


Figure 12

**INPUT BIAS CURRENT AND
INPUT OFFSET CURRENT†
vs
FREE-AIR TEMPERATURE**

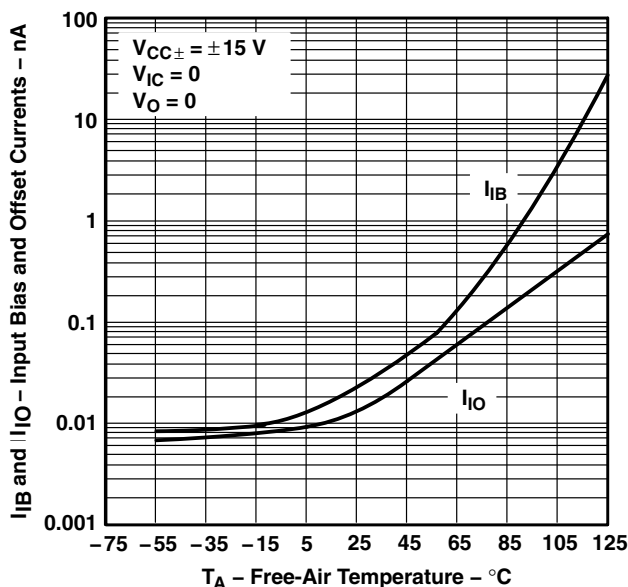
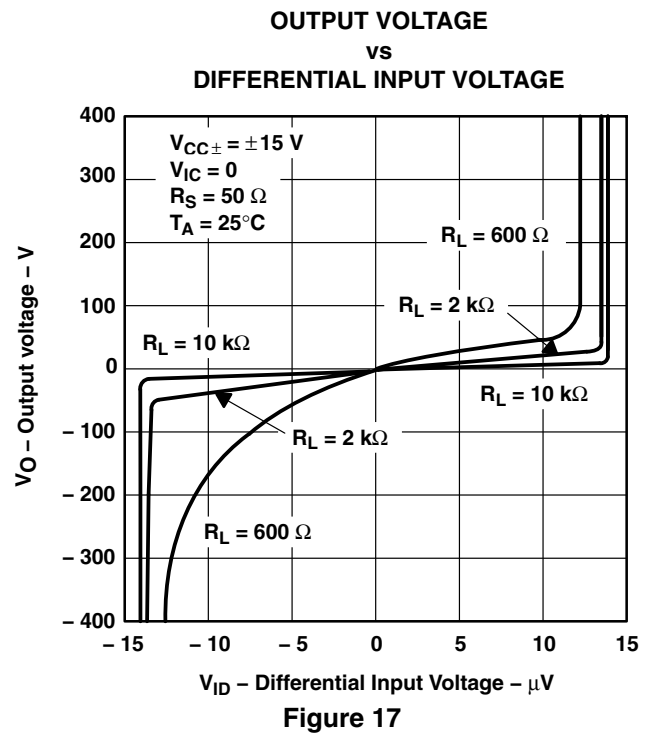
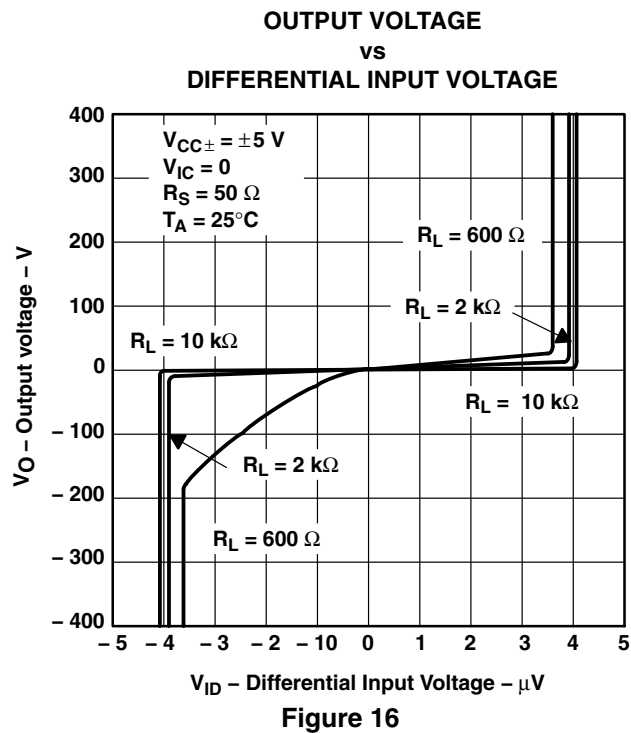
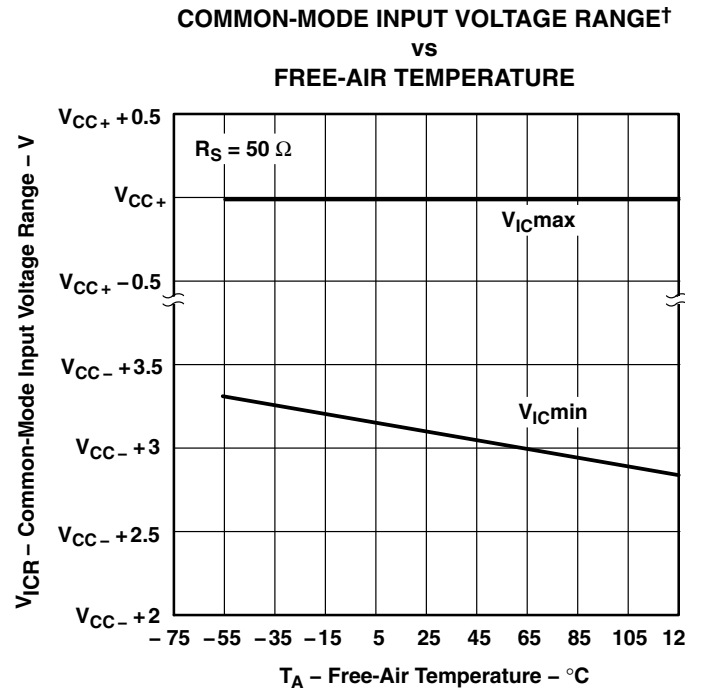
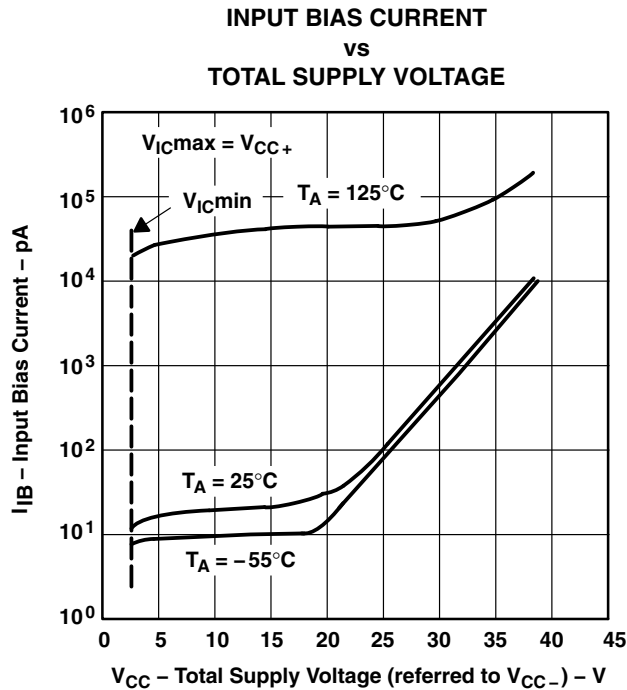


Figure 13

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

TYPICAL CHARACTERISTICS



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

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

SLOS181C – FEBRUARY 1997 – REVISED DECEMBER 2009

TYPICAL CHARACTERISTICS

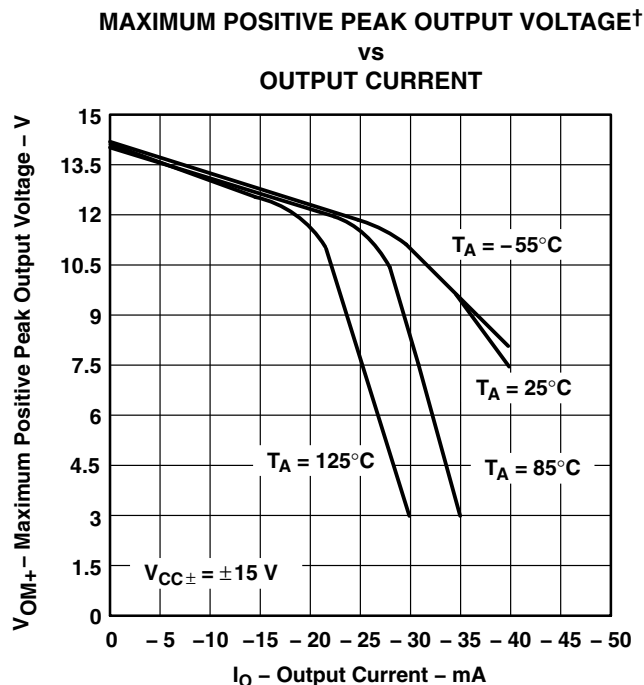


Figure 18

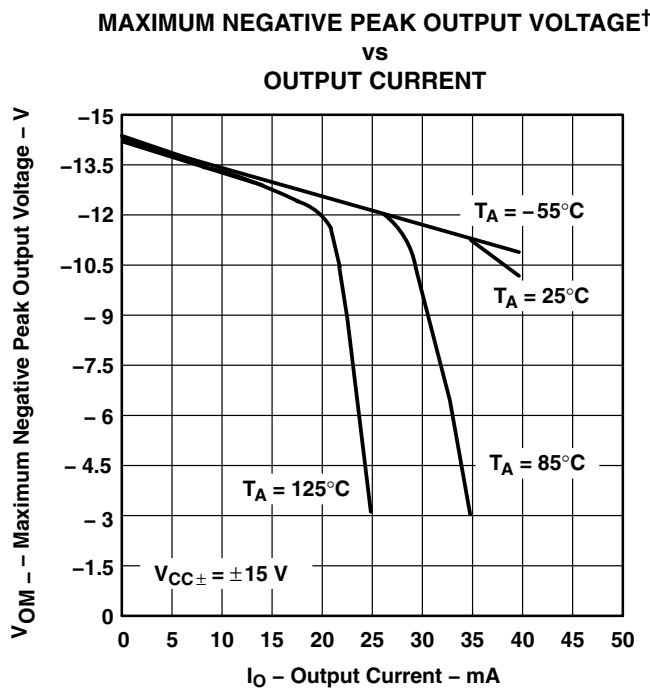


Figure 19

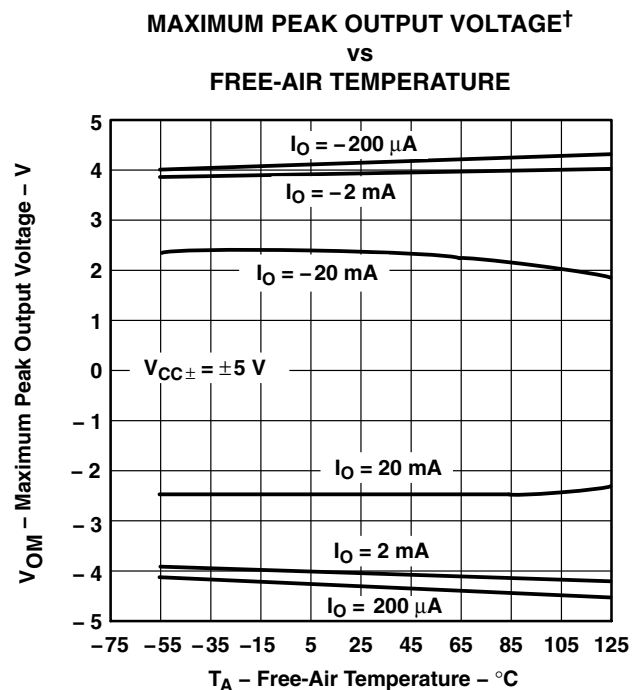


Figure 20

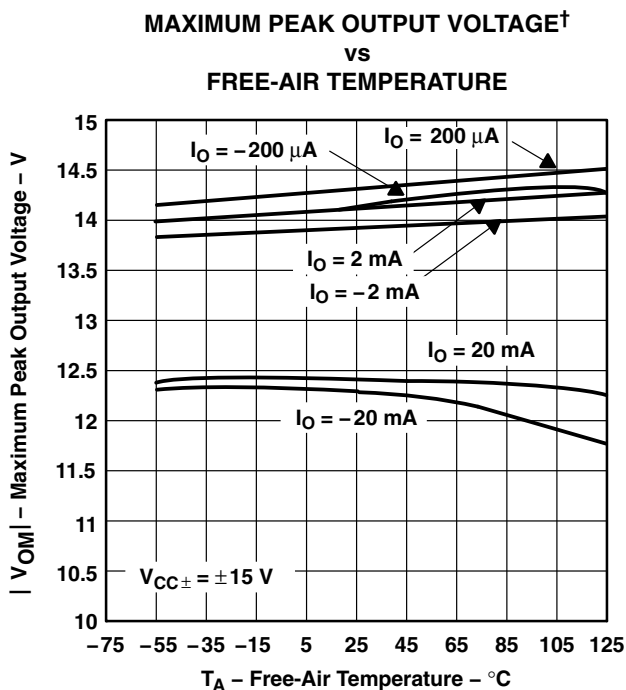
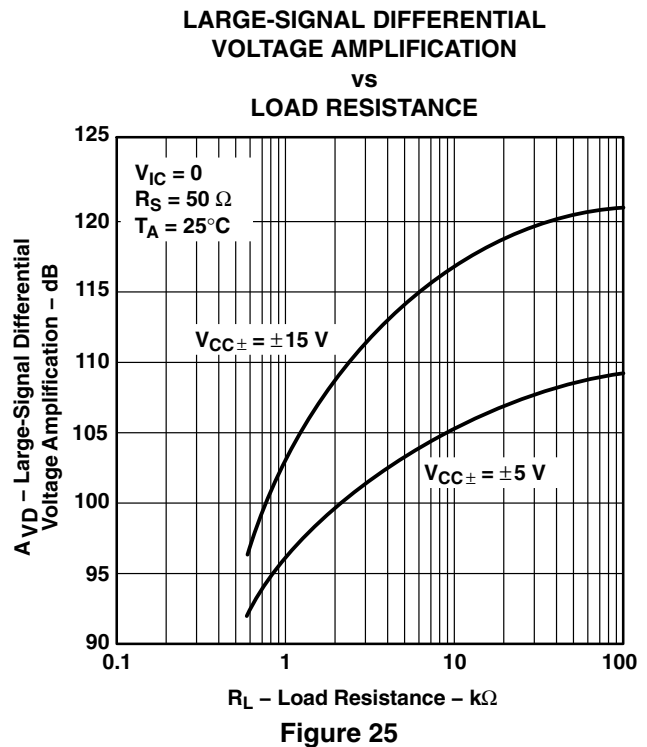
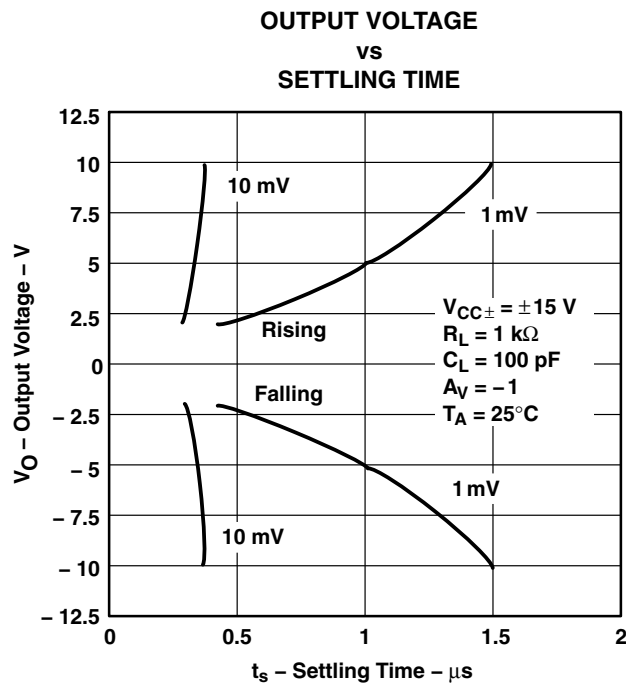
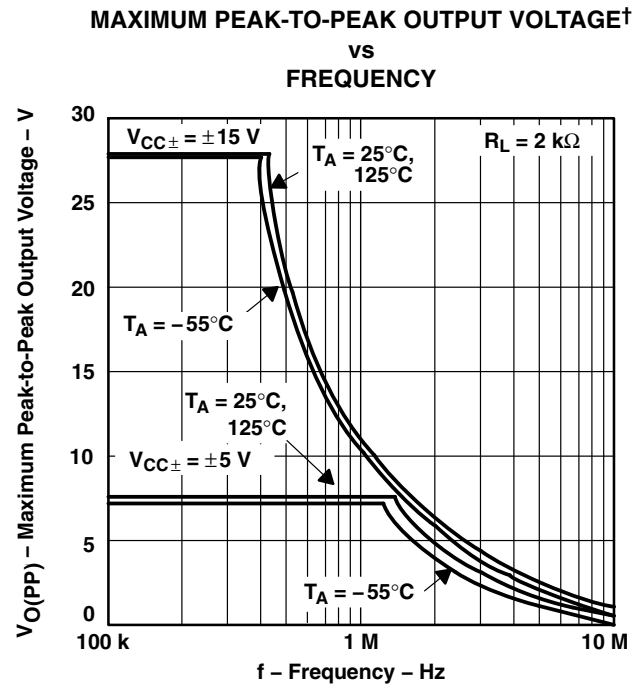
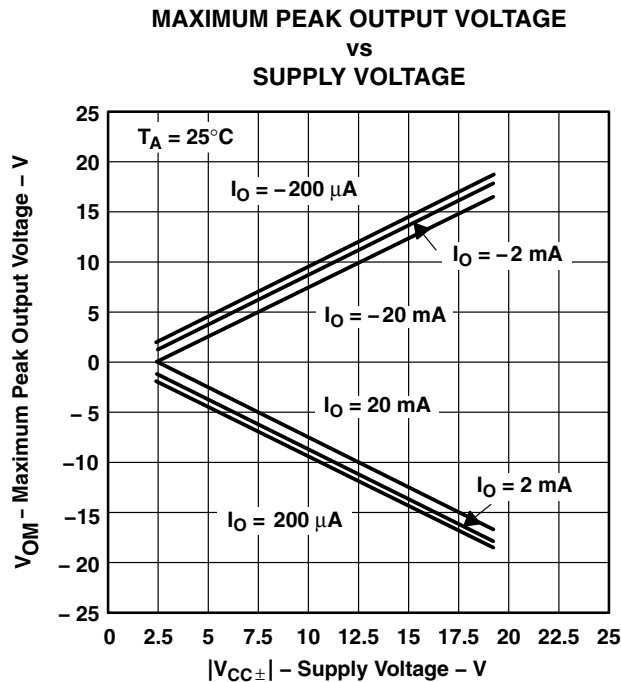


