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- 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/ $\sqrt{\text{Hz}}$ , 17-nV/ $\sqrt{\text{Hz}}$  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  $\pm 19$  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  $\pm 15$  V and  $\pm 5$  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.



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#### **TLE2071 AVAILABLE OPTIONS**

		PACKAGED DEVICES									
T <sub>A</sub>	V <sub>IO</sub> max AT 25°C	SMALL OUTLINE† (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	-55°C to 125°C 2 mV 4 mV		TLE2071AMFK TLE2071MFK	TLE2071AMJG TLE2071MJG		TLE2071AMU TLE2071MU					

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

#### **TLE2072 AVAILABLE OPTIONS**

			PACKAGED DEVICES									
T <sub>A</sub>	V <sub>IO</sub> max AT 25°C	SMALL CHIP OUTLINE† CARRIER (D) (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						

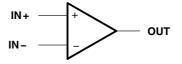
<sup>&</sup>lt;sup>†</sup> The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2072ACDR).

#### **TLE2074 AVAILABLE OPTIONS**

			P	ACKAGED DEVICE	s		
T <sub>A</sub>	V <sub>IO</sub> max AT 25°C	SMALL CHIP OUTLINE† CARRIER (DW) (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	

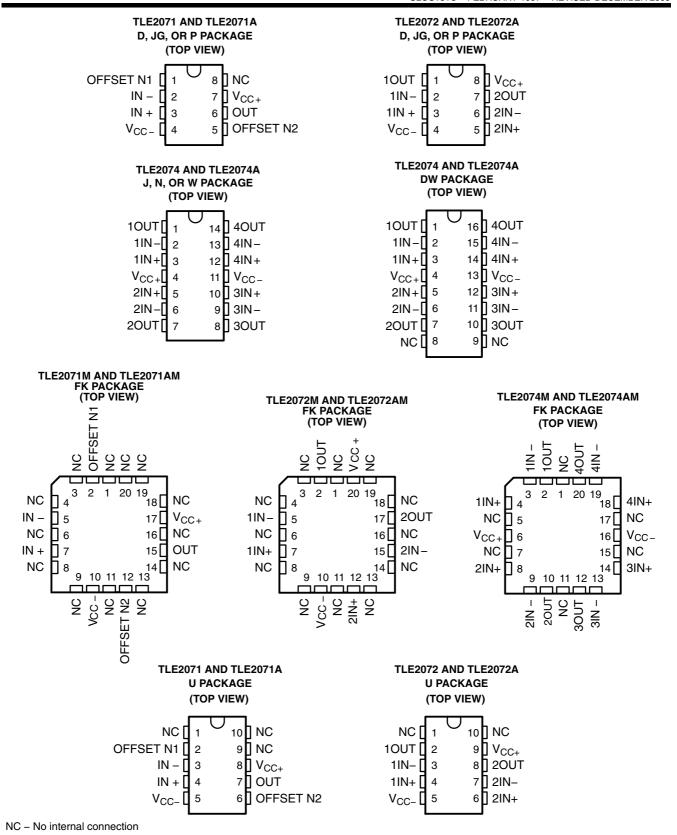
<sup>&</sup>lt;sup>†</sup> The DW packages are available taped and reeled. Add R suffix to device type (e.g., TLE2074ACDWR).

#### symbol



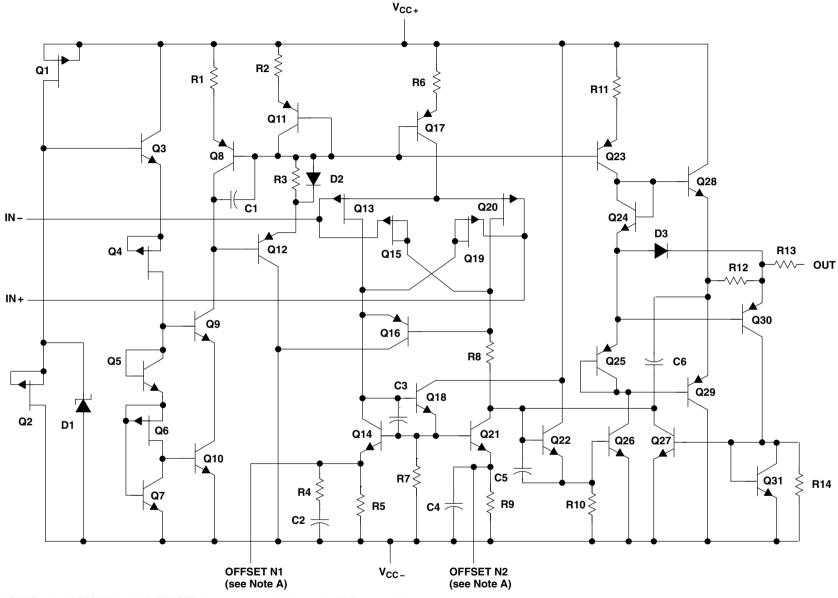


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TEXAS
INSTRUMENTS
POST OFFICE BOX 655300\* DALLAS, TEXAS 75265



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

# TEXAS INSTRUMENTS POST OFFICE BOX 655303 DALLAS, TEXAS 75265

#### 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 <sub>CC+</sub> (see Note 1)		
Differential input voltage range, V <sub>ID</sub> (see Note 2)		
Input voltage range, V <sub>I</sub> (any input)		
Input current, I <sub>I</sub> (each input)		
Output current, IO (each output)		
Total current into V <sub>CC+</sub>		
Total current out of V <sub>CC</sub>		
Duration of short-circuit current at (or below) 25°C (see	e Note 3)	unlimited
Package thermal impedance, $\theta_{JA}$ (see Notes 4 and 5):	D package	97.1°C/W
	DW package	57.3°C/W
	N package	
	P package	
Package thermal impedance, $\theta_{JC}$ (see Notes 4 and 5):		
	J package	
	JG package	
	U package	
	W package	
Operating free-air temperature range, $T_A$ : C suffix		
Storage temperature range	seconds: DW or N package	260°C 260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60	seconds: J, JG, U, or w package	300°C

<sup>&</sup>lt;sup>†</sup> 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<sub>CC+</sub> and V<sub>CC-</sub>.

- 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  $T_J(max)$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(max) T_A)/\theta_{JA}$ . 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 su	C SUFFIX		FIX	M SUFFIX		
	MIN	MAX	MIN	MAX	MIN	MAX	UNIT	
Supply voltage, V <sub>CC±</sub>			±19	±2.25	±19	±2.25	±19	V
	$V_{CC\pm} = \pm 5 \text{ V}$	-0.9	5	-0.8	5	-0.8	5	\/
Common-mode input voltage, V <sub>IC</sub>	$V_{CC\pm} = \pm 15 \text{ V}$	-10.9	15	-10.8	15	-10.8	15	V
Operating free-air temperature, T <sub>A</sub>		0	70	-40	85	-55	125	°C



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

	DADAMETED	TEST OO	NDITIONS		Τι	_E20710		TLE2071AC			UNIT
	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNII
v	logest offeet wells as			25°C		0.34	4		0.3	2	
$V_{IO}$	Input offset voltage		$V_{O} = 0$ ,	Full range			6			4	mV
$\alpha_{\text{VIO}}$	Temperature coefficient of input offset voltage	$R_S = 50 \Omega$		Full range		3.2	29		3.2	29	μV/°C
	land the first account			25°C		5	100		5	100	pА
I <sub>IO</sub>	Input offset current	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			1.4			1.4	nA
1	Input bias current	See Figure 4		25°C		15	175		15	175	pА
I <sub>IB</sub>	input bias current			Full range			5			5	nA
$V_{ICR}$	Common-mode input	R <sub>S</sub> = 50 Ω		25°C	5 to –1	5 to -1.9		5 to –1	5 to -1.9		٧
VICH	voltage range	115 - 30 32		Full range	5 to -0.9			5 to -0.9			•
		$I_{O} = -200 \mu\text{A}$		25°C	3.8	4.1		3.8	4.1		
		10 = -200 μΑ		Full range	3.7			3.7			
V <sub>OM+</sub>	Maximum positive peak	$I_{O} = -2 \text{ mA}$		25°C	3.5	3.9		3.5	3.9		٧
V OM +	output voltage swing	10 = -2 1114		Full range	3.4			3.4			V
		$I_{O} = -20 \text{ mA}$		25°C	1.5	2.3		1.5	2.3		
		10 = -20 1117		Full range	1.5			1.5			
	I <sub>O</sub> = 200 μA		25°C	-3.5	-4.2		-3.5	-4.2			
		ιο = 200 με τ	10 = 200 μΑ		-3.4			-3.4			
$V_{OM-}$	Maximum negative peak	I <sub>O</sub> = 2 mA		25°C	-3.7	-4.1		-3.7	-4.1		٧
- OIVI –	output voltage swing	-0		Full range	-3.6			-3.6			-
		I <sub>O</sub> = 20 mA		25°C	-1.5	-2.4		-1.5	-2.4		
		10 = 1	I	Full range	-1.5			-1.5			
			$R_L = 600 \Omega$	25°C	80	91		80	91		
			_	Full range	79			79			
$A_{VD}$	Large-signal differential	$V_{O} = \pm 2.3 \text{ V}$	$R_L = 2 k\Omega$	25°C	90	100		90	100		dB
,,,	voltage amplification			Full range	89	100		89	100		
			$R_L = 10 \text{ k}\Omega$	25°C	95	106		95	106		
	In and an eleterate			Full range	94	4012		94	4012		0
rį	Input resistance	V <sub>IC</sub> = 0	I a	25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
c <sub>i</sub>	Input capacitance	V <sub>IC</sub> = 0, See Figure 5	Common mode	25°C		11			11		рF
			Differential	25°C		2.5			2.5		
Z <sub>O</sub>	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> min,	25°C	70	89		70	89		dB	
OWINH	rejection ratio	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	68			68			uБ
k <sub>SVR</sub>	Supply-voltage rejection	$V_{CC\pm} = \pm 5 \text{ V t}$		25°C	82	99		82	99		dB
SVN	ratio( $\Delta V_{CC\pm}/\Delta V_{IO}$ )	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			~2

<sup>†</sup> Full range is 0°C to 70°C.