Figure 21

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

TYPICAL CHARACTERISTICS



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

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

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TYPICAL CHARACTERISTICS

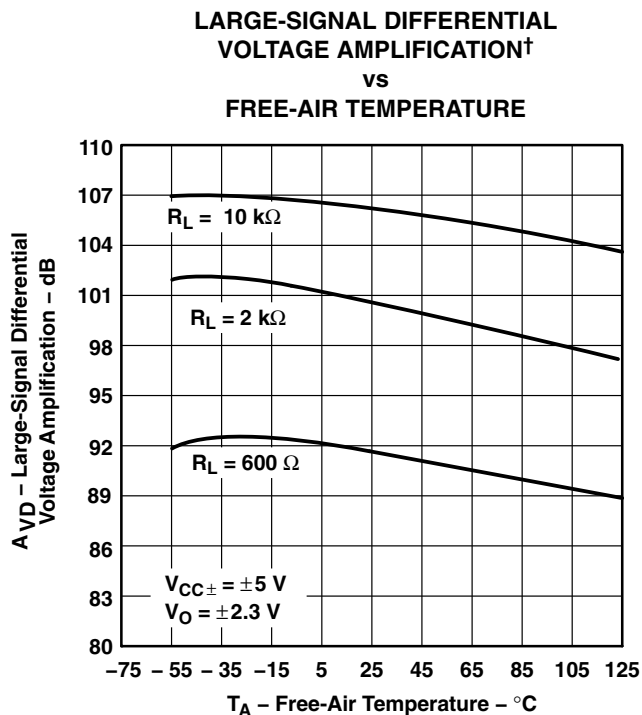


Figure 26

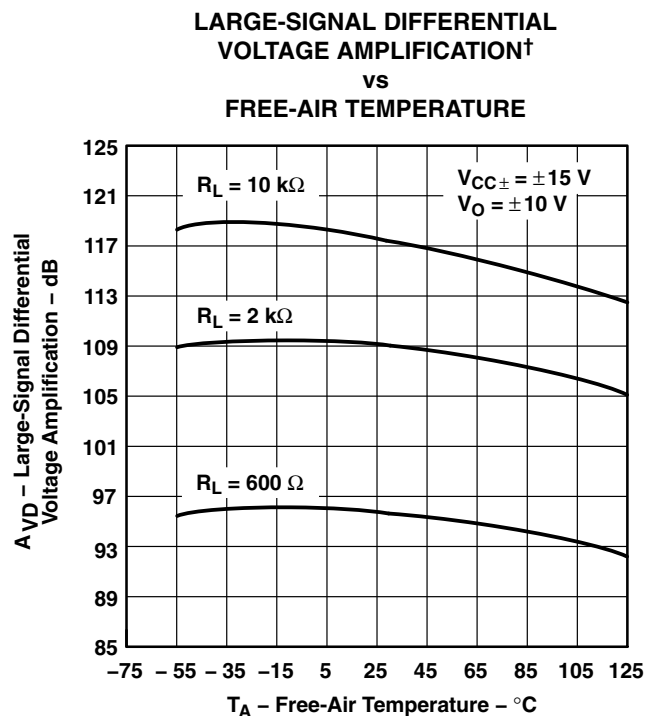


Figure 27

† 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

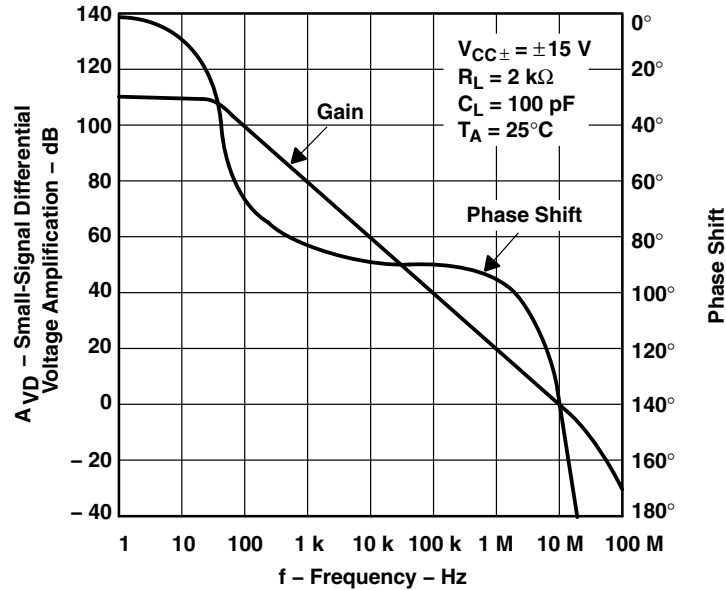


Figure 28

SMALL-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT

vs

FREQUENCY

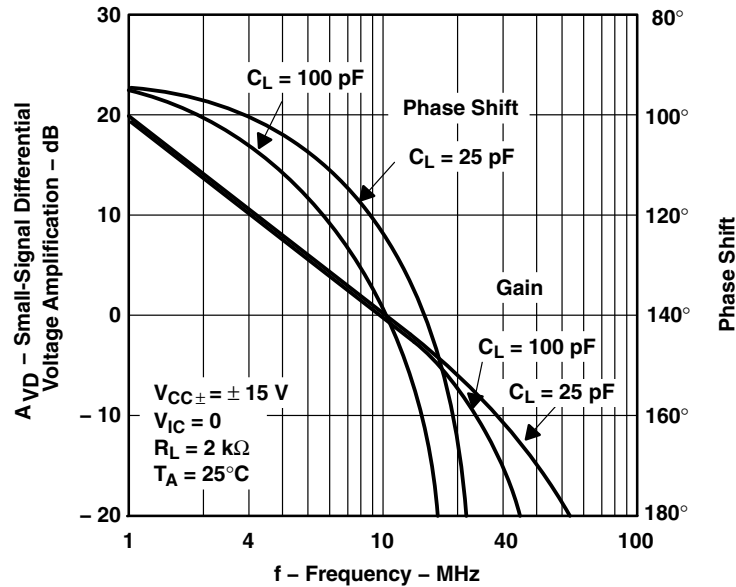


Figure 29

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

SLOS181C – FEBRUARY 1997 – REVISED DECEMBER 2009

TYPICAL CHARACTERISTICS

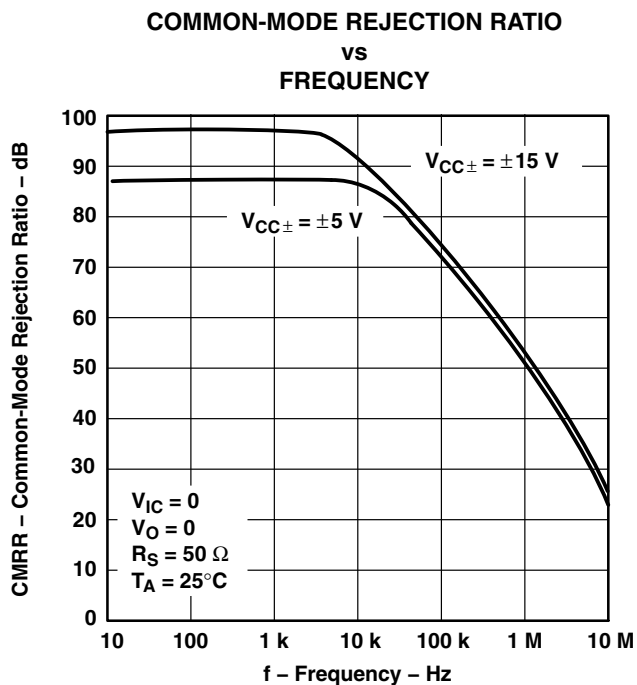


Figure 30

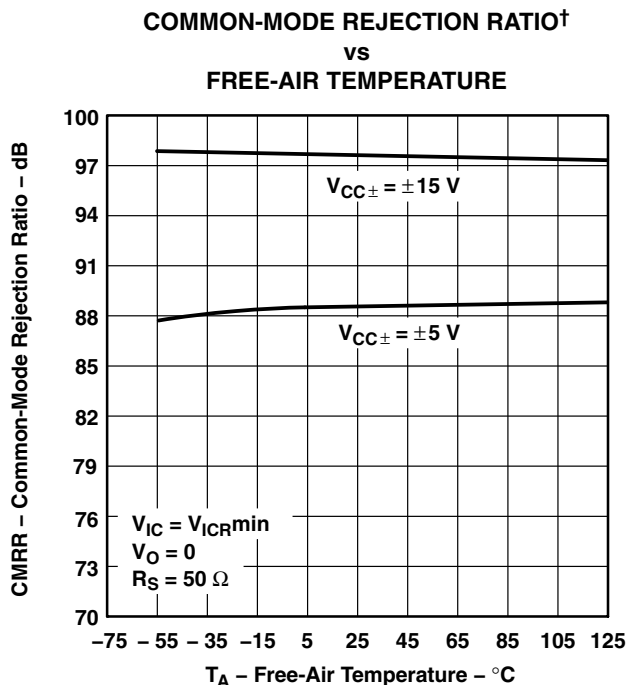


Figure 31

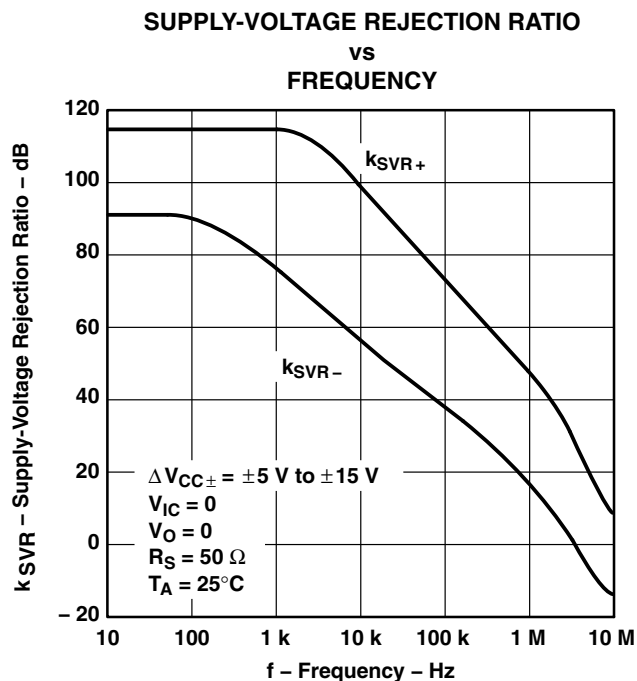


Figure 32

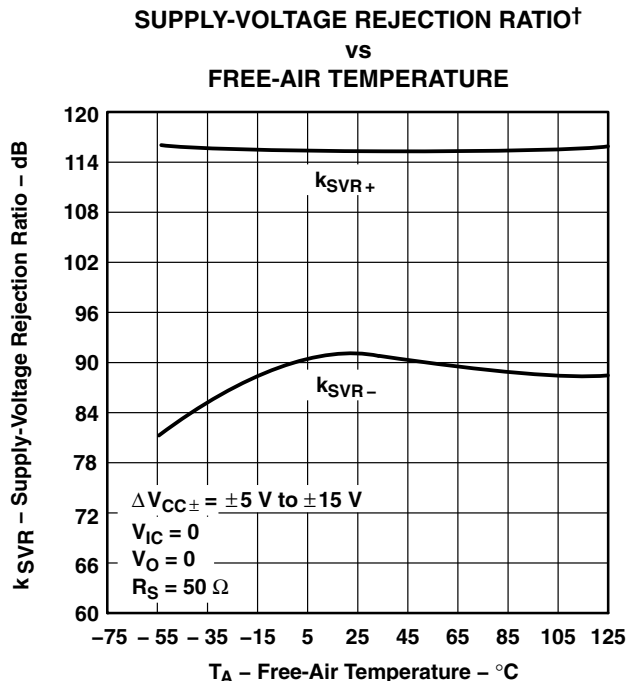
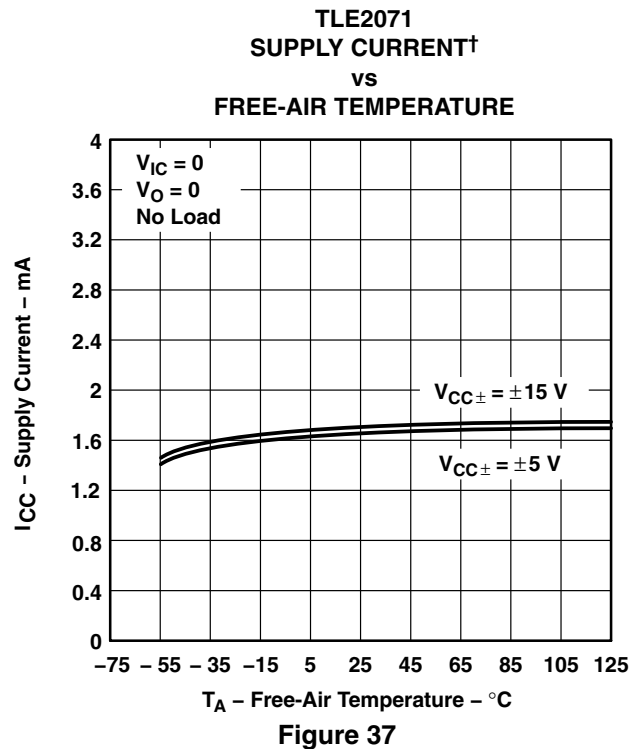
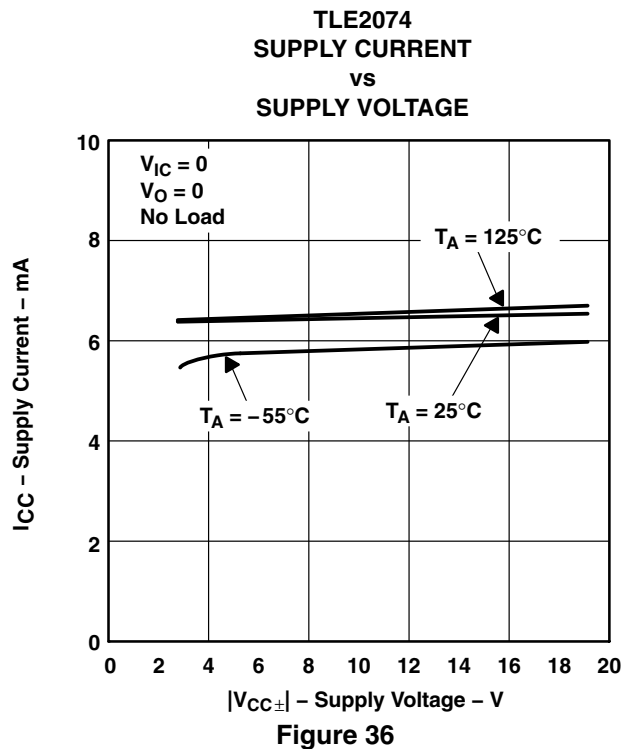
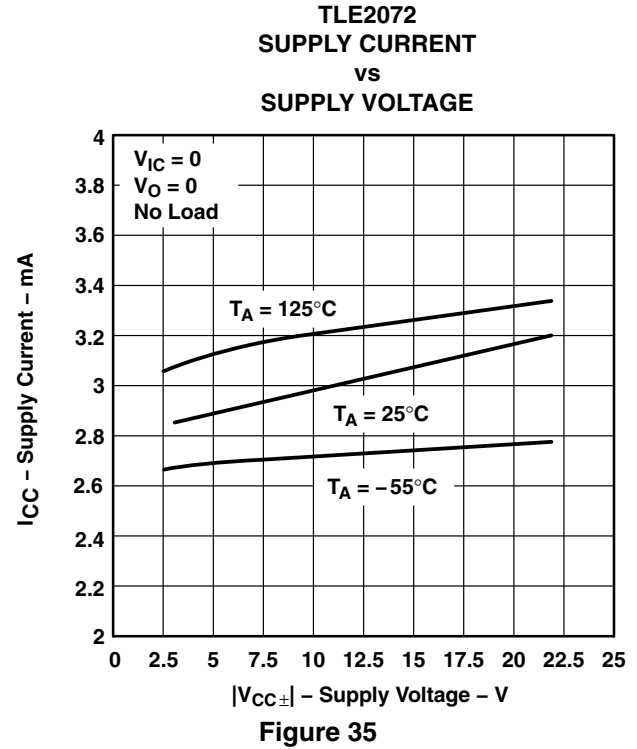
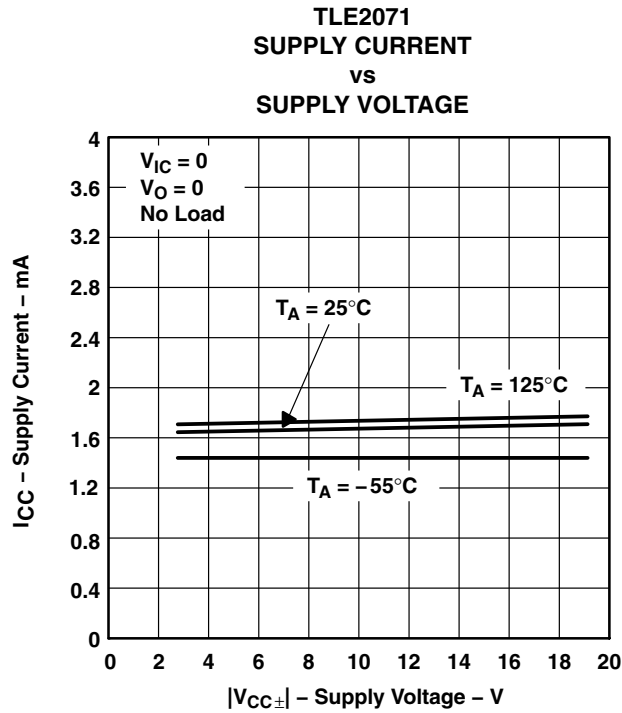