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

	DADAMETED	TEST OF	TECT CONDITIONS		TLE2071C			TL	UNIT		
PARAMETER		TEST CONDITIONS		T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
	0	V 0	Noteed	25°C	1.35	1.6	2.2	1.35	1.6	2.2	
ICC	Supply current	$V_{O} = 0$ ,	No load	Full range			2.2			2.2	mA
	Short-circuit output	V 0	V <sub>ID</sub> = 1 V	0500		-35			-35		
los	current	$V_O = 0$	$V_{ID} = -1 V$	25°C		45			45		mA

<sup>&</sup>lt;sup>†</sup> Full range is 0°C to 70°C.

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

					Т	LE2071	С	TL	E2071A	C	
	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C		35			35		
SR+	Positive slew rate	$V_{O(PP)} = \pm 2.3 \text{ V},$		Full range	23			23			V/μs
		$A_{VD} = -1,$ $C_{I} = 100 \text{ pF},$	See Figure 1	25°C		38			38		
SR-	Negative slew rate		Ç	Full range	23			23			V/μs
	Settling time	$A_{VD} = -1$ , 2-V step,	To 10 mV	25°C		0.25			0.25		
t <sub>s</sub>	Settling time	$R_L = 1 \text{ k}\Omega,$ $C_L = 100 \text{ pF}$	To 1 mV	25 C		0.4			0.4		μs
.,	Equivalent input noise		f = 10 Hz	25°C		48	85		48	85	nV/√ <del>Hz</del>
V <sub>n</sub>	voltage		f = 10 kHz	25°C		12	17		12	17	nv/√HZ
l v	Peak-to-peak equivalent	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	25°C		6			6		
V <sub>N(PP)</sub>	input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 5 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C	Ó	0.013%		Ó	0.013%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		9.4			9.4		MHz
B <sub>OM</sub>	Maximum output-swing bandwidth	$V_{O(PP)} = 4 \text{ V},$ $R_L = 2 \text{ k}\Omega$ ,	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C		2.8			2.8		MHz
φ <sub>m</sub>	Phase margin at unity gain	V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,	$R_L = 2 k\Omega$ , See Figure 2	25°C		56°			56°		

<sup>†</sup> 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)

	DADAMETED	TEST OO	NDITIONS		Т	LE20710		TL	E2071A	С	UNIT
	PARAMETER	IESI CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNII
v	Innut offeet voltage			25°C		0.49	4		0.47	2	m\/
V <sub>IO</sub>	Input offset voltage		$V_{O} = 0$ ,	Full range			6			4	mV
$\alpha_{\text{VIO}}$	Temperature coefficient of input offset voltage	$R_S = 50 \Omega$		Full range		3.2	29		3.2	29	μV/°C
	land the standard			25°C		6	100		6	100	pА
l <sub>IO</sub>	Input offset current	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			1.4			1.4	nA
	land this a summent	See Figure 4		25°C		20	175		20	175	pА
I <sub>IB</sub>	Input bias current			Full range			5			5	nA
$V_{ICR}$	Common-mode input	$R_S = 50 \Omega$		25°C	15 to –11	15 to –11.9		15 to –11	15 to –11.9		٧
VICR	voltage range	ng = 30 sz		Full range	15 to -10.9			15 to -10.9			V
		$I_{O} = -200 \mu\text{A}$		25°C	13.8	14.1		13.8	14.1		
		10 = -200 μΑ		Full range	13.7			13.7			
V <sub>OM+</sub>	Maximum positive peak	$I_{O} = -2 \text{ mA}$		25°C	13.5	13.9		13.5	13.9		٧
V OM +	output voltage swing	10 = -2 1114		Full range	13.4			13.4			v
		$I_{O} = -20 \text{ mA}$		25°C	11.5	12.3		11.5	12.3		
		10 = -20 IIIA		Full range	11.5			11.5			
		I <sub>O</sub> = 200 μA		25°C	-13.8	-14.2		-13.8	-14.2		
		10 = 200 μ/ (	- 200 μπ		-13.7			-13.7			
$V_{OM-}$	Maximum negative peak	I <sub>O</sub> = 2 mA		25°C	-13.5	-14		-13.5	-14		٧
* OIVI –	output voltage swing	10 = 2 11.7		Full range	-13.4			-13.4			•
		I <sub>O</sub> = 20 mA		25°C	-11.5	-12.4		-11.5	-12.4		
		10 20 1		Full range	-11.5			-11.5			
			$R_L = 600 \Omega$	25°C	80	96		80	96		
				Full range	79			79			
$A_{VD}$	Large-signal differential	V <sub>O</sub> = ±10 V	$R_L = 2 k\Omega$	25°C	90	109		90	109		dB
VD	voltage amplification			Full range	89			89			
			$R_L = 10 \text{ k}\Omega$	25°C	95	118		95	118		
				Full range	94			94			
rį	Input resistance	$V_{IC} = 0$		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
c <sub>i</sub>	Input capacitance	V <sub>IC</sub> = 0, See Figure 5	Common mode	25°C		7.5			7.5		pF
		200 . Iguio 0	Differential	25°C		2.5			2.5		
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> min,	25°C	80	98		80	98		٩D	
CIVIAN	rejection ratio	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	79			79	-		dB
kovo	Supply-voltage rejection	$V_{CC\pm} = \pm 5 \text{ V}$		25°C	82	99		82	99		dB
k <sub>SVR</sub>	ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ )	$V_{O} = 0$ ,	$R_S = 50 \Omega$	Full range	80			81			uБ

<sup>†</sup> Full range is 0°C to 70°C.



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

	DADAMETED	TEST OO	TECT CONDITIONS		TLE2071C			TL	UNIT		
PARAMETER		TEST CONDITIONS		T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
	0	V 0	NI- II	25°C	1.35	1.7	2.2	1.35	1.7	2.2	
ICC	I <sub>CC</sub> Supply current	$V_{O} = 0$ ,	No load	Full range			2.2			2.2	mA
	Short-circuit output	V 0	V <sub>ID</sub> = 1 V	0500	-30	-45		-30	-45		
IOS	los current	$V_O = 0$	$V_{ID} = -1 V$	25°C	30	48		30	48		mA

<sup>†</sup> Full range is 0°C to 70°C.

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

	DADAMETED		UDITIONS		Т	LE2071	С	ΤL	E2071A	C	LINUT
	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C	30	40		30	40		
SR+	Positive slew rate	$V_{O(PP)} = 10 \text{ V},$		Full range	27			27			V/μs
		$R_L = 2 kΩ$ , See Figure 1	$C_L = 100 \text{ pF},$	25°C	30	45		30	45		
SR-	Negative slew rate	<b>3</b>		Full range	27			27			V/μs
	Settling time	$A_{VD} = -1,$ 10-V step,	To 10 mV	25°C		0.4			0.4		
t <sub>s</sub>	Settling time	$R_L = 1 \text{ k}\Omega$ , $C_L = 100 \text{ pF}$	To 1 mV	25 C		1.5			1.5		μs
· ·	Equivalent input noise		f = 10 Hz	25°C		48	85		48	85	nV√ <del>Hz</del>
V <sub>n</sub>	voltage		f = 10 kHz	25°C		12	17		12	17	IIV VIIZ
.,	Peak-to-peak equivalent	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	0500		6			6		.,
V <sub>N(PP)</sub>	input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C	(	0.008%		(	0.008%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C	8	10		8	10		MHz
ВОМ	Maximum output-swing bandwidth	$V_{O(PP)} = 20 \text{ V},$ $R_L = 2 \text{ k}\Omega,$	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C	478	637	_	478	637	_	kHz
φm	Phase margin at unity gain	V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,	$R_L = 2 k\Omega$ , See Figure 2	25°C		57°			57°		

<sup>†</sup> 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)