Figure 33

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

TYPICAL CHARACTERISTICS



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

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

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TYPICAL CHARACTERISTICS

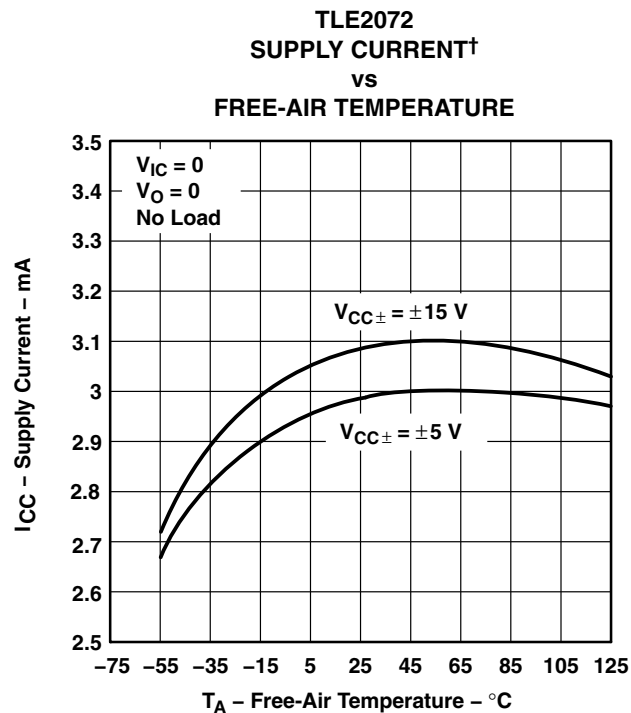


Figure 38

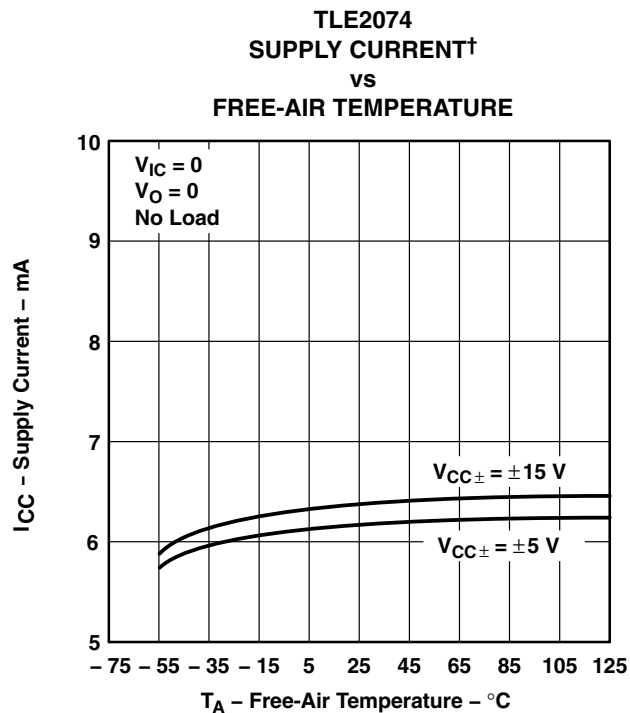


Figure 39

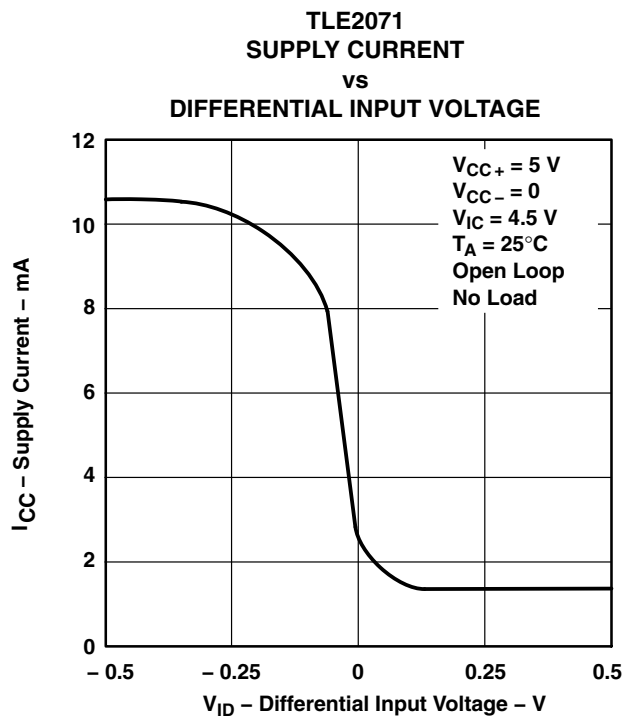


Figure 40

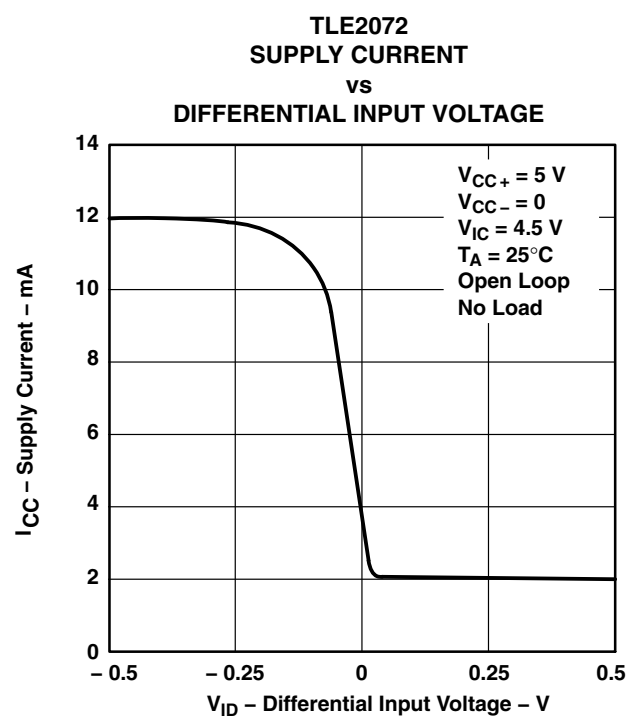
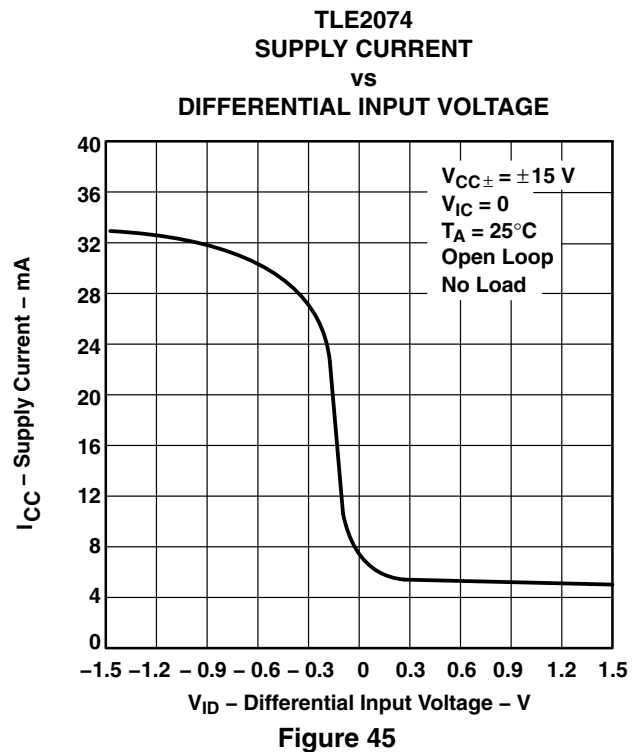
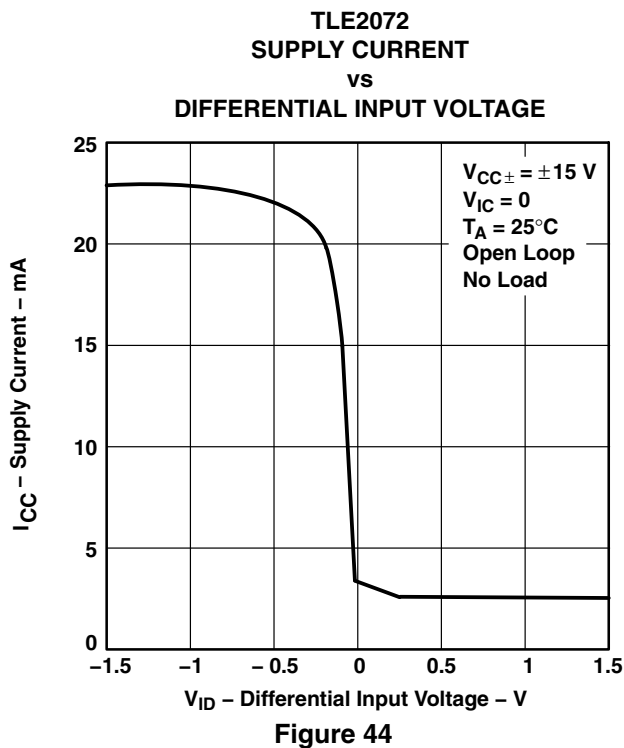
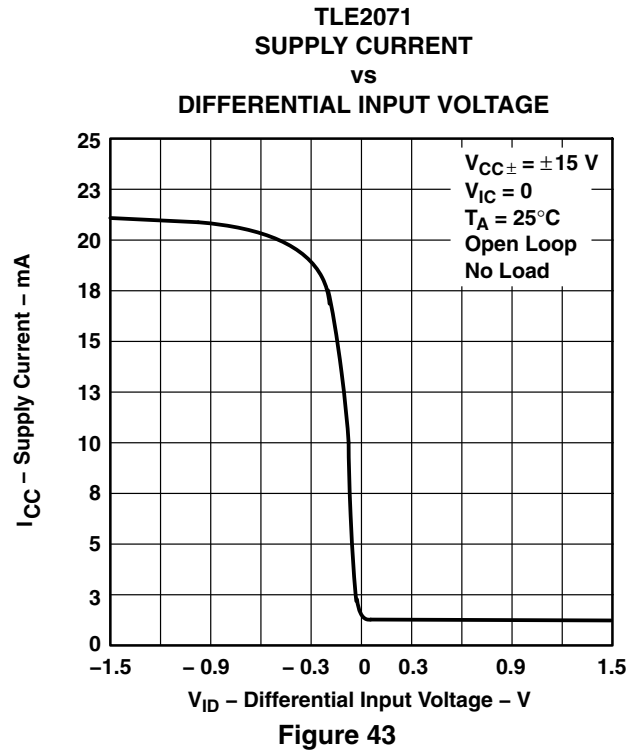
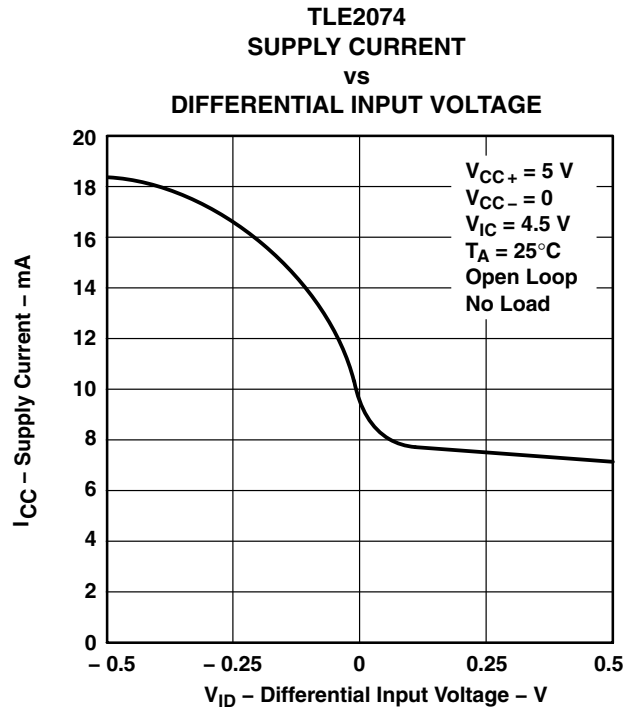


Figure 41

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

TYPICAL CHARACTERISTICS



TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

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TYPICAL CHARACTERISTICS

SHORT-CIRCUIT OUTPUT CURRENT
vs
SUPPLY VOLTAGE

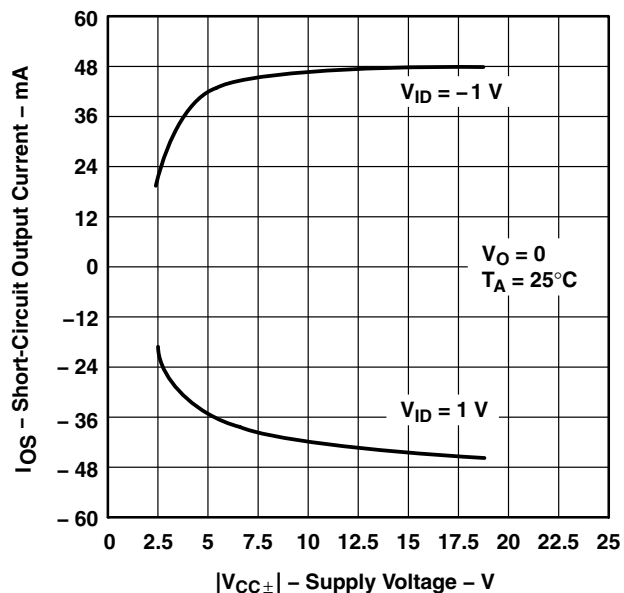


Figure 46

SHORT-CIRCUIT OUTPUT CURRENT
vs
ELAPSED TIME

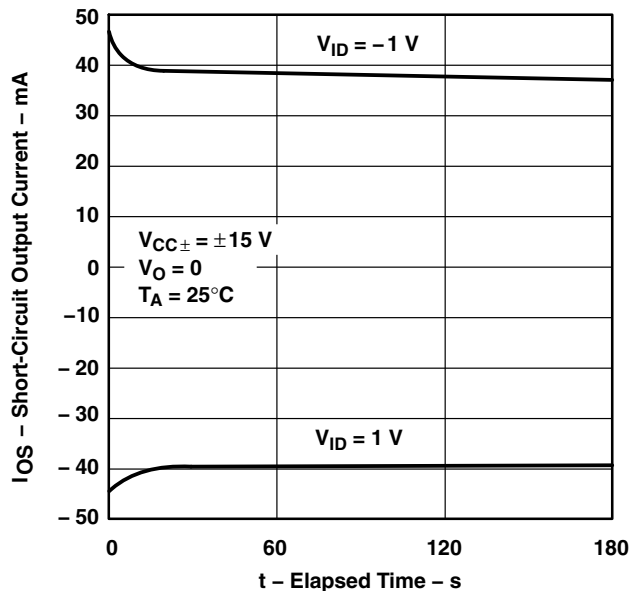


Figure 47

SHORT-CIRCUIT OUTPUT CURRENT†
vs
FREE-AIR TEMPERATURE

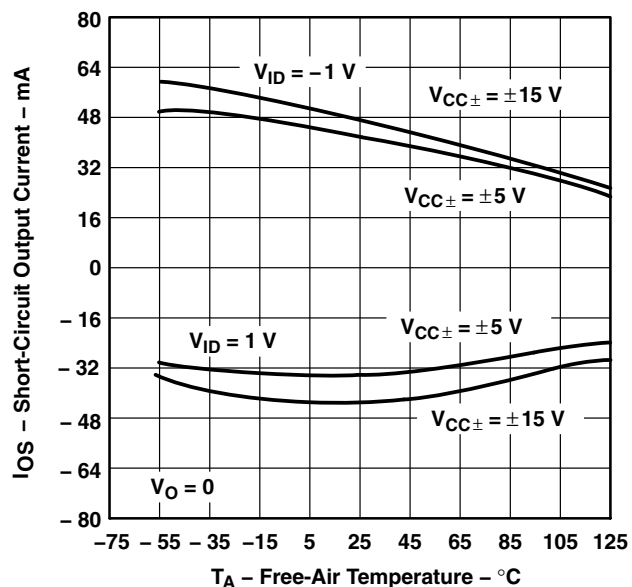


Figure 48

SLEW RATE†
vs
FREE-AIR TEMPERATURE

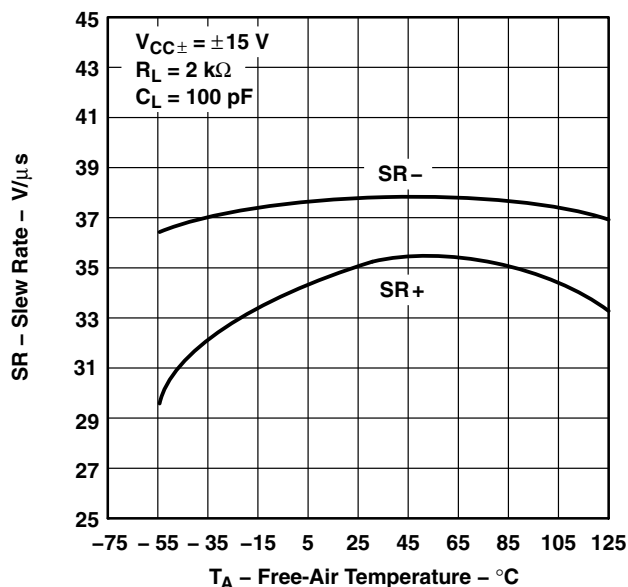


Figure 49

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

TYPICAL CHARACTERISTICS

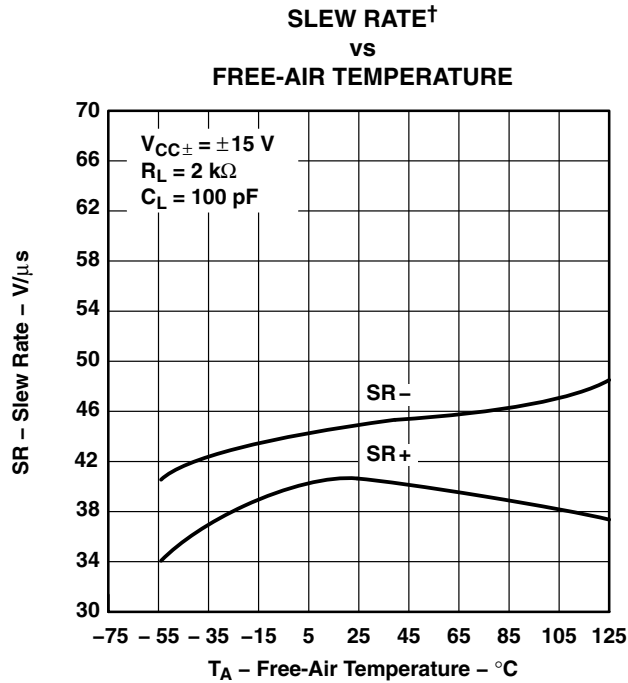


Figure 50

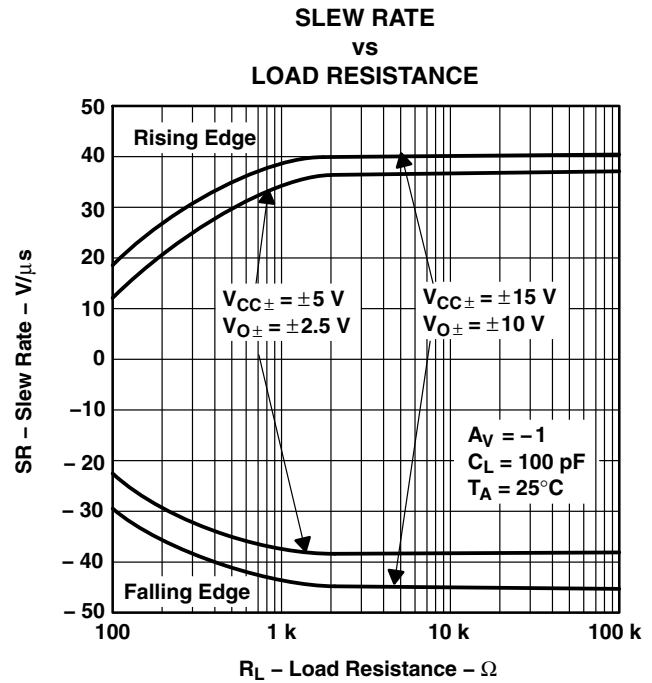


Figure 51

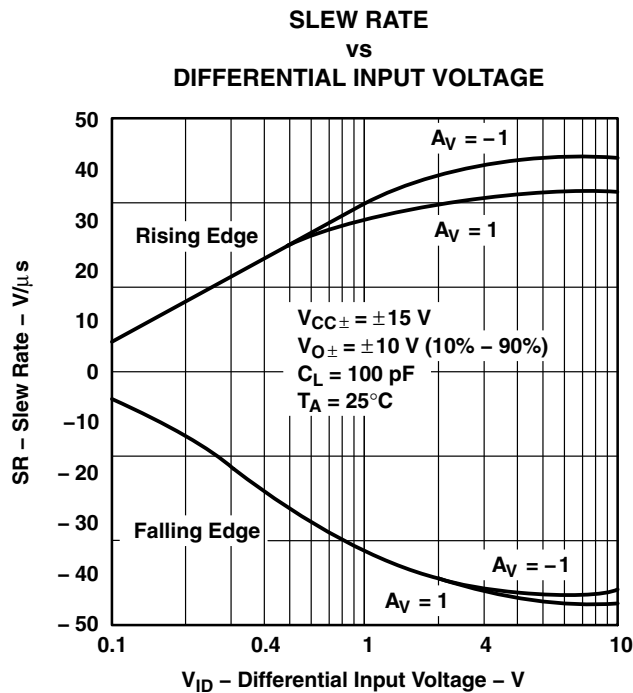


Figure 52

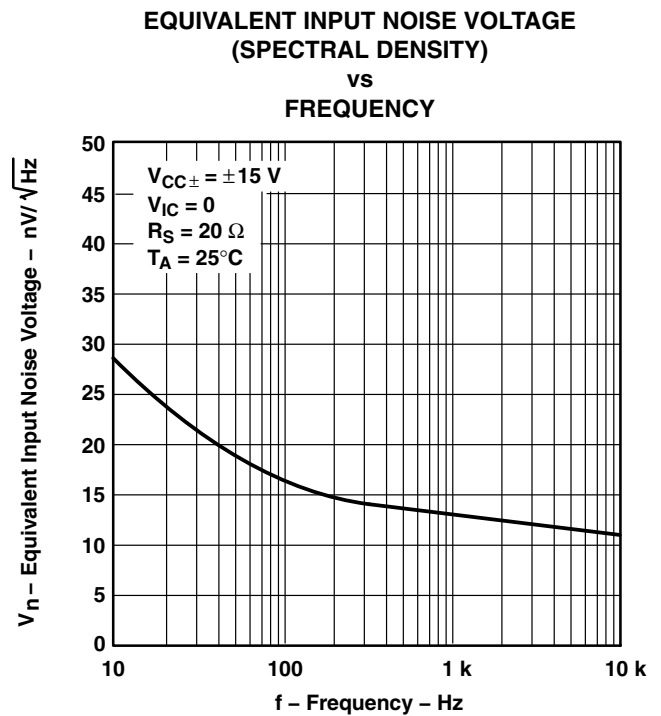


Figure 53

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

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

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TYPICAL CHARACTERISTICS

INPUT-REFERRED NOISE VOLTAGE
vs
NOISE BANDWIDTH

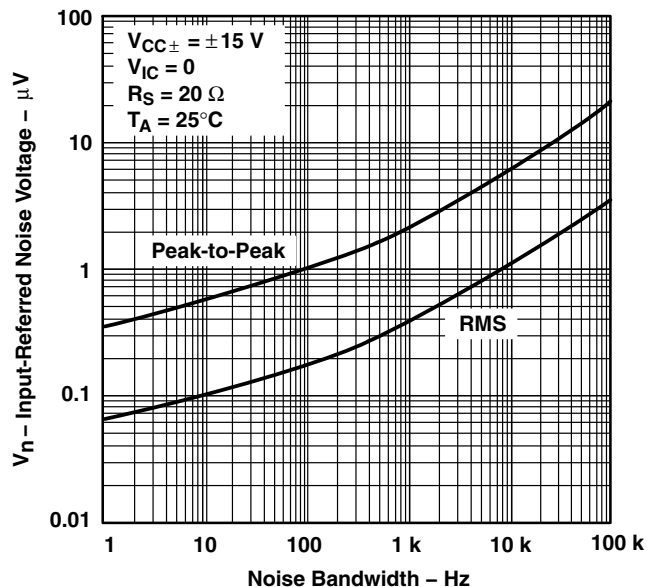


Figure 54

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

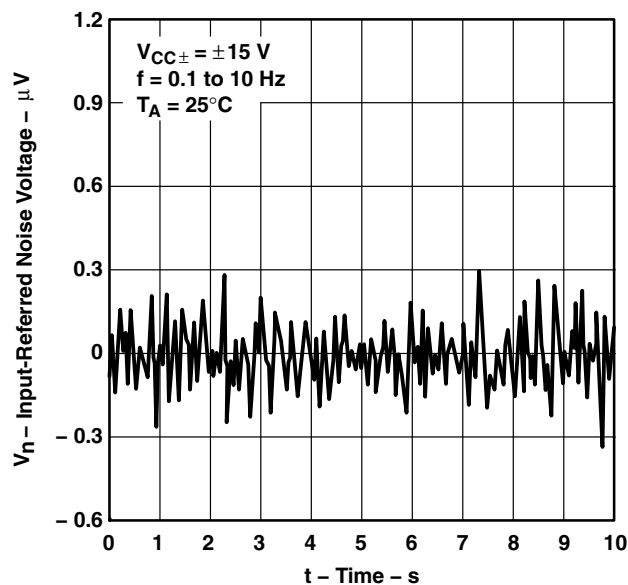


Figure 55

THIRD-OCTAVE SPECTRAL NOISE DENSITY
vs
FREQUENCY BANDS

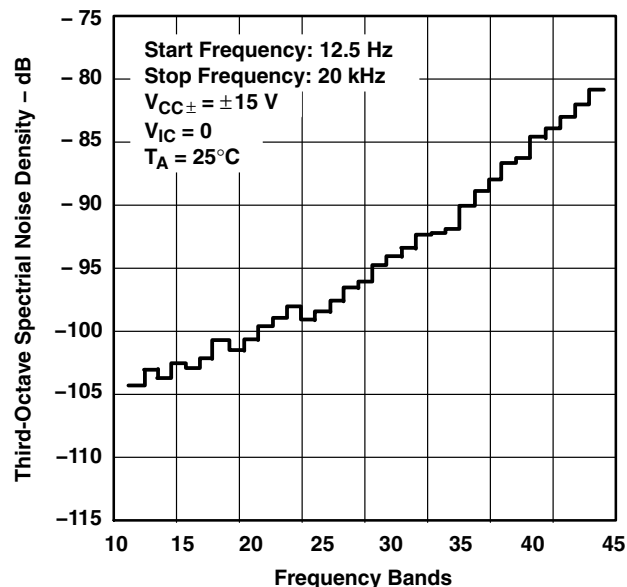


Figure 56

TOTAL HARMONIC DISTORTION PLUS NOISE
vs
FREQUENCY

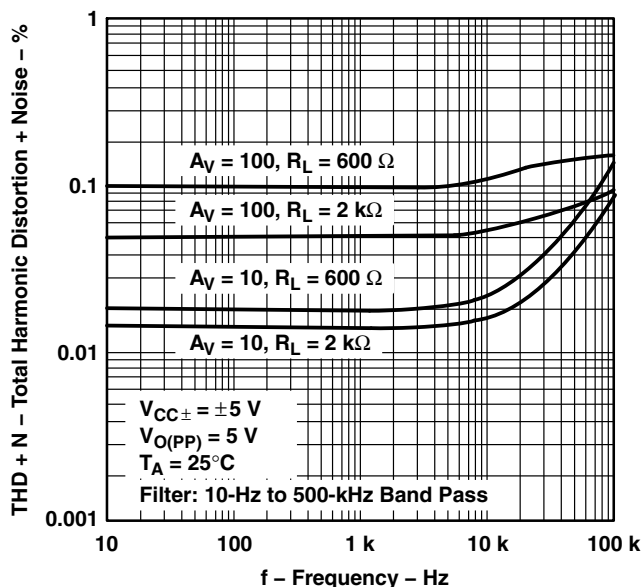