	DADAMETED	TEST OF	NDITIONS	_ +	Т	LE2071	l	TL	.E2071A	NI .	LINUT
	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
v	Innut offeet veltere			25°C		0.34	4		0.3	2	m\/
V <sub>IO</sub>	Input offset voltage		$V_{O} = 0$ ,	Full range			7.6			5.6	mV
$\alpha_{\text{VIO}}$	Temperature coefficient of input offset voltage	$R_S = 50 \Omega$ ,		Full range		3.2	29		3.2	29	μV/°C
	l			25°C		5	100		5	100	pА
l <sub>IO</sub>	Input offset current	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			5			5	nA
	land biogramment	See Figure 4		25°C		15	175		15	175	pА
I <sub>IB</sub>	Input bias current			Full range			10			10	nA
$V_{ICR}$	Common-mode input	$R_S = 50 \Omega$		25°C	5 to –1	5 to -1.9		5 to –1	5 to -1.9		٧
VICH	voltage range	ng = 30 sz		Full range	5 to -0.8			5 to -0.8			V
		I <sub>O</sub> = -200 μA		25°C	3.8	4.1		3.8	4.1		
		10 = -200 μΑ		Full range	3.7			3.7			
V <sub>OM+</sub>	Maximum positive peak	$I_{O} = -2 \text{ mA}$		25°C	3.5	3.9		3.5	3.9		٧
V OM +	output voltage swing	10 = -2 111A		Full range	3.4			3.4			v
		$I_{O} = -20 \text{ mA}$		25°C	1.5	2.3		1.5	2.3		
		10 = -20 IIIA		Full range	1.5			1.5			
		I <sub>O</sub> = 200 μA		25°C	-3.8	-4.2		-3.8	-4.2		
		10 = 200 μ/ τ		Full range	-3.7			-3.7			
$V_{OM-}$	Maximum negative peak	I <sub>O</sub> = 2 mA		25°C	-3.5	-4.1		-3.5	-4.1		٧
* OIVI –	output voltage swing	10 = 2 1117 1		Full range	-3.4			-3.4			•
		I <sub>O</sub> = 20 mA		25°C	-1.5	-2.4		-1.5	-2.4		
		10 = 20 11171		Full range	-1.5			-1.5			
			$R_L = 600 \Omega$	25°C	80	91		80	91		
			11[ - 000 22	Full range	79			79			
$A_{VD}$	Large-signal differential	$V_{O} = \pm 2.3 \text{ V}$	$R_L = 2 k\Omega$	25°C	90	100		90	100		dB
· •VD	voltage amplification			Full range	89			89			ű.Z
			$R_L = 10 \text{ k}\Omega$	25°C	95	106		95	106		
				Full range	94			94			
r <sub>i</sub>	Input resistance	$V_{IC} = 0$		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
Cį	Input capacitance	V <sub>IC</sub> = 0, See Figure 5	Common mode	25°C		11			11		pF
		Joo i igaio o	Differential	25°C		2.5			2.5		
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMDD	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> mir	 1,	25°C	70	89		70	89		40
CMRR	rejection ratio	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	68			68			dB
	Supply-voltage rejection	$V_{CC\pm} = \pm 5 \text{ V}$		25°C	82	99		82	99		40
k <sub>SVR</sub>	ratio $(\Delta V_{CC\pm}/\Delta V_{IO})$	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			dB

<sup>†</sup> Full range is –40°C to 85°C.



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

	DADAMETED	TEST CONDITIONS		- +	TLE2071I			TL	.E2071A	l l	LINUT
	PARAMETER	IESI CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
	Complex accompany	V 0	Nelsed	25°C	1.35	1.6	2.2	1.35	1.6	2.2	4
ICC	Supply current	$V_{O} = 0$ ,	No load	Full range			2.2			2.2	mA
	Short-circuit output	V 0	V <sub>ID</sub> = 1 V	0500		-35			-35		A
los	current	$V_O = 0$	$V_{ID} = -1 V$	25°C		45			45		mA

<sup>&</sup>lt;sup>†</sup> Full range is -40°C to 85°C.

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

					T	LE2071		TL	.E2071A	.I	
	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C		35			35		
SR+	Positive slew rate	$V_{O(PP)} = \pm 2.3$	V,	Full range	22			22			V/μs
		$A_{VD} = -1,$ $C_{I} = 100 \text{ pF},$	See Figure 1	25°C		38			38		
SR-	Negative slew rate		· ·	Full range	22			22			V/μs
•	Settling time	$A_{VD} = -1,$ 2-V step,	To 10 mV	25°C		0.25			0.25		
t <sub>s</sub>	Settling time	$R_L = 1 \text{ k}\Omega,$ $C_L = 100 \text{ pF}$	To 1 mV	25 C		0.4			0.4		μS
V <sub>n</sub>	Equivalent input noise		f = 10 Hz	25°C		48	85		48	85	nV/√ <del>Hz</del>
v <sub>n</sub>	voltage		f = 10 kHz	25 C		12	17		12	17	IIV/ V⊓Z
,,	Peak-to-peak equivalent	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	0500		6			6		.,
V <sub>N(PP)</sub>	input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 5 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C	0	.013%		0	.013%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		9.4			9.4		MHz
B <sub>OM</sub>	Maximum output-swing bandwidth	$V_{O(PP)} = 4 V$ , $R_L = 2 k\Omega$ ,	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C		2.8			2.8		MHz
φ <sub>m</sub>	Phase margin at unity gain	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		56°			56°		

<sup>&</sup>lt;sup>†</sup> Full range is -40°C to 85°C.



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

	DADAMETED	TEST OO	NDITIONS	<b>-</b> +	Т	LE2071		TL	_E2071A	N	UNIT
	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V	Innut offeet veltage			25°C		0.49	4		0.47	2	m\/
V <sub>IO</sub>	Input offset voltage	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			7.6			5.6	mV
$\alpha_{VIO}$	Temperature coefficient of input offset voltage	$R_S = 50 \Omega$ ,		Full range		3.2	29		3.2	29	μV/°C
	land the state of			25°C		6	100		6	100	pА
l <sub>IO</sub>	Input offset current	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			5			5	nA
	logest biog assument	See Figure 4		25°C		20	175		20	175	pА
I <sub>IB</sub>	Input bias current			Full range			10			10	nA
V	Common-mode input	R <sub>S</sub> = 50 Ω		25°C	15 to –11	15 to –11.9		15 to –11	15 to –11.9		٧
V <sub>ICR</sub>	voltage range	ng = 30 sz		Full range	15 to –10.8			15 to -10.8			V
		$I_{O} = -200  \mu A$		25°C	13.8	14.1		13.8	14.1		
		10 = -200 μΑ		Full range	13.7			13.7			
V <sub>OM+</sub>	Maximum positive peak	$I_O = -2 \text{ mA}$		25°C	13.5	13.9		13.5	13.9		V
VOM+	output voltage swing	10 = -2 IIIA		Full range	13.4			13.4			<b>v</b>
		$I_{O} = -20 \text{ mA}$		25°C	11.5	12.3		11.5	12.3		
		10 = -20 IIIA		Full range	11.5			11.5			
		I <sub>O</sub> = 200 μA		25°C	-13.8	-14.2		-13.8	-14.2		
		10 = 200 μΑ		Full range	-13.7			-13.7			
V	Maximum negative peak	I <sub>O</sub> = 2 mA		25°C	-13.5	-14		-13.5	-14		V
$V_{OM-}$	output voltage swing	10 - 2 1117		Full range	-13.4			-13.4			
		I <sub>O</sub> = 20 mA		25°C	-11.5	-12.4		-11.5	-12.4		
		10 = 20 IIIA	_	Full range	-11.5			-11.5			
			$R_L = 600 \Omega$	25°C	80	96		80	96		
			11[ = 000 32	Full range	79			79			
A <sub>VD</sub>	Large-signal differential	V <sub>O</sub> = ± 10 V	$R_L = 2 k\Omega$	25°C	90	109		90	109		dB
, ,vD	voltage amplification	100-100	11[ - 2 1(22	Full range	89			89			l GD
			$R_L = 10 \text{ k}\Omega$	25°C	95	118		95	118		
			11[ - 10 1(22	Full range	94			94			
r <sub>i</sub>	Input resistance	V <sub>IC</sub> = 0	_	25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
c <sub>i</sub>	Input capacitance	V <sub>IC</sub> = 0, See Figure 5	Common mode	25°C		7.5			7.5		pF
		oce i igule 5	Differential	25°C		2.5			2.5		
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> min,	١,	25°C	80	98		80	98		_
CMRR	rejection ratio	$V_O = 0$ , $R_S = 50 \Omega$		Full range	79			79			dB
	Supply-voltage rejection	$V_{CC\pm} = \pm 5 \text{ V}$		25°C	82	99		82	99		4D
k <sub>SVR</sub>	ratio $(\Delta V_{CC\pm}/\Delta V_{IO})$	$V_{O} = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			dB

<sup>†</sup> Full range is -40°C to 85°C.



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

	DADAMETED	TEST CONDITIONS		_ +	TLE2071I			TL	.E2071A	d .	UNIT
	PARAMETER			T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
	Owner to the company	.v. o	Noteed	25°C	1.35	1.7	2.2	1.35	1.7	2.2	
ICC	Supply current	$V_{O} = 0$ ,	No load	Full range			2.2			2.2	mA
	Short-circuit output	.v. o	V <sub>ID</sub> = 1 V	0500	-30	-45		-30	-45		
los	los current	$IV_{\circ} = 0$	V <sub>ID</sub> = -1 V	25°C	30	48		30	48		mA

<sup>†</sup> Full range is -40°C to 85°C.

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

	DADAMETED	TEOT 001	IDITIONS		T	LE2071		TL	.E2071A	I	
	PARAMETER	TEST CON	IDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C	30	40		30	40		
SR+	Positive slew rate	$V_{O(PP)} = \pm 10 \text{ V},$		Full range	24			24			V/μs
		$A_{VD} = -1,$ $C_{L} = 100 \text{ pF},$	See Figure 1	25°C	30	45		30	45		
SR-	Negative slew rate	0 <u>L</u> = 100 pr,	Coo i iguro i	Full range	24			24			V/μs
t <sub>s</sub>	Settling time	$A_{VD} = -1,$ 10-V step,	To 10 mV	25°C		0.4			0.4		μs
'S	Setting time	$R_L = 1 \text{ k}\Omega$ , $C_L = 100 \text{ pF}$	To 1 mV	20 0		1.5			1.5		μο
$V_n$	Equivalent input noise		f = 10 Hz	25°C		48	85		48	85	nV/√ <del>Hz</del>
v <sub>n</sub>	voltage		f = 10 kHz	25 C		12	17		12	17	IIV/√⊓Z
V	Peak-to-peak equivalent	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	25°C		6			6		
V <sub>N(PP)</sub>	input noise voltage		f = 0.1 Hz to 10 Hz	25 0		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)}$ = 20 V, f = 1 kHz, $R_S$ = 25 $\Omega$	$A_{VD} = 10,$ $R_L = 2 k\Omega,$	25°C	0	.008%		0	.008%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C	8	10		8	10		MHz
B <sub>OM</sub>	Maximum output-swing bandwidth	$V_{O(PP)} = 20 \text{ V},$ $R_L = 2 \text{ k}\Omega,$	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C	478	637		478	637		kHz
φ <sub>m</sub>	Phase margin at unity gain	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		57°	•	•	57°	_	

<sup>&</sup>lt;sup>†</sup> Full range is –40°C to 85°C.



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

	DADAMETED	TEST 00	NDITIONO	_ +	TL	E2071N	И	TL	E2071A	M	
	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V	Innut offeet veltege			25°C		0.34	4		0.3	2	m)/
$V_{IO}$	Input offset voltage	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			9.2			7.2	mV
$\alpha_{\text{VIO}}$	Temperature coefficient of input offset voltage	$R_S = 50 \Omega$ ,		Full range		3.2	29 <sup>‡</sup>		3.2	29 <sup>‡</sup>	μV/°C
	law it offers a commant			25°C		5	100		5	100	pА
I <sub>IO</sub>	Input offset current	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			20			20	nA
	land black summer	See Figure 4		25°C		15	175		15	175	pА
I <sub>IB</sub>	Input bias current			Full range			60			60	nA
V <sub>ICR</sub>	Common-mode input	R <sub>S</sub> = 50 Ω		25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9		٧
VICK	voltage range	115 - 00 32		Full range	5 to -0.8			5 to -0.8			•
		$I_{O} = -200 \mu\text{A}$		25°C	3.8	4.1		3.8	4.1		
		10 = -200 μΑ		Full range	3.6			3.6			
V <sub>OM+</sub>	Maximum positive peak	$I_{O} = -2 \text{ mA}$		25°C	3.5	3.9		3.5	3.9		٧
VOM+	output voltage swing	10 = -2 IIIA		Full range	3.3			3.3			V
		la = 20 mA		25°C	1.5	2.3		1.5	2.3		
		$I_0 = -20 \text{ mA}$		Full range	1.4			1.4			
				25°C	-3.8	-4.2		-3.8	-4.2		
		$I_{O} = 200  \mu A$		Full range	-3.6			-3.6			
.,	Maximum negative peak			25°C	-3.5	-4.1		-3.5	-4.1		V
$V_{OM-}$	output voltage swing	$I_O = 2 \text{ mA}$		Full range	-3.3			-3.3			V
				25°C	-1.5	-2.4		-1.5	-2.4		
		$I_O = 20 \text{ mA}$		Full range	-1.4			-1.4			
			<b>5</b> 222 0	25°C	80	91		80	91		
			$R_L = 600 \Omega$	Full range	78			78			
_	Large-signal differential			25°C	90	100		90	100		
$A_{VD}$	voltage amplification	$V_0 = \pm 2.3 \text{ V}$	$R_L = 2 k\Omega$	Full range	88			88			dB
				25°C	95	106		95	106		
			$R_L = 10 \text{ k}\Omega$	Full range	93			93			
rį	Input resistance	V <sub>IC</sub> = 0	•	25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
C <sub>i</sub>	Input capacitance	V <sub>IC</sub> = 0,	Common mode	25°C		11			11		pF
•	•	See Figure 5	Differential	25°C		2.5			2.5		•
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> min	١,	25°C	70	89		70	89		
CMRR	rejection ratio	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	68			68			dB
	Supply-voltage rejection	$V_{CC\pm} = \pm 5 \text{ V t}$	o ± 15 V,	25°C	82	99		82	99		
k <sub>SVR</sub>	ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ )	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			dB

<sup>†</sup> Full range is –55°C to 125°C.

 $<sup>\</sup>mbox{$^{$\sharp$}$}$  \*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)

	DADAMETED	TEST OF	TEST CONDITIONS		TLE2071M			TL	E2071AI	M	LINUT
	PARAMETER	IESI CC	SNOTTIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
	Completerment	V 0	Natard	25°C	1.35	1.6	2.2	1.35	1.6	2.2	A
ICC	Supply current	$V_{O} = 0,$	No load	Full range			2.2			2.2	mA
	Short-circuit output	V 0	V <sub>ID</sub> = 1 V	0500		-35			-35		A
los	current	$V_O = 0$	$V_{ID} = -1 V$	25°C		45			45		mA

<sup>†</sup> Full range is –55°C to 125°C.

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

	24244555		IDITIONS		TL	E2071N	1	TLI	E2071A	VI	
	PARAMETER	TEST CON	IDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C		35			35		
SR+	Positive slew rate	$V_{O(PP)} = \pm 2.3 \text{ V}$	, , <b>D</b>	Full range	20 <sup>‡</sup>			20 <sup>‡</sup>			V/μs
		$A_{VD} = -1,$ $C_{L} = 100 \text{ pF},$		25°C		38			38		
SR-	Negative slew rate	12 11 7	<b>3</b>	Full range	20 <sup>‡</sup>			20 <sup>‡</sup>			V/μs
ts	Settling time	$A_{VD} = -1,$ 2-V step,	To 10 mV	25°C		0.25			0.25		μs
is	Setting time	$R_L = 1 \text{ k}\Omega$ , $C_L = 100 \text{ pF}$	To 1 mV	25 0		0.4			0.4		μδ
V	Equivalent input noise		f = 10 Hz	25°C		48	85 <sup>‡</sup>		48	85 <sup>‡</sup>	nV/√ <del>Hz</del>
V <sub>n</sub>	voltage		f = 10 kHz	25°C		12	17 <sup>‡</sup>		12	17 <sup>‡</sup>	IIV/VIIZ
ļ.,	Peak-to-peak equivalent	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	0500		6			6		.,
V <sub>N(PP)</sub>	input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 5 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C	0	.013%		0	.013%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 kΩ$ , See Figure 2	25°C		9.4			9.4		MHz
ВОМ	Maximum output-swing bandwidth	$V_{O(PP)} = 4 \text{ V},$ $R_L = 2 \text{ k}\Omega$ ,	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C		2.8			2.8		MHz
φ <sub>m</sub>	Phase margin at unity gain	V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,	$R_L = 2 kΩ$ , See Figure 2	25°C		56°			56°		

 $<sup>^{\</sup>dagger}$  Full range is  $-55^{\circ}$ C to 125 $^{\circ}$ C.



 $<sup>\</sup>ensuremath{^{\ddagger}}$  \*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

#### TLE2071M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = $\pm 15$ V (unless otherwise noted)

	24244555		NEITIONO		Т	LE2071	И	TL	E2071A	M	
	PARAMETER	I EST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
.,	leaved offered college			25°C		0.49	4		0.47	2	
$V_{IO}$	Input offset voltage	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			9.2			7.2	mV
$\alpha_{VIO}$	Temperature coefficient of input offset voltage	$R_S = 50 \Omega$		Full range		3.2	29*		3.2	29*	μV/°C
				25°C		6	100		6	100	pА
l <sub>IO</sub>	Input offset current	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			20			20	nA
		See Figure 4		25°C		20	175		20	175	pА
I <sub>IB</sub>	Input bias current			Full range			60			60	nA
v	Common-mode input	B 500		25°C	15 to –11	15 to –11.9		15 to –11	15 to -11.9		٧
V <sub>ICR</sub>	voltage range	$R_S = 50 \Omega$		Full range	15 to -10.9			15 to -10.9			V
		$I_{O} = -200  \mu A$		25°C	13.8	14.1		13.8	14.1		
		10 = -200 μΑ		Full range	13.6			13.6			
V <sub>OM+</sub>	Maximum positive peak	$I_{O} = -2 \text{ mA}$		25°C	13.5	13.9		13.5	13.9		V
V OM +	output voltage swing	10 = -2 111A		Full range	13.3			13.3			•
		$I_0 = -20 \text{ mA}$		25°C	11.5	12.3		11.5	12.3		
		10 = -20 IIIA		Full range	11.4			11.4			
		I <sub>O</sub> = 200 μA		25°C	-13.8	-14.2		-13.8	-14.2		
		10 = 200 μΑ		Full range	-13.6			-13.6			
\ <i>/</i>	Maximum negative peak	1 - 2 m 4		25°C	-13.5	-14		-13.5	-14		V
$V_{OM-}$	output voltage swing	$I_O = 2 \text{ mA}$		Full range	-13.3			-13.3			V
				25°C	-11.5	-12.4		-11.5	-12.4		
		$I_O = 20 \text{ mA}$		Full range	-11.4			-11.4			
			B 000 0	25°C	80	96		80	96		
			$R_L = 600 \Omega$	Full range	78			78			
	Large-signal differential		D 01:0	25°C	90	109		90	109		-10
$A_{VD}$	voltage amplification	$V_0 = \pm 10 \text{ V}$	$R_L = 2 k\Omega$	Full range	88			88			dB
			<b>5</b> 4810	25°C	95	118		95	118		
			$R_L = 10 \text{ k}\Omega$	Full range	93			93			
rį	Input resistance	V <sub>IC</sub> = 0		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
c <sub>i</sub>	Input capacitance	V <sub>IC</sub> = 0,	Common mode	25°C		7.5			7.5		pF
	. ,	See Figure 5	Differential	25°C		2.5			2.5		·
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
<u> </u>	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> mir	າ,	25°C	80	98		80	98		
CMRR	rejection ratio	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	78			78			dB
	Supply-voltage rejection	$V_{CC\pm} = \pm 5 \text{ V}$	to ±15 V.	25°C	82	99		82	99		
k <sub>SVR</sub>	ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ )	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			dB
					•						