Figure 57

TYPICAL CHARACTERISTICS

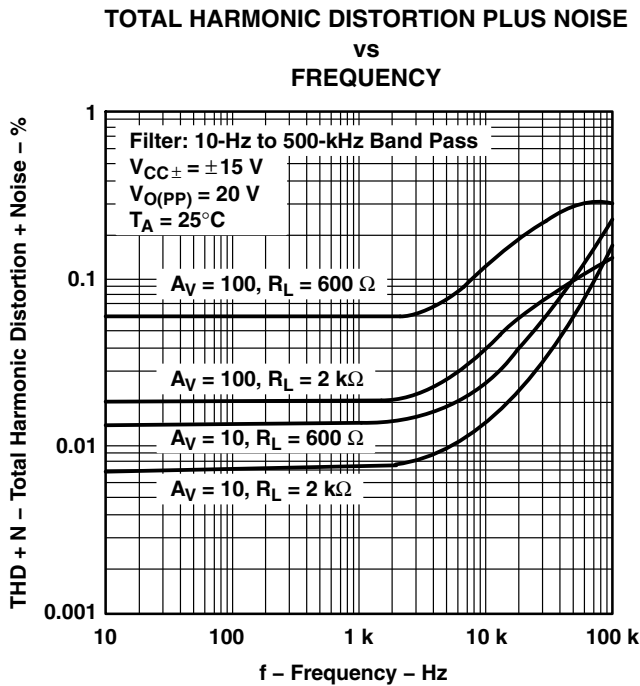


Figure 58

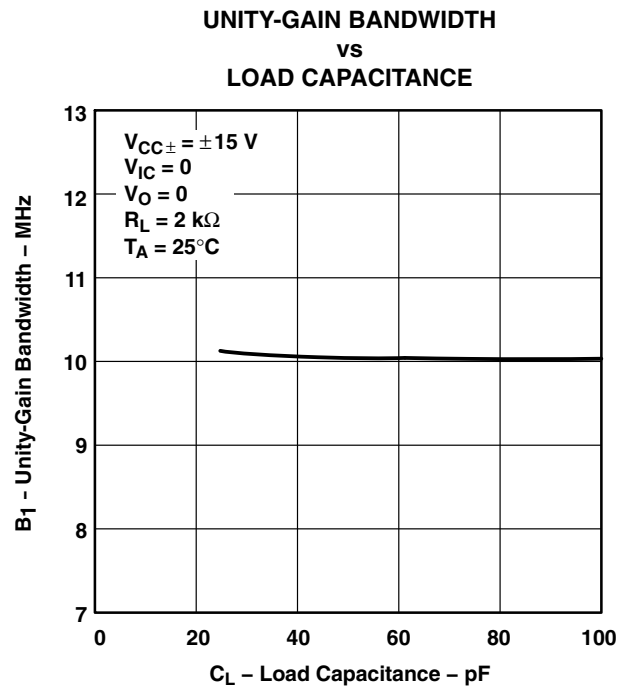


Figure 59

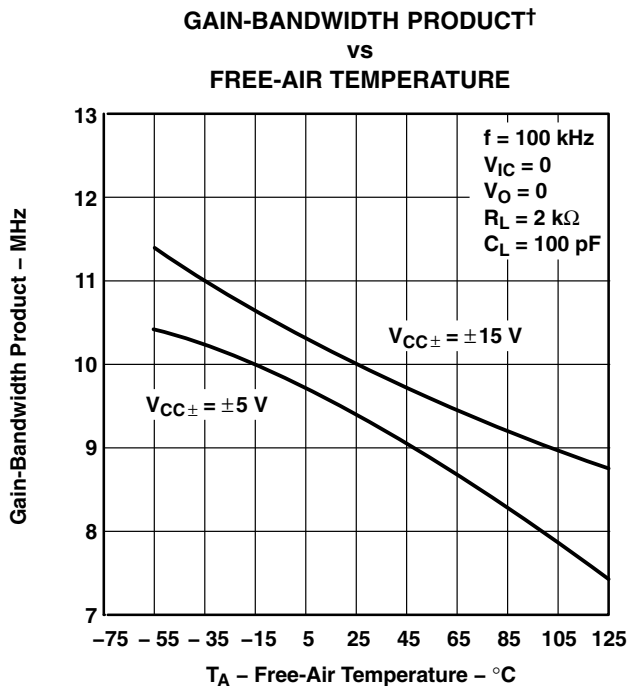


Figure 60

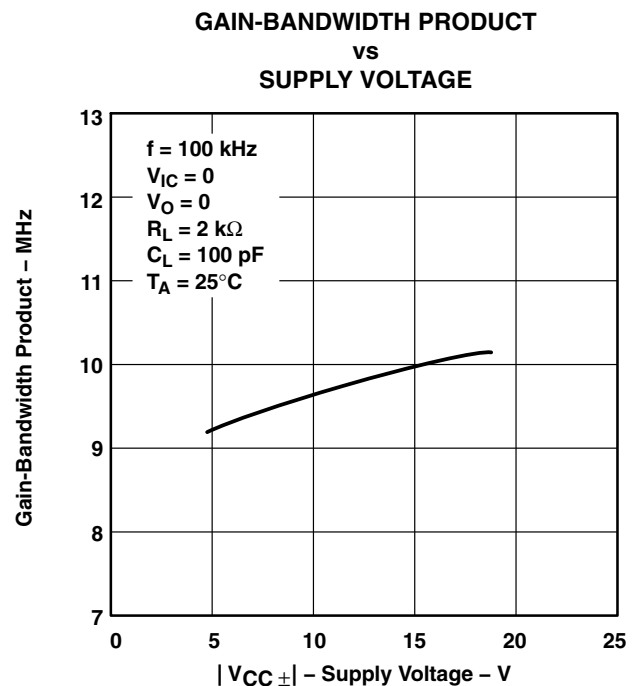


Figure 61

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

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

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TYPICAL CHARACTERISTICS

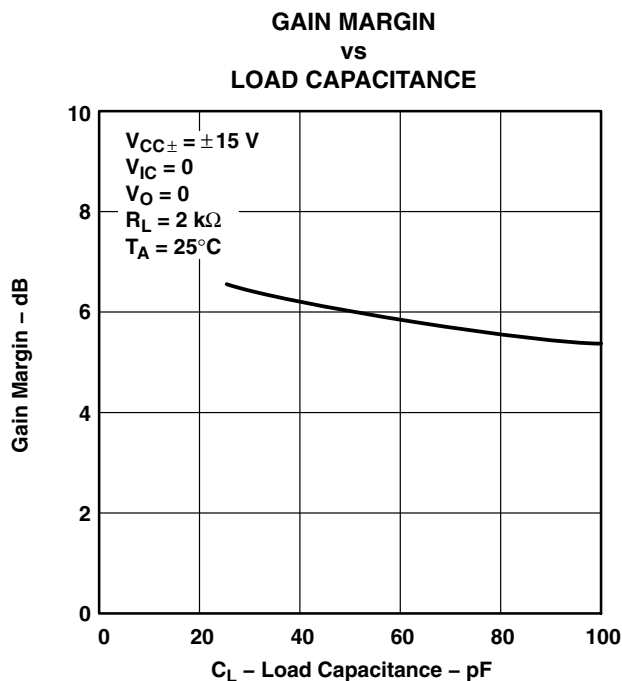


Figure 62

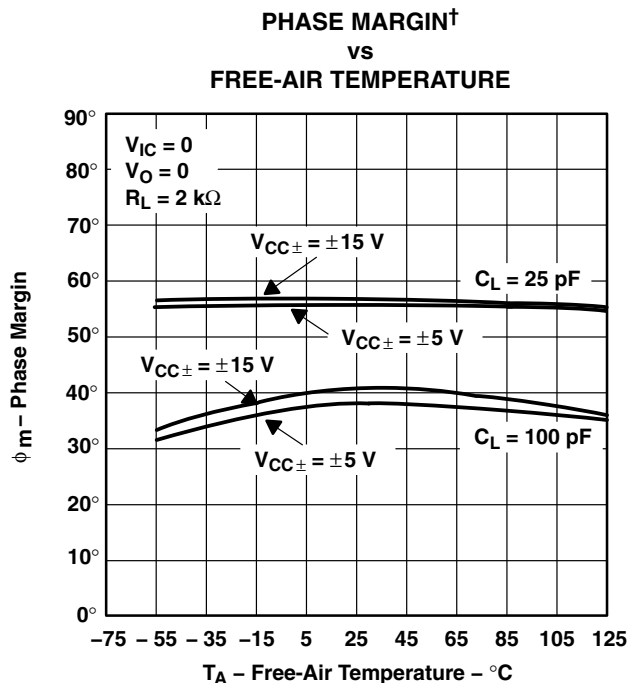


Figure 63

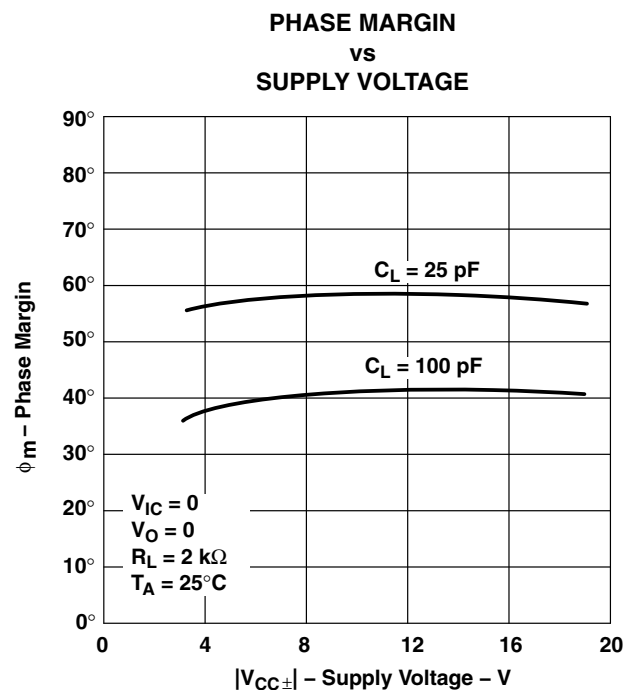


Figure 64

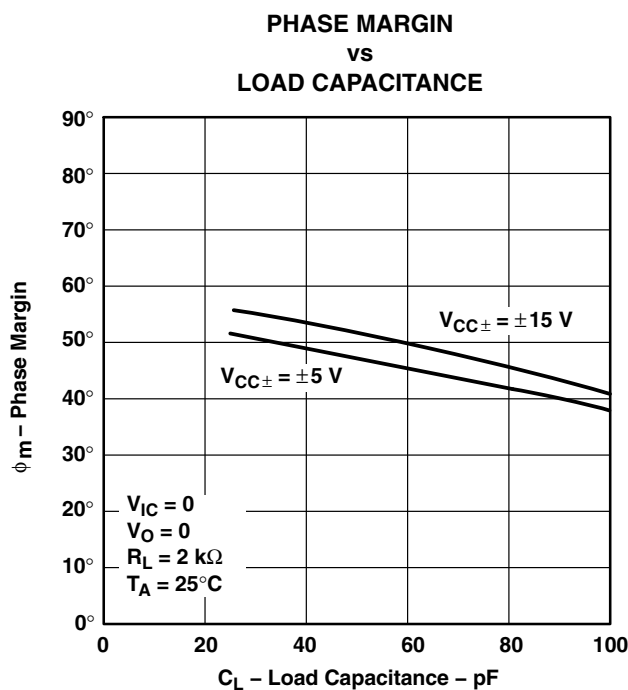


Figure 65

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

TYPICAL CHARACTERISTICS

**NONINVERTING LARGE-SIGNAL
PULSE RESPONSE†**

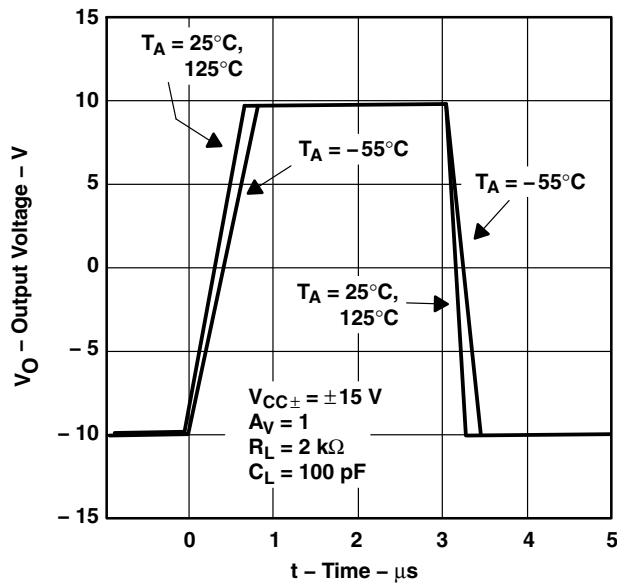


Figure 66

SMALL-SIGNAL PULSE RESPONSE

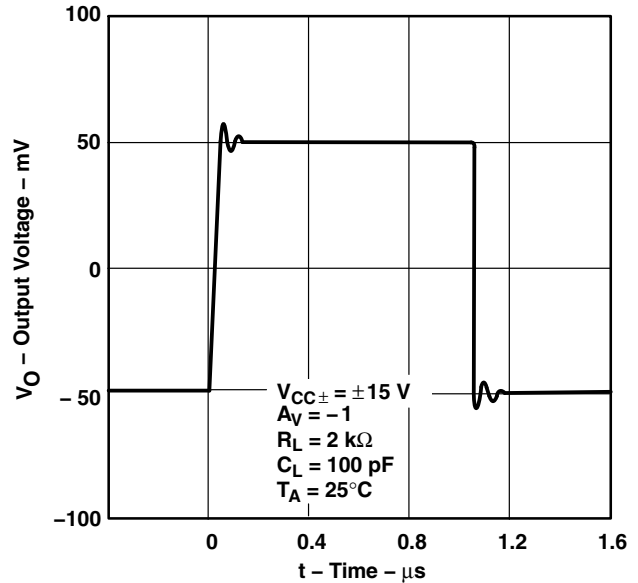


Figure 67

**CLOSED-LOOP OUTPUT IMPEDANCE
vs
FREQUENCY**

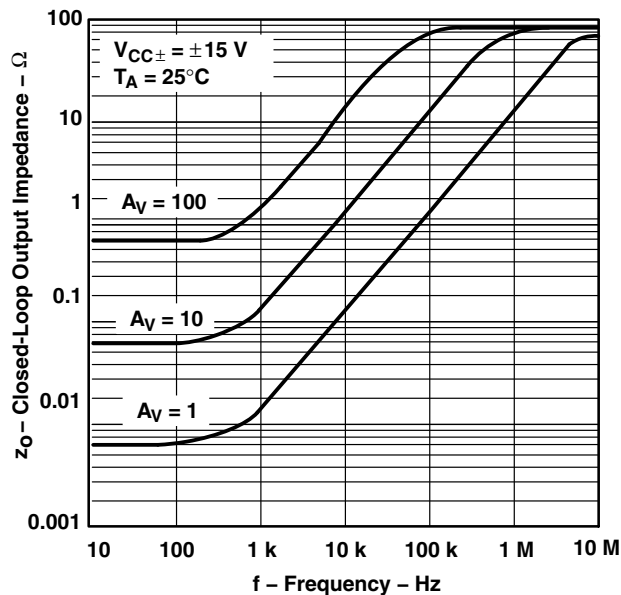


Figure 68

**TLE2072 AND TLE2074
CROSSTALK ATTENUATION
vs
FREQUENCY**

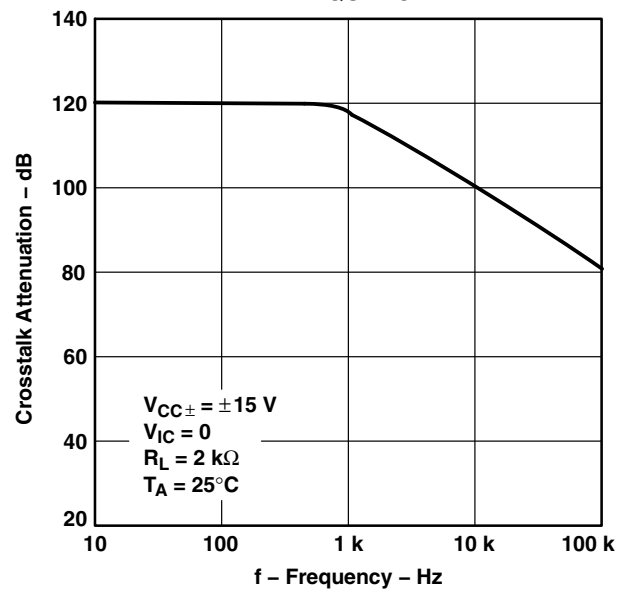


Figure 69

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

TLE207x, TLE207xA 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.

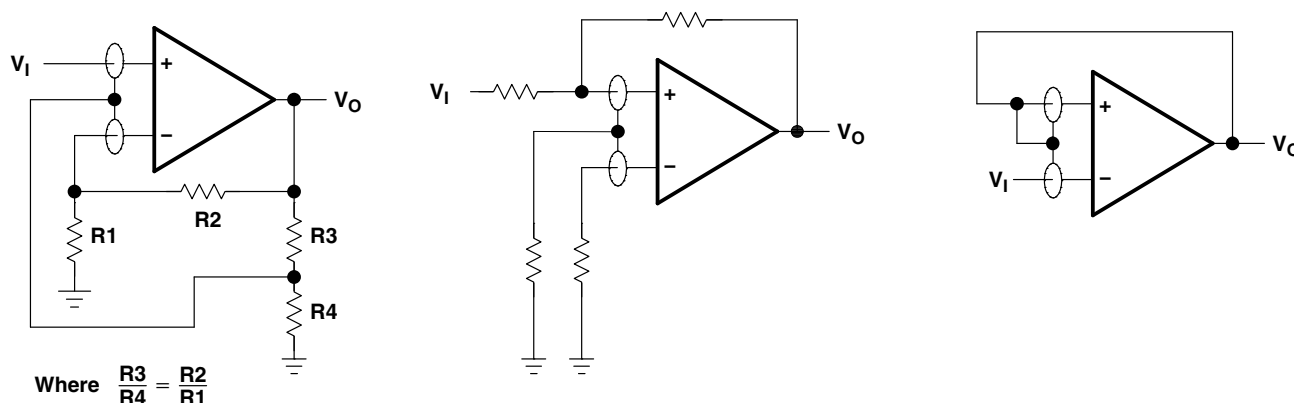


Figure 70. Use of Guard Rings

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.

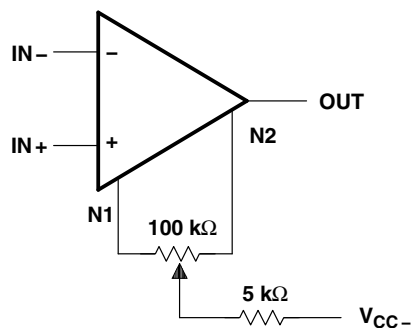


Figure 71. Input Offset Voltage Nulling

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).