<sup>\*</sup>On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

† Full range is -55°C to 125°C.



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## TLE2071M electrical characteristics at specified free-air temperature, $V_{CC^\pm}$ = $\pm 15$ V (unless otherwise noted) (continued)

	DADAMETED	TEST CONDITIONS		_ +	TLE2071M			TL	E2071A	М	UNIT	
	PARAMETER			T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	ONIT	
	Owner by summer to	., .	N. I.	25°C	1.35	1.7	2.2	1.35	1.7	2.2		
ICC	Supply current	$V_{O} = 0,$	No load	No load	Full range			2.2			2.2	mA
	Object since it seeks at severe	., .	$V_{ID} = 1 V$	0500	-30	-45		-30	-45			
los	I <sub>OS</sub> Short-circuit output current	$V_O = 0$	V <sub>ID</sub> = -1 V	25°C	30	48		30	48		mA	

<sup>†</sup> Full range is -55°C to 125°C.

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

	24244555		101710110		TL	.E2071N	1	TL	E2071A	М	
	PARAMETER	TEST CON	IDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C	30	40		30	40		
SR+	Positive slew rate	$V_{O(PP)} = 10 \text{ V},$		Full range	22			22			V/μs
		$R_L = 2 k\Omega$ , See Figure 1	$C_L = 100 \text{ pF},$	25°C	30	45		30	45		
SR-	Negative slew rate	3. I		Full range	22			22			V/μs
+	Settling time	$A_{VD} = -1,$ 10-V step,	To 10 mV	25°C		0.4			0.4		μs
t <sub>s</sub>	Setting time	$R_L = 1 \text{ k}\Omega$ , $C_L = 100 \text{ pF}$	To 1 mV	25 0		1.5			1.5		μ5
	Equivalent input noise		f = 10 Hz	25°C		48	85*		48	85*	nV/√ <del>Hz</del>
V <sub>n</sub>	voltage		f = 10 kHz	25°C		12	17*		12	17*	IIV/VIIZ
ļ.,	Peak-to-peak equivalent	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	2502		6			6		.,
V <sub>N(PP)</sub>	input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C	0	.008%		0	.008%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 kΩ$ , See Figure 2	25°C	8*	10		8*	10		MHz
B <sub>OM</sub>	Maximum output-swing bandwidth	$V_{O(PP)} = 20 \text{ V},$ $R_L = 2 \text{ k}\Omega,$	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C	478*	637		478*	637		kHz
φ <sub>m</sub>	Phase margin at unity gain	V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,	$R_L = 2 k\Omega$ , See Figure 2	25°C		57°	_	_	57°	_	

<sup>\*</sup>On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.



<sup>&</sup>lt;sup>†</sup> Full range is –55°C to 125°C.

## TLE2071Y electrical characteristics at $V_{CC^\pm}$ = $\pm 15$ V, $T_A$ = $25^{\circ}C$

	DADAMETED		CT CONDIT	IONG	Т	LE2071\	1	
	PARAMETER	'5	ST CONDIT	IONS	MIN	TYP	MAX	UNIT
V <sub>IO</sub>	Input offset voltage	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	$R_S = 50 \Omega$		0.49	4	mV
I <sub>IO</sub>	Input offset current					6	100	pА
I <sub>IB</sub>	Input bias current	$V_{IC} = 0$ ,	$V_{O}=0$ ,	See Figure 4		20	175	pА
V <sub>ICR</sub>	Common-mode input voltage range	$R_S = 50 \Omega$			15 to –11	15 to 11.9		V
		$I_{O} = -200  \mu A$			13.8	14.1		
V <sub>OM+</sub>	Maximum positive peak output voltage swing	$I_0 = -2 \text{ mA}$			13.5	13.9		V
		$I_O = -20 \text{ mA}$			11.5	12.3		
		$I_{O} = 200  \mu A$			-13.8	-14.2		
$V_{OM-}$	Maximum negative peak output voltage swing	I <sub>O</sub> = 2 mA			-13.5	-14		V
		I <sub>O</sub> = 20 mA			-11.5	-12.4		
			R <sub>L</sub> = 600 Ω	2	80	96		
$A_{VD}$	Large-signal differential voltage amplification	V <sub>O</sub> = ±10 V	$R_L = 2 k\Omega$		90	109		dB
			$R_L = 10 \text{ k}\Omega$	2	95	118		
rį	Input resistance	$V_{IC} = 0$				10 <sup>12</sup>		Ω
		$V_{O} = 0$ ,	Common r	node		7.5		
c <sub>i</sub>	Input capacitance	See Figure 5	Differentia			2.5		pF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz	•			80		Ω
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR}min,$ $R_S = 50 \Omega$		V <sub>O</sub> = 0,	80	98		dB
k <sub>SVR</sub>	Supply-voltage rejection ratio ( $\Delta V_{CC^{\pm}}/\Delta V_{IO}$ )	$V_{CC\pm} = \pm 5 \text{ V to}$ $R_S = 50 \Omega$	±15 V,	V <sub>O</sub> = 0,	82	99		dB
I <sub>CC</sub>	Supply current	$V_O = 0$ ,	No load		1.35	1.7	2.2	mA
	Object allowed and a second	., .	V <sub>ID</sub> = 1 V		-30	-45		
los	Short-circuit output current	$V_O = 0$	$V_{ID} = -1 V$	1	30	48		mA

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

	DADAMETED	TEOT 00	NDITIONO		TL	E20720	;	TL	E2072A	С	
	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V	Input offset voltage			25°C		0.9	6		0.65	3.5	mV
V <sub>IO</sub>	Input offset voltage	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			7.8			5.3	IIIV
$\alpha_{VIO}$	Temperature coefficient of input offset voltage	$R_S = 50 \Omega$		Full range		2.3	25		2.3	25	μV/°C
	Innut effect ourrent			25°C		5	100		5	100	pА
I <sub>IO</sub>	Input offset current	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			1.4			1.4	nA
,	lanut biog gurrant	See Figure 4		25°C		15	175		15	175	pА
I <sub>IB</sub>	Input bias current			Full range			5			5	nA
V	Common-mode input	R <sub>S</sub> = 50 Ω		25°C	5 to –1	5 to –1.9		5 to -1	5 to –1.9		٧
V <sub>ICR</sub>	voltage range	n <sub>S</sub> = 50 12		Full range	5 to -0.9			5 to -0.9			V
				25°C	3.8	4.1		3.8	4.1		
		$I_{O} = -200 \mu\text{A}$		Full range	3.7			3.7			
.,	Maximum positive peak			25°C	3.5	3.9		3.5	3.9		V
V <sub>OM+</sub>	output voltage swing	$I_0 = -2 \text{ mA}$		Full range	3.4			3.4			V
		1 00 m A		25°C	1.5	2.3		1.5	2.3		
		$I_O = -20 \text{ mA}$		Full range	1.5			1.5			
		L = 200 ··· A		25°C	-3.8	-4.2		-3.8	-4.2		
		$I_{O} = 200 \mu\text{A}$		Full range	-3.7			-3.7			
٠,	Maximum negative peak			25°C	-3.5	-4.1		-3.5	-4.1		٧
$V_{OM-}$	output voltage swing	$I_O = 2 \text{ mA}$		Full range	-3.4			-3.4			V
				25°C	-1.5	-2.4		-1.5	-2.4		
		$I_O = 20 \text{ mA}$		Full range	-1.5			-1.5			
			D 600.0	25°C	80	91		80	91		
			$R_L = 600 \Omega$	Full range	79			79			
^	Large-signal differential	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	D 010	25°C	90	100		90	100		dB
A <sub>VD</sub>	voltage amplification	$V_0 = \pm 2.3 \text{ V}$	$R_L = 2 k\Omega$	Full range	89			89			uБ
			D 401-0	25°C	95	106		95	106		
			$R_L = 10 \text{ k}\Omega$	Full range	94			94			
r <sub>i</sub>	Input resistance	V <sub>IC</sub> = 0		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
c <sub>i</sub>	Input capacitance	V <sub>IC</sub> = 0,	Common mode	25°C		11			11		pF
	<u> </u>	See Figure 5	Differential	25°C		2.5			2.5		
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
OMBB	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> min,	25°C	70	89		70	89		į	
CMRR	rejection ratio	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	68			68			dB
	Supply-voltage rejection		25°C	82	99		82	99		d D	
k <sub>SVR</sub>	ratio( $\Delta V_{CC\pm}/\Delta V_{IO}$ )	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			dB

<sup>†</sup> Full range is 0°C to 70°C.



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

	PARAMETER		TEST CONDITIONS		TLE2072C			TL	С		
	PARAMETER	TEST CO	INDITIONS	T <sub>A</sub>	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
	Supply current	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Noteed	25°C	2.7	2.9	3.9	2.7	2.9	3.9	A
ICC	(both channels)	$V_{O} = 0$ ,	No load	Full range			3.9			3.9	mA
a <sub>x</sub>	Crosstalk attenuation	$V_{IC} = 0$ ,	$R_L = 2 k\Omega$	25°C		120			120		dB
	Short-circuit output	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	$V_{ID} = 1 V$	0500		-35			-35		A
los	current	$V_O = 0$	$V_{ID} = -1 V$	25°C		45			45		mA

## TLE2072C operating characteristics at specified free-air temperature, $V_{\text{CC}\pm}$ = $\pm5~\text{V}$

					1	ΓLE20720	)	Т	LE2072A	С	
	PARAMETER	TEST CON	IDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C		35			35		
SR+	Positive slew rate	$V_{O(PP)} = \pm 2.3 \text{ V}$		Full range	22			22			V/μs
		$A_{VD} = -1,$ $C_{L} = 100 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 1	25°C		38			38		
SR-	Negative slew rate		3	Full range	22			22			V/μs
	Settling time	$A_{VD} = -1$ , 2-V step,	To 10 mV	25°C		0.25			0.25		
t <sub>s</sub>	Settling time	$R_L = 1 \text{ k}\Omega,$ $C_L = 100 \text{ pF}$	To 1 mV	25 C		0.4			0.4		μs
	Equivalent input noise		f = 10 Hz	25°C		48	85		48	85	nV/√ <del>Hz</del>
V <sub>n</sub>	voltage		f = 10 kHz	25°C		12	17		12	17	IIV/∀⊓Z
,,	Peak-to-peak equiva-	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	0500		6			6		.,
V <sub>N(PP)</sub>	lent input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distor- tion plus noise	$V_{O(PP)} = 5 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C		0.013%			0.013%		
B <sub>1</sub>	Unity-gain bandwidth	$V_{I} = 10 \text{ mV},$ $C_{L} = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		9.4			9.4		MHz
B <sub>OM</sub>	Maximum output-swing bandwidth	$V_{O(PP)} = 4 \text{ V},$ $R_L = 2 \text{ k}\Omega$ ,	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C		2.8			2.8		MHz
фm	Phase margin at unity gain	V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,	$R_L = 2 k\Omega$ , See Figure 2	25°C		56°			56°		

<sup>†</sup> Full range is 0°C to 70°C.

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

	DADAMETED	TEST CO	NDITIONS		Т	LE20720		TL	E2072A	С	UNIT
	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V	Input offeet voltage			25°C		1.1	6		0.7	3.5	m\/
$V_{IO}$	Input offset voltage	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			7.8			5.3	mV
$\alpha_{\text{VIO}}$	Temperature coefficient of input offset voltage	$R_S = 50 \Omega$		Full range		2.4	25		2.4	25	μV/°C
	lowed affect accommons			25°C		6	100		6	100	pА
I <sub>IO</sub>	Input offset current	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			1.4			1.4	nA
	lament bing assument	See Figure 4		25°C		20	175		20	175	pА
I <sub>IB</sub>	Input bias current			Full range			5			5	nA
V	Common-mode input	R <sub>S</sub> = 50 Ω		25°C	15 to –11	15 to –11.9		15 to –11	15 to –11.9		٧
V <sub>ICR</sub>	voltage range	ng = 50 12		Full range	15 to –10.9			15 to -10.9			V
		$I_{O} = -200  \mu A$		25°C	13.8	14.1		13.8	14.1		
		10 = 200 μ/τ		Full range	13.6			13.6			
V <sub>OM+</sub>	Maximum positive peak	$I_O = -2 \text{ mA}$		25°C	13.5	13.9		13.5	13.9		٧
V OIVI +	output voltage swing	10 - 2117		Full range	13.4			13.4			ľ
		$I_0 = -20 \text{ mA}$		25°C	11.5	12.3		11.5	12.3		
		10 = 2011//		Full range	11.5			11.5			
		I <sub>O</sub> = 200 μA		25°C	-13.8	-14.2		-13.8	-14.2		
		10 = 200 μ/τ		Full range	-13.7			-13.7			
$V_{OM-}$	Maximum negative peak	I <sub>O</sub> = 2 mA		25°C	-13.5	-14		-13.5	-14		V
VOM –	output voltage swing	10 – 2 1117		Full range	-13.4			-13.4			
		I <sub>O</sub> = 20 mA		25°C	-11.5	-12.4		-11.5	-12.4		
		10 = 20 111A	_	Full range	-11.5			-11.5			
			$R_L = 600 \Omega$	25°C	80	96		80	96		
			11[ = 000 32	Full range	79			79			
Δ	Large-signal differential	V <sub>O</sub> = ±10 V	$R_L = 2 k\Omega$	25°C	90	109		90	109		dB
$A_{VD}$	voltage amplification	VO = ±10 V	11[ - 2 K32	Full range	89			89			ub.
			$R_L = 10 \text{ k}\Omega$	25°C	95	118		95	118		
			11[ = 10 K22	Full range	94			94			
rį	Input resistance	$V_{IC} = 0$		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
Ci	Input capacitance	V <sub>IC</sub> = 0,	Common mode	25°C		7.5			7.5		pF
	<u> </u>	See Figure 5	Differential	25°C		2.5			2.5		
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
01455	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> mir	١,	25°C	80	98		80	98		
CMRR	rejection ratio	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	79			79			dB
1.	Supply-voltage rejection	$V_{CC\pm} = \pm 5 \text{ V}$	to ±15 V,	25°C	82	99		82	99		, in
k <sub>SVR</sub>	ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ )	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	81			81			dB

<sup>†</sup> 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	TF0T 00	TEST CONDITIONS		TLE2072C			TL	С		
	PARAMETER	IESI CO	NUTTIONS	T <sub>A</sub>	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
	Supply current	V 0	No local	25°C	2.7	3.1	3.9	2.7	3.1	3.9	A
ICC	(both channels)	$V_{O} = 0$ ,	No load	Full range			3.9			3.9	mA
a <sub>x</sub>	Crosstalk attenuation	$V_{IC} = 0$ ,	$R_L = 2 k\Omega$	25°C		120			120		dB
	Object since it as too to some	., .	$V_{ID} = 1 V$	0500	-30	-45		-30	-45		
los	Short-circuit output current	$V_O = 0$	$V_{ID} = -1 V$	25°C	30	48		30	48		mA

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

			IDITIONS		1	ΓLE20720		Т	LE2072A	2	
	PARAMETER	TEST CON	IDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C	28	40		28	40		
SR+	Positive slew rate	$V_{O(PP)} = 10 \text{ V},$	D 0k0	Full range	25			25			V/μs
		$A_{VD} = -1,$ $C_{I} = 100 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 1	25°C	30	45		30	45		
SR-	Negative slew rate		<u> </u>	Full range	25			25			V/μs
+	Settling time	$A_{VD} = -1,$ 10-V step,	To 10 mV	25°C		0.4			0.4		μS
t <sub>s</sub>	Settling time	$R_L = 1 k\Omega$ , $C_L = 100 pF$	To 1 mV	25 0		1.5			1.5		μδ
V <sub>n</sub>	Equivalent input noise		f = 10 Hz	25°C		48	85		48	85	nV/√ <del>Hz</del>
v <sub>n</sub>	voltage		f = 10 kHz	25°C		12	17		12	17	IIV/VIIZ
,,	Peak-to-peak	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	0500		6			6		.,
V <sub>N(PP)</sub>	equivalent input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C		0.008%			0.008%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C	8	10		8	10		MHz
B <sub>OM</sub>	Maximum output-swing bandwidth	$V_{O(PP)} = 20 \text{ V},$ $R_L = 2 \text{ k}\Omega,$	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C	478	637		478	637		kHz
φ <sub>m</sub>	Phase margin at unity gain	$V_{I} = 10 \text{ mV},$ $C_{L} = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C	_	57°	_	_	57°	_	_

<sup>†</sup> Full range is 0°C to 70°C.