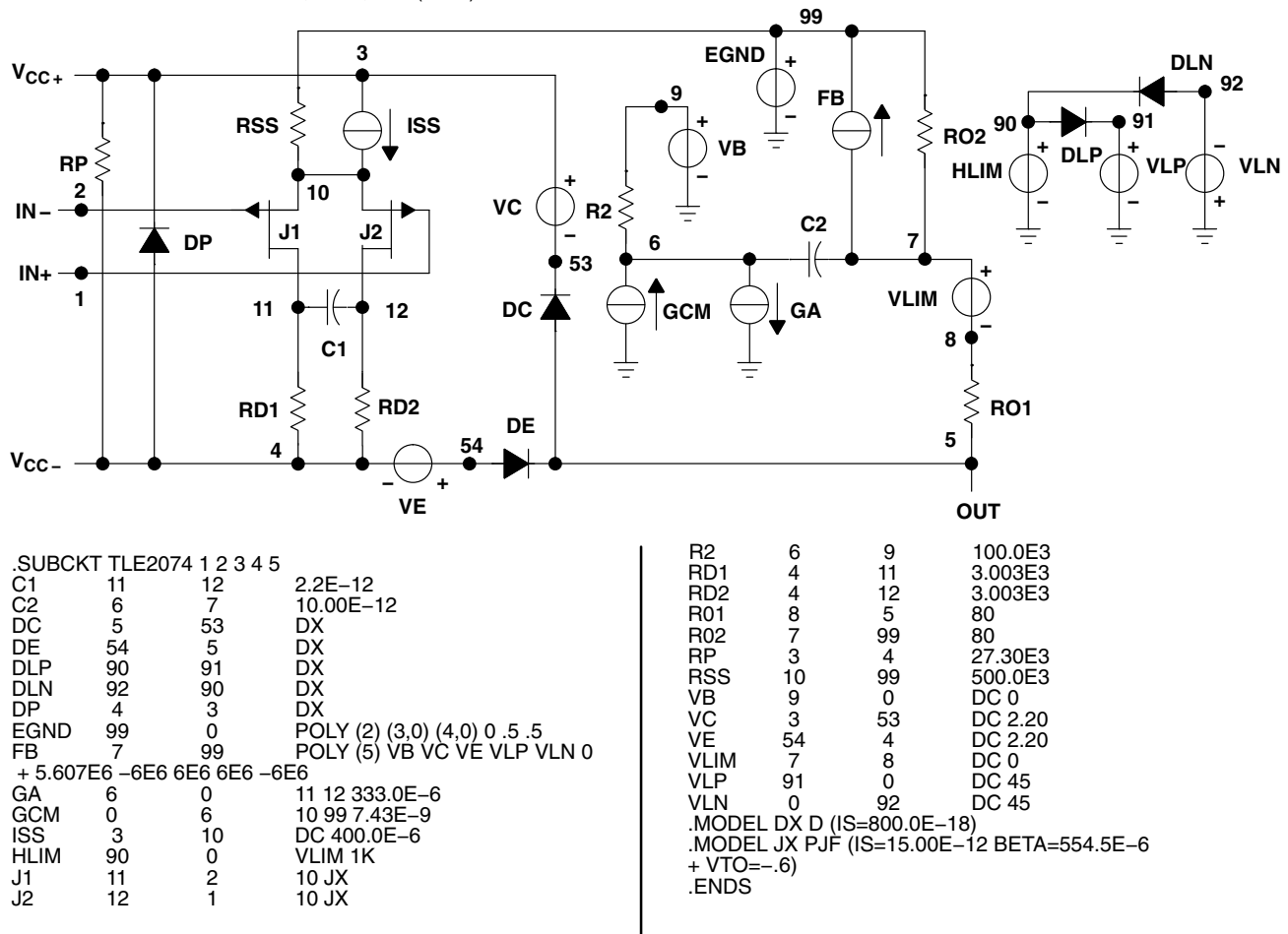


Figure 72. Boyle Macromodel and Subcircuit

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

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Revision History

Version	Date	Changes
C	Dec-2009	<ul style="list-style-type: none">– For TLE2071M/1AM (VCC $\pm 5V$) changed V_n NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 16– For TLE2071M/1AM (VCC $\pm 15V$) changed V_n NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 18– For TLE2072M/2AM (VCC $\pm 5V$) changed V_n NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 29– For TLE2072M/2AM (VCC $\pm 15V$) changed V_n NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 31– For TLE2074M/4AM (VCC $\pm 5V$) changed V_n NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 42– For TLE2074M/4AM (VCC $\pm 15V$) changed V_n NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 44

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9460201Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9460201Q2A TLE2071 MFKB	Samples
5962-9460201QPA	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460201QPA TLE2071M	Samples
5962-9460202Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9460202Q2A TLE2072 MFKB	Samples
5962-9460202QHA	ACTIVE	CFP	U	10	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460202QHA TLE2072M	Samples
5962-9460202QPA	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460202QPA TLE2072M	Samples
5962-9460203Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9460203Q2A TLE2074 MFKB	Samples
5962-9460203QCA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9460203QC A TLE2074MJB	Samples
5962-9460204Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962 9460204Q2A TLE2071 AMFKB	Samples
5962-9460204QHA	ACTIVE	CFP	U	10	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460204QHA TLE2071AM	Samples
5962-9460204QPA	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460204QPA TLE2071AM	Samples
5962-9460205Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9460205Q2A TLE2072 AMFKB	Samples
5962-9460205QHA	ACTIVE	CFP	U	10	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460205QHA TLE2072AM	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9460205QPA	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460205QPA TLE2072AM	Samples
5962-9460206Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9460206Q2A TLE2074 AMFKB	Samples
5962-9460206QCA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9460206QC A TLE2074AMJB	Samples
5962-9460206QDA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9460206QD A TLE2074AMWB	Samples
TLE2071ACD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071AC	Samples
TLE2071ACDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071AC	Samples
TLE2071ACDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071AC	Samples
TLE2071ACP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2071AC	Samples
TLE2071ACPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2071AC	Samples
TLE2071AID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071AI	Samples
TLE2071AIDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071AI	Samples
TLE2071AIDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071AI	Samples
TLE2071AIDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071AI	Samples
TLE2071AIP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2071AI	Samples
TLE2071AMFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962 9460204Q2A TLE2071 AMFKB	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TLE2071AMJG	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	TLE2071 AMJG	Samples
TLE2071AMJGB	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460204QPA TLE2071AM	Samples
TLE2071AMUB	ACTIVE	CFP	U	10	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460204QHA TLE2071AM	Samples
TLE2071CD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071C	Samples
TLE2071CDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071C	Samples
TLE2071CDR	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI			
TLE2071CP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2071CP	Samples
TLE2071CPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2071CP	Samples
TLE2071ID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071I	Samples
TLE2071IDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071I	Samples
TLE2071IDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071I	Samples
TLE2071IDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2071I	Samples
TLE2071IP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2071IP	Samples
TLE2071MFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9460201Q2A TLE2071 MFKB	Samples
TLE2071MJG	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	TLE2071MJG	Samples
TLE2071MJGB	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460201QPA TLE2071M	Samples
TLE2072ACD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2072AC	Samples
TLE2072ACDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2072AC	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TLE2072ACP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2072AC	Samples
TLE2072ACPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2072AC	Samples
TLE2072AID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2072AI	Samples
TLE2072AIDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2072AI	Samples
TLE2072AIDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2072AI	Samples
TLE2072AIDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2072AI	Samples
TLE2072AIP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2072AI	Samples
TLE2072AIPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2072AI	Samples
TLE2072AMFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9460205Q2A TLE2072 AMFKB	Samples
TLE2072AMJG	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	TLE2072 AMJG	Samples
TLE2072AMJGB	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460205QPA TLE2072AM	Samples
TLE2072AMUB	ACTIVE	CFP	U	10	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460205QHA TLE2072AM	Samples
TLE2072CD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2072C	Samples
TLE2072CDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2072C	Samples
TLE2072CDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2072C	Samples
TLE2072CDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2072C	Samples
TLE2072CP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2072CP	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TLE2072ID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2072I	Samples
TLE2072IDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2072I	Samples
TLE2072IDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	2072I	Samples
TLE2072IDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	2072I	Samples
TLE2072IP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2072IP	Samples
TLE2072IPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2072IP	Samples
TLE2072MFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9460202Q2A TLE2072 MFKB	Samples
TLE2072MJG	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	TLE2072MJG	Samples
TLE2072MJGB	ACTIVE	CDIP	JG	8	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460202QPA TLE2072M	Samples
TLE2072MUB	ACTIVE	CFP	U	10	1	TBD	A42	N / A for Pkg Type	-55 to 125	9460202QHA TLE2072M	Samples
TLE2074ACDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TLE2074AC	Samples
TLE2074ACDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TLE2074AC	Samples
TLE2074ACDWR	OBSOLETE	SOIC	DW	16		TBD	Call TI	Call TI			
TLE2074ACN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2074ACN	Samples
TLE2074ACNE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2074ACN	Samples
TLE2074AIDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TLE2074AI	Samples
TLE2074AIDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TLE2074AI	Samples
TLE2074AIDWR	OBSOLETE	SOIC	DW	16		TBD	Call TI	Call TI			

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TLE2074AIN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2074AIN	Samples
TLE2074AINE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2074AIN	Samples
TLE2074AMFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9460206Q2A TLE2074 AMFKB	Samples
TLE2074AMJ	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	TLE2074AMJ	Samples
TLE2074AMJB	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9460206QC A TLE2074AMJB	Samples
TLE2074AMWB	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9460206QD A TLE2074AMWB	Samples
TLE2074CDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TLE2074C	Samples
TLE2074CDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TLE2074C	Samples
TLE2074CDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TLE2074C	Samples
TLE2074CDWRG4	ACTIVE	SOIC	DW	16		TBD	Call TI	Call TI			Samples
TLE2074CN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2074CN	Samples
TLE2074CNE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2074CN	Samples
TLE2074IDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TLE2074I	Samples
TLE2074IDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TLE2074I	Samples
TLE2074IDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		TLE2074I	Samples
TLE2074IN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2074IN	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TLE2074INE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2074IN	Samples
TLE2074MFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962-9460203Q2A TLE2074 MFKB	Samples
TLE2074MJ	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	TLE2074MJ	Samples
TLE2074MJB	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9460203QC A TLE2074MJB	Samples

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

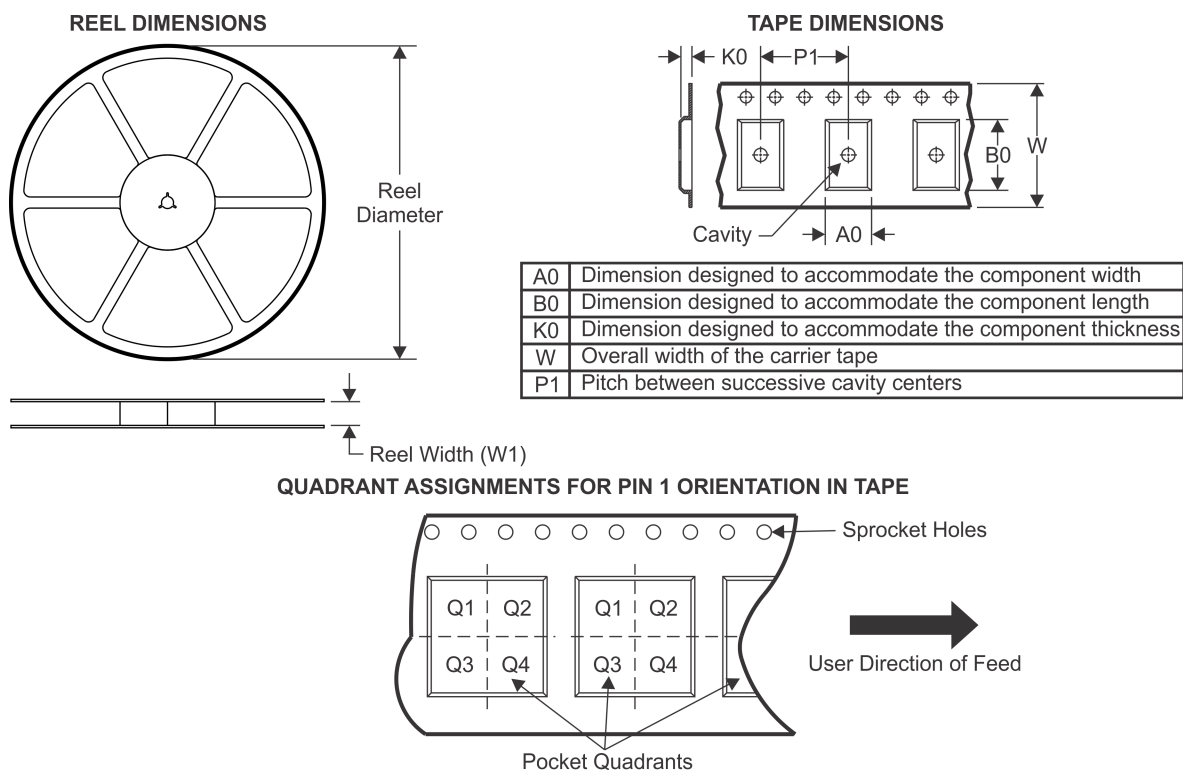
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF TLE2071, TLE2071A, TLE2071AM, TLE2071M, TLE2072, TLE2072A, TLE2072AM, TLE2072M, TLE2074, TLE2074A, TLE2074AM, TLE2074M :

- Catalog: [TLE2071A](#), [TLE2071](#), [TLE2072A](#), [TLE2072](#), [TLE2074A](#), [TLE2074](#)
- Automotive: [TLE2071-Q1](#), [TLE2071A-Q1](#), [TLE2071A-Q1](#), [TLE2071-Q1](#), [TLE2072A-Q1](#), [TLE2072A-Q1](#)
- Military: [TLE2071M](#), [TLE2071AM](#), [TLE2072M](#), [TLE2072AM](#), [TLE2074M](#), [TLE2074AM](#)

NOTE: Qualified Version Definitions:

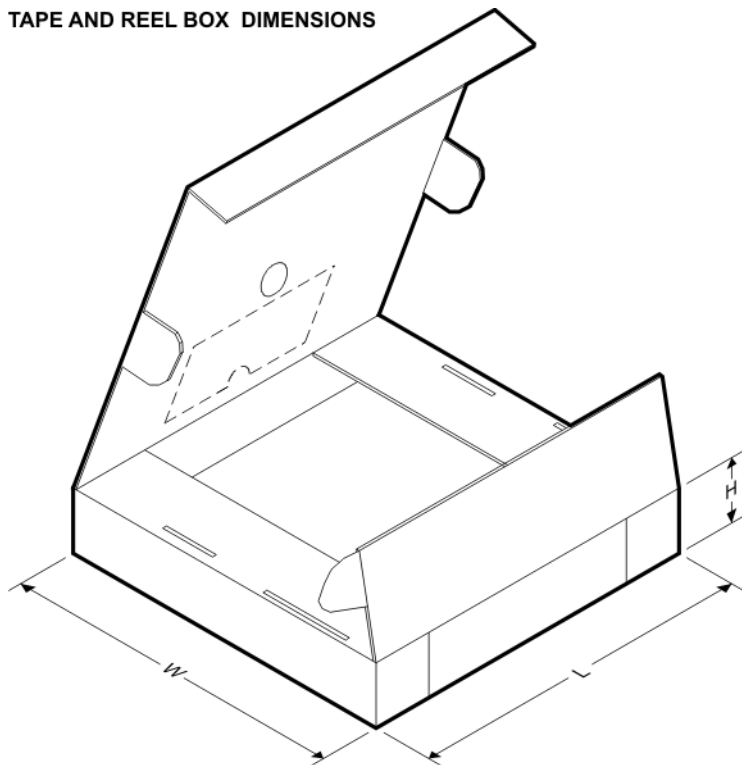
- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TLE2071ACDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2071AIDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2071IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2072AIDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2072CDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2072IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2072IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2072IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2074CDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
TLE2074IDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS

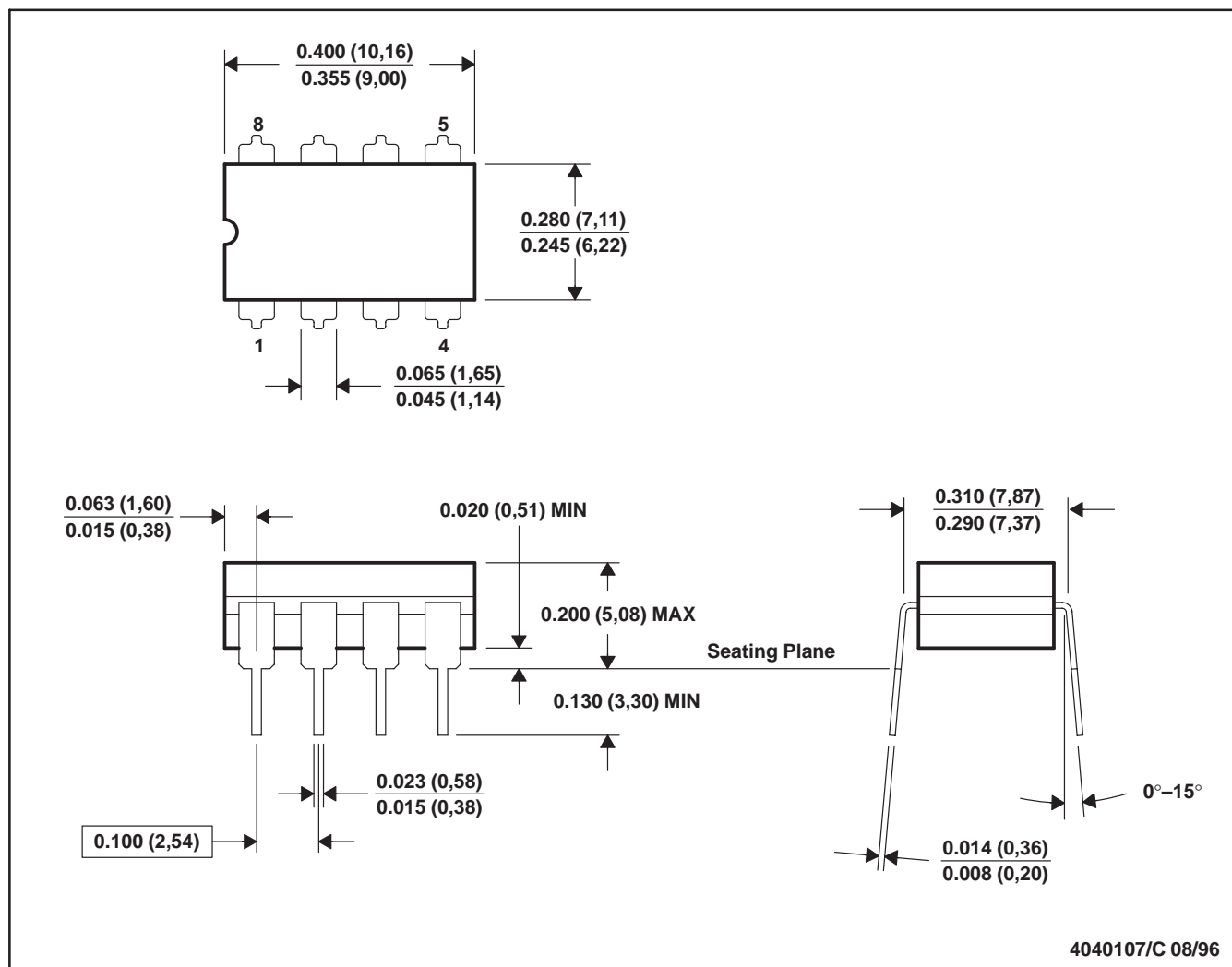


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLE2071ACDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2071AIDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2071IDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2072AIDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2072CDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2072IDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2072IDR	SOIC	D	8	2500	367.0	367.0	38.0
TLE2072IDR	SOIC	D	8	2500	367.0	367.0	35.0
TLE2074CDWR	SOIC	DW	16	2000	367.0	367.0	38.0
TLE2074IDWR	SOIC	DW	16	2000	367.0	367.0	38.0

JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE

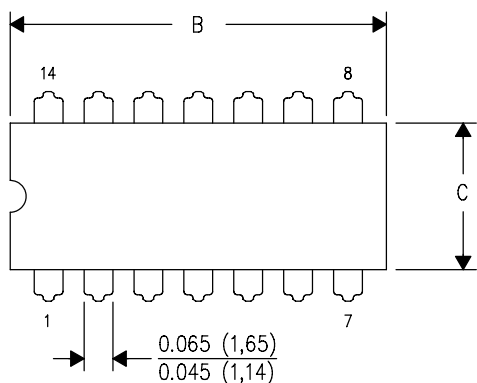


- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification.
 - Falls within MIL STD 1835 GDIP1-T8

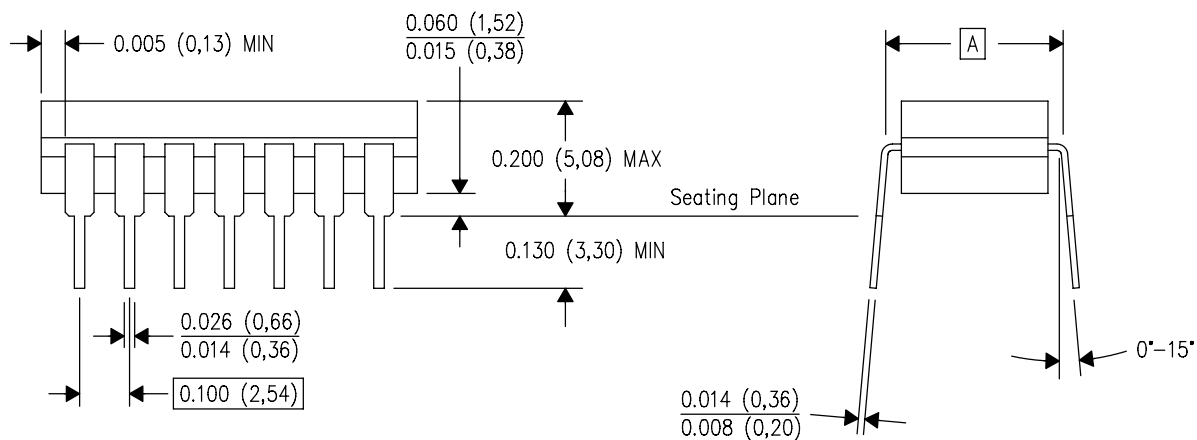
J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



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

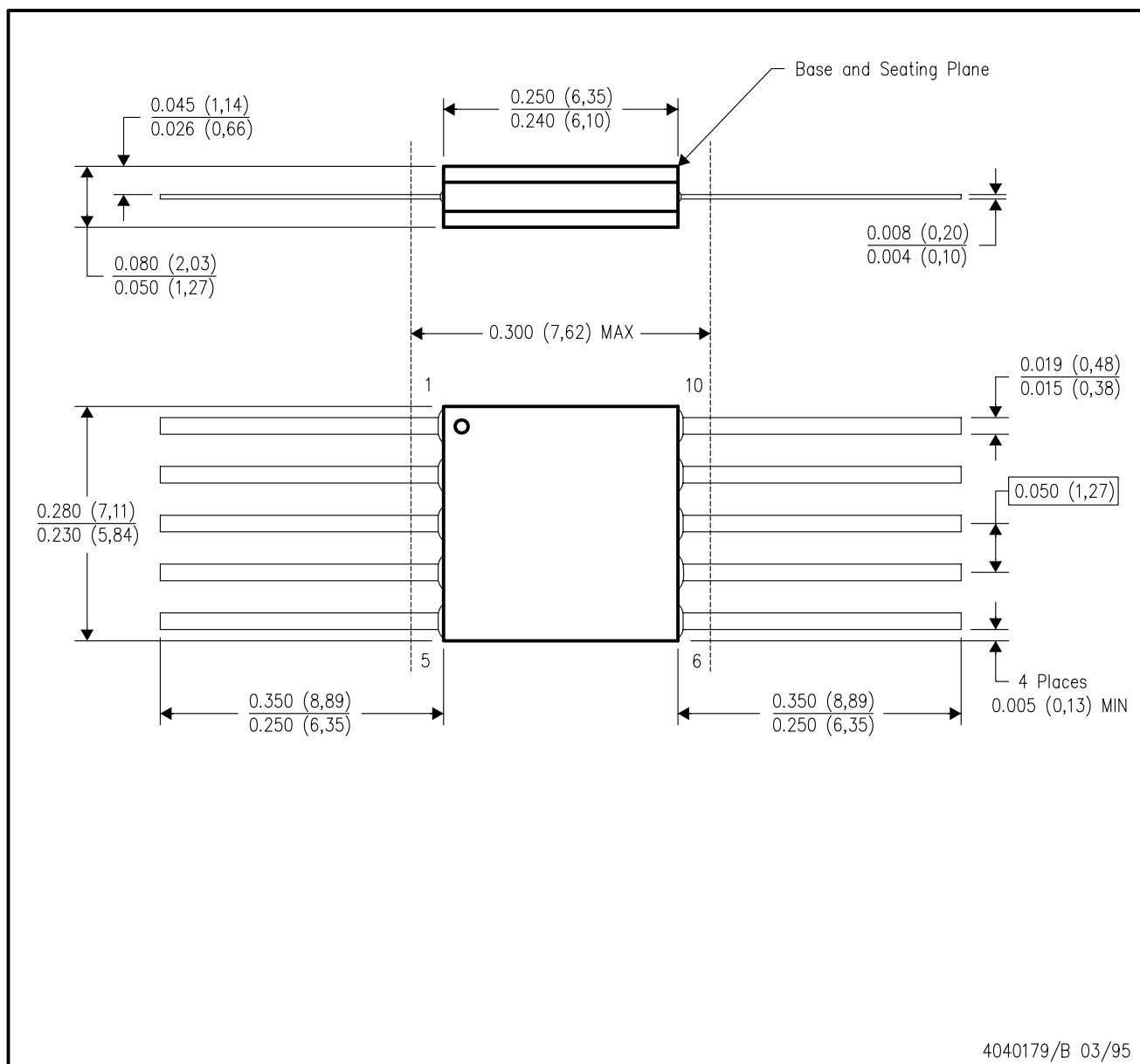


4040083/F 03/03

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

U (S-GDFP-F10)

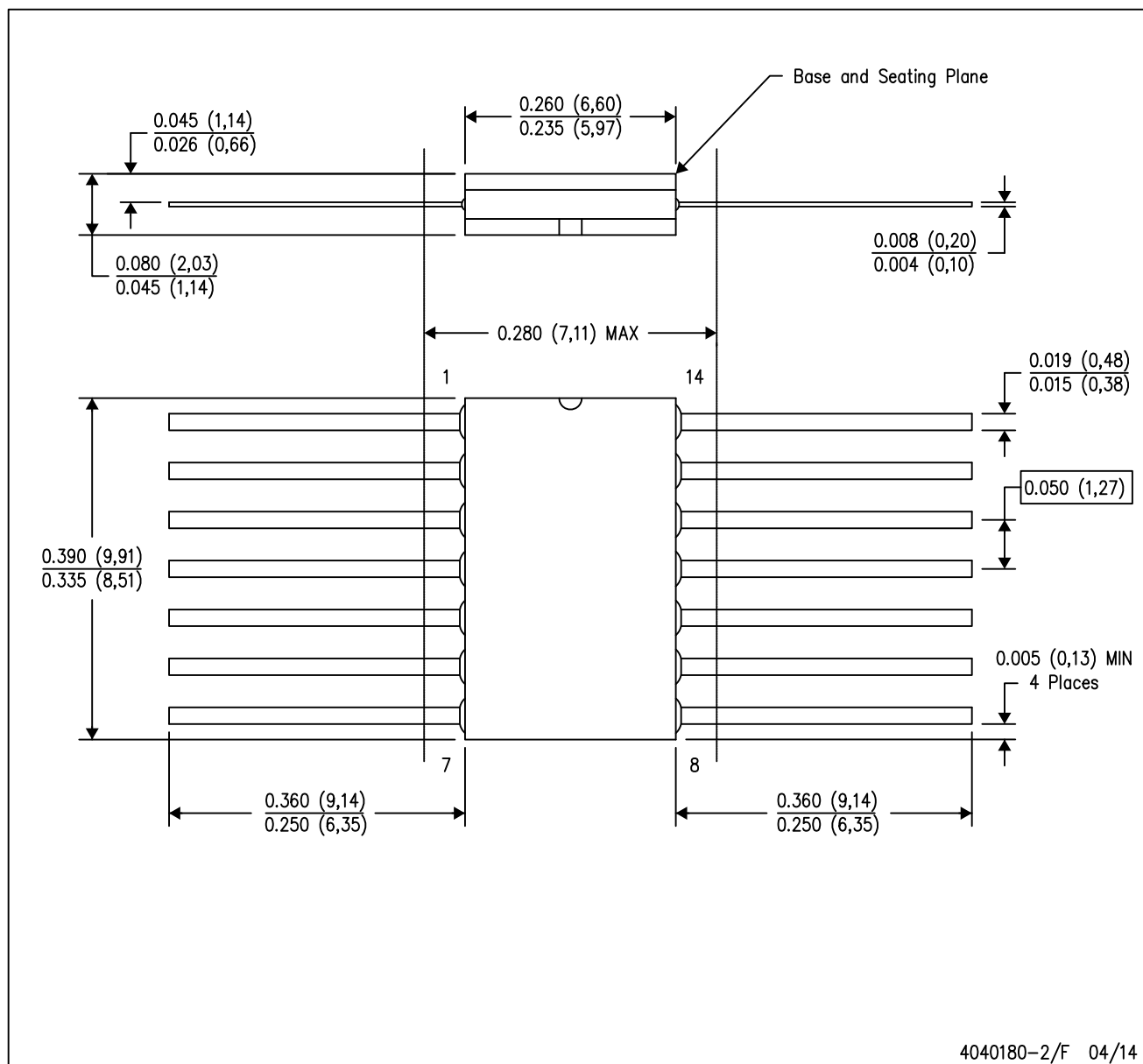
CERAMIC DUAL FLATPACK



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

W (R-GDFP-F14)

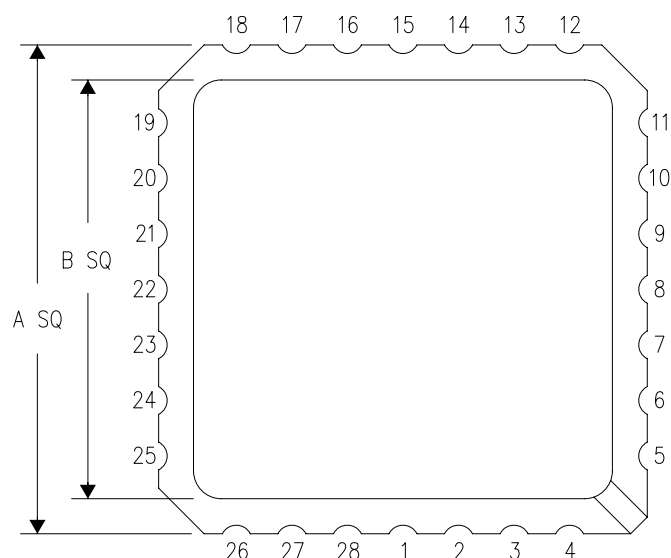
CERAMIC DUAL FLATPACK



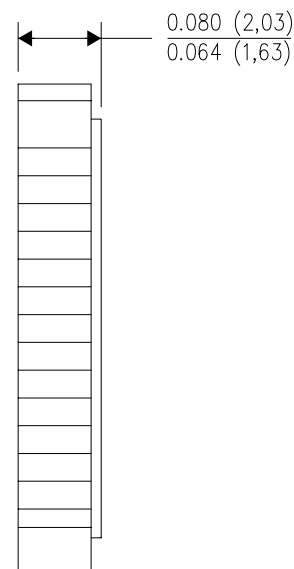
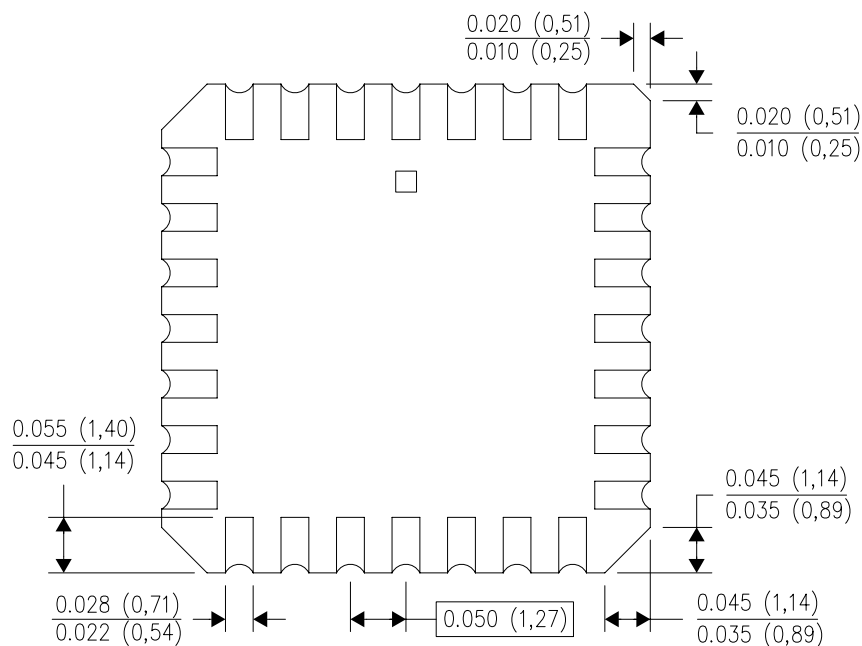
FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)