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

			NEUTIONO		Т	LE2072I		TL	E2072A	1	
	PARAMETER	IESI CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
v	Innut offeet veltage			25°C		0.9	6		0.65	3.5	m)/
$V_{IO}$	Input offset voltage		$V_{O} = 0$ ,	Full range			9.1			6.4	mV
$\alpha_{\text{VIO}}$	Temperature coefficient of input offset voltage	$R_S = 50 \Omega$ ,		Full range		2.4	25		2.4	25	μV/°C
	love to the standard			25°C		5	100		5	100	pА
I <sub>IO</sub>	Input offset current	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			5			5	nA
	In most hill a summer t	See Figure 4		25°C		15	175		15	175	pА
I <sub>IB</sub>	Input bias current			Full range			10			10	nA
V	Common-mode input	B <b>50</b> O		25°C	5 to –1	5 to –1.9		5 to –1	5 to –1.9		٧
V <sub>ICR</sub>	voltage range	$R_S = 50 \Omega$		Full range	5 to -0.8			5 to -0.8			V
		$I_{O} = -200 \mu\text{A}$		25°C	3.8	4.1		3.8	4.1		
		-10 = 200 μ/τ		Full range	3.7			3.7			
V <sub>OM+</sub>	Maximum positive peak	$I_O = -2 \text{ mA}$		25°C	3.5	3.9		3.5	3.9		V
• OIVI +	output voltage swing	-0 =		Full range	3.4			3.4			
		$I_{O} = -20 \text{ mA}$		25°C	1.5	2.3		1.5	2.3		
		10 = 2011#1		Full range	1.5			1.5			
		I <sub>O</sub> = 200 μA		25°C	-3.8	-4.2		-3.8	-4.2		
		10 = 200 μ/ (		Full range	-3.7			-3.7			
$V_{OM-}$	Maximum negative peak	I <sub>O</sub> = 2 mA		25°C	-3.5	-4.1		-3.5	-4.1		V
* OIVI –	output voltage swing	.0 = 2		Full range	-3.4			-3.4			·
		I <sub>O</sub> = 20 mA		25°C	-1.5	-2.4		-1.5	-2.4		
		10 = 20 11171	,	Full range	-1.5			-1.5			
			$R_L = 600 \Omega$	25°C	80	91		80	91		
			11_ 000 11	Full range	79			79			
$A_{VD}$	Large-signal differential	$V_0 = \pm 2.3 \text{ V}$	$R_L = 2 k\Omega$	25°C	90	100		90	100		dB
, vD	voltage amplification	VO = <u>12</u> .0 V	11 - 2 1/32	Full range	89			89			u <sub>D</sub>
			$R_L = 10 \text{ k}\Omega$	25°C	95	106		95	106		
			11[ = 10 K22	Full range	94			94			
rį	Input resistance	$V_{IC} = 0$		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
Ci	Input capacitance	V <sub>IC</sub> = 0,	Common mode	25°C		11			11		pF
		See Figure 5	Differential	25°C		2.5			2.5		
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
01155	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> mir	١,	25°C	70	89		70	89		.:5
CMRR	rejection ratio	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	68			68			dB
	Supply-voltage rejection	$V_{CC\pm} = \pm 5 \text{ V}$	to ±15 V.	25°C	82	99		82	99		
$k_{SVR}$	ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ )	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			dB

<sup>†</sup> 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)

	DADAMETED	TEOT O	TEST CONDITIONS		TLE2072I			TL	Al .		
	PARAMETER	IESI CO	ONDITIONS	T <sub>A</sub>	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
1	Supply current	V 0	No load	25°C	2.7	2.9	3.9	2.7	2.9	3.9	mA
Icc	(both channels)	$V_{O} = 0$ ,	No load	Full range			3.9			3.9	IIIA
a <sub>x</sub>	Crosstalk attenuation	$V_{IC} = 0$ ,	$R_L = 2 k\Omega$	25°C		120			120		dB
	Chart sive it autout august	V 0	V <sub>ID</sub> = 1 V	0500		-35			-35		A
los	Short-circuit output current	v <sub>O</sub> = 0	$V_{ID} = -1 V$	25°C		45			45		mA

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

						TLE2072I		Т	LE2072A	I	
	PARAMETER	TEST CON	IDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C		35			35		
SR+	Positive slew rate	$V_{O(PP)} = \pm 2.3 \text{ V}$		Full range	20			20			V/μs
		$A_{VD} = -1,$ $C_{L} = 100 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 1	25°C		38			38		
SR-	Negative slew rate		3	Full range	20			20			V/μs
t <sub>s</sub>	Settling time	$A_{VD} = -1$ , 2-V step,	To 10 mV	25°C		0.25			0.25		116
is	Settling time	$R_L = 1 \text{ k}\Omega$ , $C_L = 100 \text{ pF}$	To 1 mV	25 C		0.4			0.4		μs
	Equivalent input noise		f = 10 Hz	25°C		48	85		48	85	nV/√ <del>Hz</del>
V <sub>n</sub>	voltage		f = 10 kHz	25 C		12	17		12	17	IIV/VIIZ
,,	Peak-to-peak	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	0500		6			6		.,
V <sub>N(PP)</sub>	equivalent input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 5 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C		0.013%			0.013%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		9.4			9.4		MHz
B <sub>OM</sub>	Maximum output- swing bandwidth	$V_{O(PP)} = 4 \text{ V},$ $R_L = 2 \text{ k}\Omega$ ,	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C		2.8			2.8		MHz
φ <sub>m</sub>	Phase margin at unity gain	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 kΩ$ , See Figure 2	25°C		56°			56°		

<sup>†</sup> Full range is 40°C to 85°C.

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

	DADAMETED	TEST CONDITIONS		Т	LE2072		TL	E2072A	d .		
	PARAMETER	TEST CO	NUTTIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V	logest offeet valtage			25°C		1.1	6		0.7	3.5	\ <i>(</i>
V <sub>IO</sub>	Input offset voltage		$V_{O} = 0$ ,	Full range			9.1			6.4	mV
$\alpha_{\text{VIO}}$	Temperature coefficient of input offset voltage	$R_S = 50 \Omega$ ,		Full range		2.4	25		2.4	25	μV/°C
	land the offers of a common to			25°C		6	100		6	100	pА
I <sub>IO</sub>	Input offset current	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			5			5	nA
	Input biog gurrent	See Figure 4		25°C		20	175		20	175	pА
I <sub>IB</sub>	Input bias current			Full range			10			10	nA
V	Common-mode input	$R_S = 50 \Omega$		25°C	15 to –11	15 to –11.9		15 to –11	15 to –11.9		٧
V <sub>ICR</sub>	voltage range	ng = 30 12		Full range	15 to –10.8			15 to -10.8			V
		I <sub>O</sub> = -200 μA		25°C	13.8	14.1		13.8	14.1		
		10 = -200 μΑ		Full range	13.7			13.7			
V	Maximum positive peak	I <sub>O</sub> = -2 mA		25°C	13.5	13.9		13.5	13.9		V
V <sub>OM+</sub>	output voltage swing	10 = -2 IIIA		Full range	13.4			13.4			V
		$I_{O} = -20 \text{ mA}$		25°C	11.5	12.3		11.5	12.3		
		10 = -20 IIIA		Full range	11.5			11.5			
		I <sub>O</sub> = 200 μA		25°C	-13.8	-14.2		-13.8	-14.2		
		10 = 200 μΑ		Full range	-13.7			-13.7			
$V_{OM-}$	Maximum negative peak	I <sub>O</sub> = 2 mA		25°C	-13.5	-14		-13.5	-14		V
V OIVI –	output voltage swing	10 = 2 1117 (		Full range	-13.4			-13.4			·
		I <sub>O</sub> = 20 mA		25°C	-11.5	-12.4		-11.5	-12.4		
		10 = 20 11,71	1	Full range	-11.5			-11.5			
			$R_L = 600 \Omega$	25°C	80	96		80	96		
				Full range	79			79			
$A_{VD}$	Large-signal differential	V <sub>O</sub> = ±10 V	$R_L = 2 k\Omega$	25°C	90	109		90	109		dB
· •VD	voltage amplification			Full range	89			89			
			$R_L = 10 \text{ k}\Omega$	25°C	95	118		95	118		
				Full range	94			94			
rį	Input resistance	V <sub>IC</sub> = 0		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
Ci	Input capacitance	V <sub>IC</sub> = 0, See Figure 5	Common mode	25°C		7.5			7.5		pF
		Joe Figure 5	Differential	25°C		2.5			2.5		
Z <sub>0</sub>	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMBB	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> mir		25°C	80	98		80	98		٩D
CMRR	rejection ratio	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	79			79			dB
le .	Supply-voltage rejection	$V_{CC\pm} = \pm 5 \text{ V}$		25°C	82	99		82	99		40
k <sub>SVR</sub>	ratio $(\Delta V_{CC\pm}/\Delta V_{IO})$	$V_{O} = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			dB

<sup>†</sup> Full range is –40°C to 85°C.