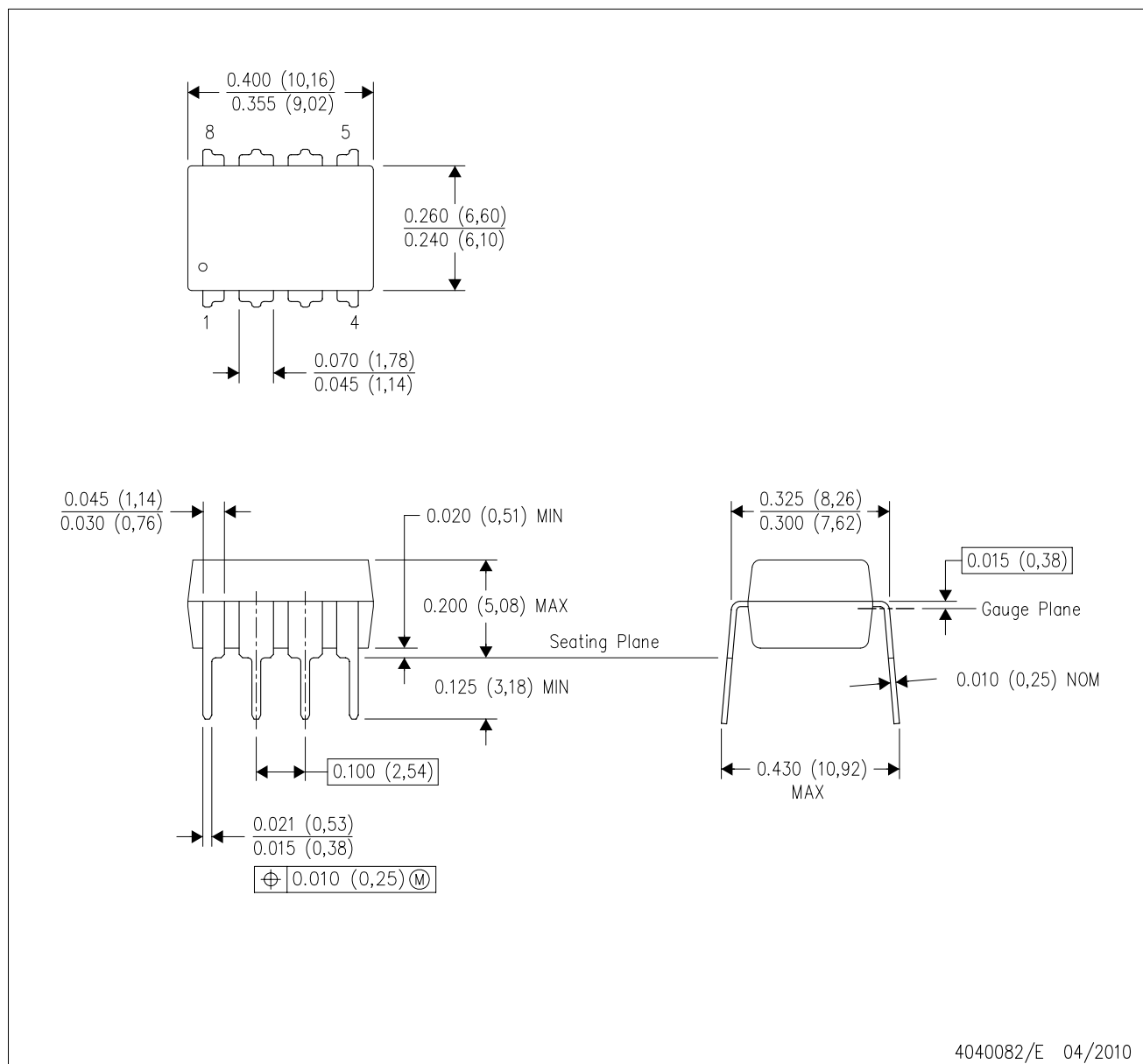


4040140/D 01/11

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

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE

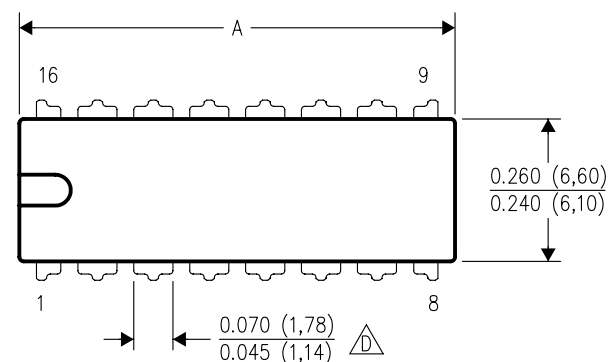


- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Falls within JEDEC MS-001 variation BA.

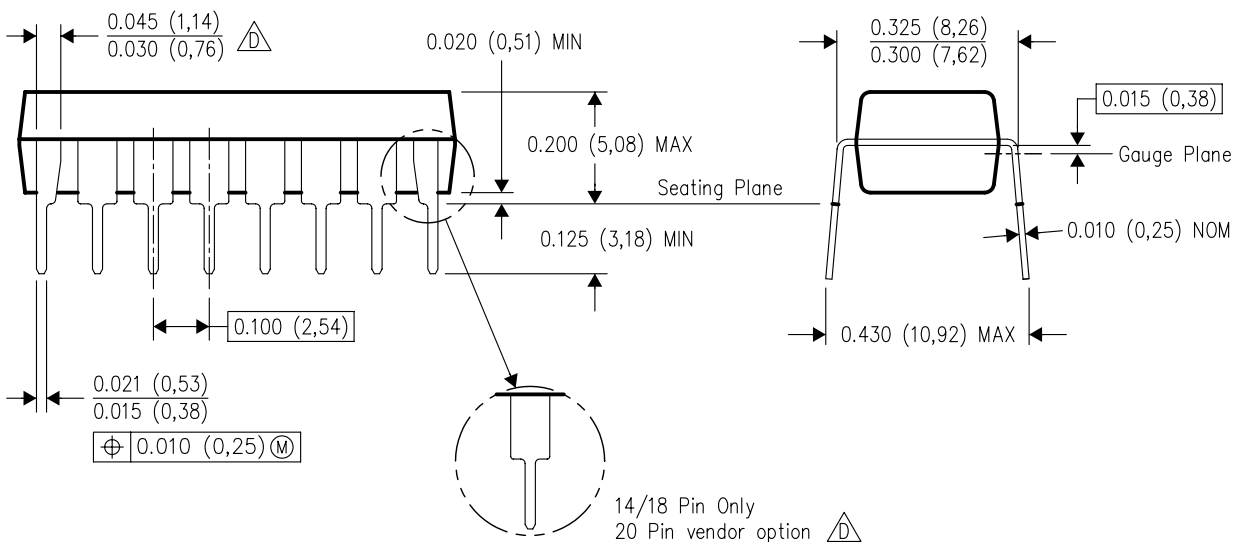
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE





PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



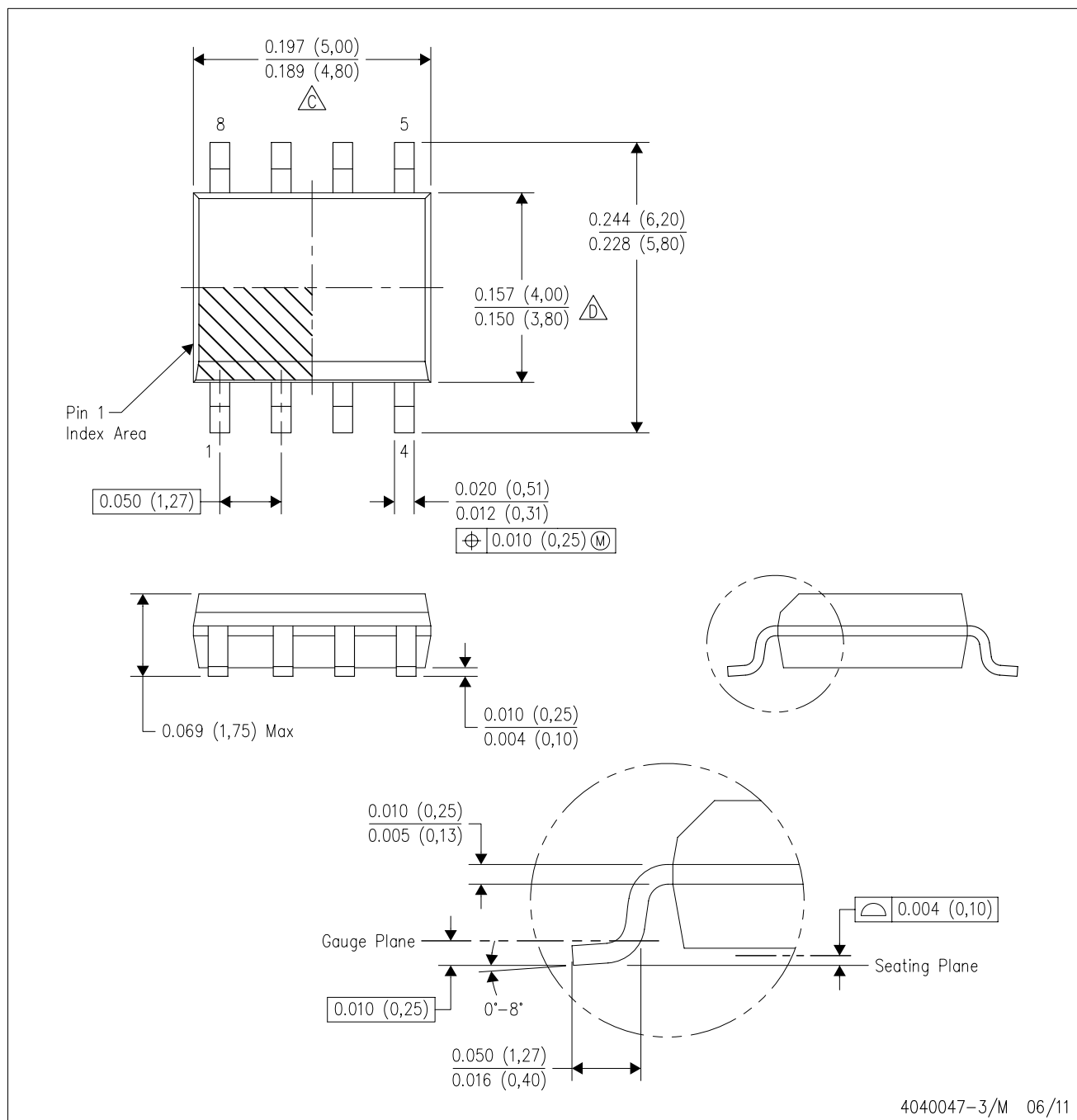
4040049/E 12/2002

NOTES:

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

D (R-PDSO-G8)

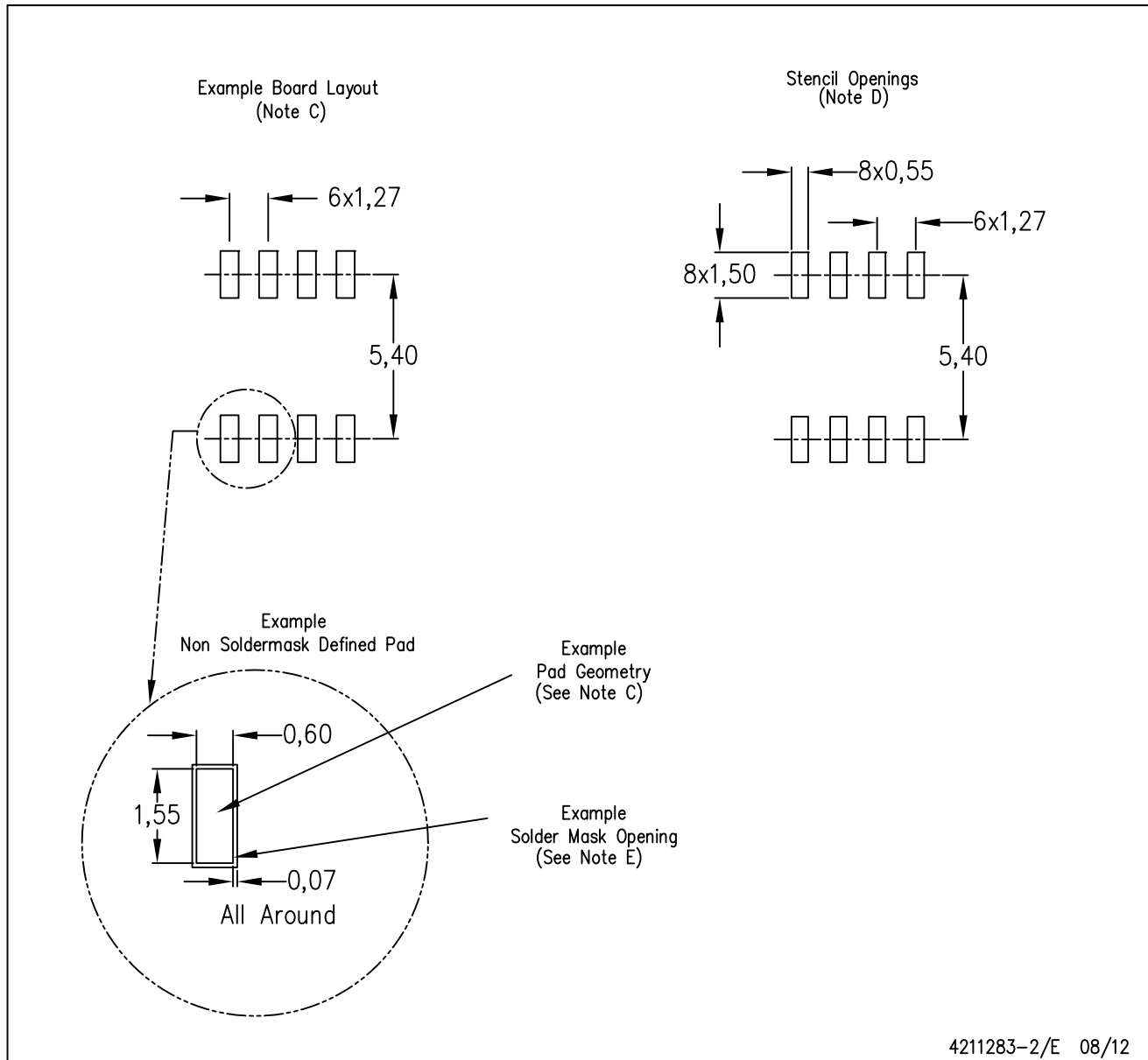
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - $\triangle C$ Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - $\triangle D$ Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AA.

D (R-PDSO-G8)

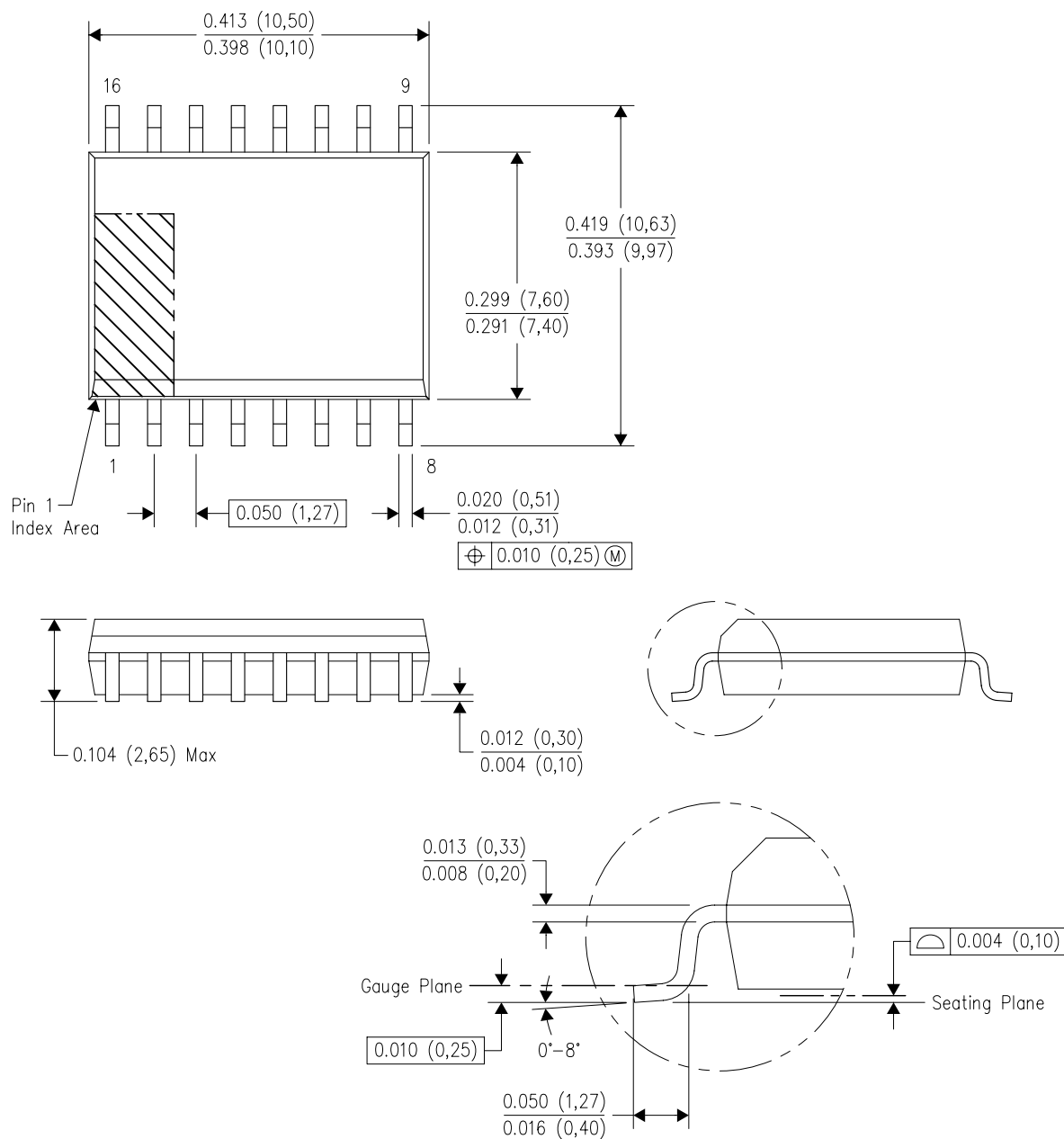
PLASTIC SMALL OUTLINE



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

DW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040000-2/G 01/11

- NOTES: A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-013 variation AA.

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