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

	PARAMETER	TEST CONDITIONS		_	TLE2072I			TL	VI		
	PARAMETER	IESI CO	MUITIONS	T <sub>A</sub>	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
1	Supply current	$V_{O} = 0$ ,	No load	25°C	2.7	3.1	3.9	2.7	3.1	3.9	mA
Icc	(both channels)	VO = 0,	No load	Full range			3.9			3.9	IIIA
a <sub>x</sub>	Crosstalk attenuation	$V_{IC} = 0$ ,	$R_L = 2 k\Omega$	25°C		120			120		dB
	Chart sive it autout auront	V 0	$V_{ID} = 1 V$	0500	-30	-45		-30	-45		A
los	Short-circuit output current	$V_O = 0$	$V_{ID} = -1 V$	25°C	30	48		30	48		mA

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

						TLE2072I		Т	LE2072A		
1	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C	28	40		28	40		
SR+	Positive slew rate	V <sub>O(PP)</sub> = ±10 V		Full range	22			22			V/μs
		$A_{VD} = -1$ , $C_{L} = 100 \text{ pF}$ ,	$R_L = 2 k\Omega$ , See Figure 1	25°C	30	45		30	45		
SR-	Negative slew rate		, and the second	Full range	22			22			V/μs
	Cattling time	$A_{VD} = -1,$ 10-V step,	To 10 mV	0E°C		0.4			0.4		
t <sub>s</sub>	Settling time	$R_L = 1 k\Omega$ , $C_L = 100 pF$	To 1 mV	25°C		1.5			1.5		μs
V	Equivalent input	$R_S = 20 \Omega$ , f See Figure 3	f = 10 Hz	05°C		48	85		48	85	nV/√ <del>Hz</del>
V <sub>n</sub>	noise voltage		f = 10 kHz	25°C		12	17		12	17	IIV/∀⊓Z
	Peak-to-peak		f = 0 Hz to 10 kHz	0500		6			6		.,
V <sub>N(PP)</sub>	equivalent input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C		0.008%			0.008%		
B <sub>1</sub>	Unity-gain bandwidth	V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,	$R_L = 2 k\Omega$ , See Figure 2	25°C	8	10		8	10		MHz
B <sub>OM</sub>	Maximum output- swing bandwidth	$V_{O(PP)} = 20 \text{ V},$ $R_L = 2 \text{ k}\Omega,$	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C	478	637		478	637		kHz
φ <sub>m</sub>	Phase margin at unity gain	V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,	$R_L = 2 k\Omega$ , See Figure 2	25°C		57°			57°		

<sup>†</sup> 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)

	DADAMETED	TEST OO	NDITIONS		TL	E2072N	1	TL	E2072A	М	LINUT
	PARAMETER	IESI CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V	Input offset voltage			25°C		0.9	6		0.65	3.5	mV
$V_{IO}$	Input offset voltage		$V_{O} = 0$ ,	Full range			10.5			8	mv
$\alpha_{\text{VIO}}$	Temperature coefficient of input offset voltage	$R_S = 50 \Omega$ ,		Full range		2.3	25*		2.3	25*	μV/°C
	Innut offeet europt			25°C		5	100		5	100	pА
I <sub>IO</sub>	Input offset current	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			20			20	nA
1	Input bias current	See Figure 4		25°C		15	175		15	175	pА
I <sub>IB</sub>	input bias current			Full range			60			60	nA
V:	Common-mode input	R <sub>S</sub> = 50 Ω		25°C	5 to –1	5 to –1.9		5 to –1	5 to –1.9		٧
V <sub>ICR</sub>	voltage range	ng = 30 sz		Full range	5 to -0.8			5 to -0.8			V
		I <sub>O</sub> = -200 μA		25°C	3.8	4.1		3.8	4.1		
		10 = -200 μΑ		Full range	3.6			3.6			
V	Maximum positive peak	$I_{O} = -2 \text{ mA}$		25°C	3.5	3.9		3.5	3.9		٧
V <sub>OM+</sub>	output voltage swing	10 = -2 IIIA		Full range	3.3			3.3			V
		In - 20 mA		25°C	1.5	2.3		1.5	2.3		
		$I_0 = -20 \text{ mA}$		Full range	1.4			1.4			
		I <sub>O</sub> = 200 μA		25°C	-3.8	-4.2		-3.8	-4.2		
		10 = 200 μΑ		Full range	-3.6			-3.6			
	Maximum negative peak	I <sub>O</sub> = 2 mA		25°C	-3.5	-4.1		-3.5	-4.1		V
V <sub>OM</sub> -	output voltage swing	10 = 2 IIIA		Full range	-3.3			-3.3			V
		1 20 mA		25°C	-1.5	-2.4		-1.5	-2.4		
		I <sub>O</sub> = 20 mA		Full range	-1.4			-1.4			
			$R_L = 600 \Omega$	25°C	80	91		80	91		
			n[ = 000 sz	Full range	78			78			
Δ	Large-signal differential	$V_{O} = \pm 2.3 \text{ V}$	$R_L = 2 k\Omega$	25°C	90	100		90	100		dB
$A_{VD}$	voltage amplification	VO = 12.5 V	11L - 2 K32	Full range	88			88			uБ
			$R_L = 10 \text{ k}\Omega$	25°C	95	106		95	106		
			H_ = 10 K22	Full range	93			93			
rį	Input resistance	$V_{IC} = 0$		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
Ci	Input capacitance	V <sub>IC</sub> = 0, See Figure 5	Common mode	25°C		11			11		pF
		Jee i iguie 5	Differential	25°C		2.5			2.5		
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMDD	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> min	1,	25°C	70	89		70	89		40
CMRR	rejection ratio	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	68			68			dB

<sup>\*</sup>On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.



<sup>&</sup>lt;sup>†</sup> Full range is –55°C to 125°C.

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

	DADAMETED	TECT OF	NDITIONS		TL	.E2072N	Λ	TL	E2072A	М	LINUT
	PARAMETER	TEST CO	INDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
k <sub>SVR</sub>	Supply-voltage rejection ratio ( $\Delta V_{CC\pm}$ / $\Delta V_{IO}$ )	$V_{CC\pm} = \pm 5 V$ $V_{O} = 0$ ,	to $\pm$ 15 V, R <sub>S</sub> = 50 $\Omega$	Full range	80			80			dB
	Supply current	., .	No local	25°C	2.7	2.9	3.6	2.7	2.9	3.6	
ICC	(both channels)	$V_{O} = 0$ ,	No load	Full range			3.6			3.6	mA
a <sub>x</sub>	Crosstalk attenuation	$V_{IC} = 0$ ,	$R_L = 2 k\Omega$	25°C		120			120		dB
	Short-circuit output	V 0	$V_{ID} = 1 V$	0500		-35			-35		A
los	current	$V_O = 0$	$V_{ID} = -1 V$	25°C		45			45		mA

<sup>†</sup> Full range is -55°C to 125°C.

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

					Т	LE2072N	1	TI	_E2072AN	Л	
	PARAMETER	TEST CON	IDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C		35			35		
SR+	Positive slew rate	$V_{O(PP)} = \pm 2.3 \text{ V}$	/, D	Full range	18*			18*			V/μs
		$A_{VD} = -1$ , $C_{I} = 100 \text{ pF}$ ,	-	25°C		38			38		
SR-	Negative slew rate		J	Full range	18*			18*			V/μs
	Settling time	$A_{VD} = -1,$ 2-V step,	To 10 mV	25°C		0.25			0.25		
t <sub>s</sub>	Settling time	$R_L = 1 \text{ k}\Omega,$ $C_L = 100 \text{ pF}$	To 1 mV	25°C		0.4			0.4		μs
.,	Equivalent input noise		f = 10 Hz	25°C		48	85*		48	85*	nV/√ <del>Hz</del>
V <sub>n</sub>	voltage	f =	f = 10 kHz	25°C		12	17*		12	17*	IIV/VIIZ
.,	Peak-to-peak	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	2502		6			6		.,
V <sub>N(PP)</sub>	equivalent input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 5 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C		0.013%			0.013%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		9.4			9.4		MHz
B <sub>OM</sub>	Maximum output-swing bandwidth	$V_{O(PP)} = 4 \text{ V},$ $R_L = 2 \text{ k}\Omega$ ,	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C		2.8			2.8		MHz
φ <sub>m</sub>	Phase margin at unity gain	$V_{I} = 10 \text{ mV},$ $C_{L} = 25 \text{ pF},$	$R_L = 2 kΩ$ , See Figure 2	25°C		56°			56°		

<sup>\*</sup>On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.



<sup>†</sup> 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)

	DADAMETED		NEUTIONO		T	LE2072N	Л	TL	E2072A	M	
	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V <sub>IO</sub>	Input offset voltage			25°C		1.1	6		0.7	3.5	mV
VIO	input onset voltage		$V_{O} = 0$ ,	Full range			10.5			8	IIIV
$\alpha_{ extsf{VIO}}$	Temperature coefficient of input offset voltage	$R_S = 50 \Omega$		Full range		2.4	25*		2.4	25*	μV/°C
1	Input offset ourrent			25°C		6	100		6	100	pА
I <sub>IO</sub>	Input offset current	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			20			20	nA
L.	Input bias current	See Figure 4		25°C		20	175		20	175	pА
I <sub>IB</sub>	input bias current			Full range			60			60	nA
V	Common-mode input	R <sub>S</sub> = 50 Ω		25°C	15 to –11	15 to –11.9		15 to –11	15 to –11.9		V
V <sub>ICR</sub>	voltage range	ng = 50 12		Full range	15 to –10.8			15 to -10.8			V
		$I_{O} = -200 \mu\text{A}$		25°C	13.8	14.1		13.8	14.1		
		10 = -200 μΑ		Full range	13.6			13.6			
V	Maximum positive peak	$I_O = -2 \text{ mA}$		25°C	13.5	13.9		13.5	13.9		V
V <sub>OM+</sub>	output voltage swing	10 = -2 IIIA		Full range	13.3			13.3			V
		$I_{O} = -20 \text{ mA}$		25°C	11.5	12.3		11.5	12.3		
		10 = -20 IIIA		Full range	11.4			11.4			
		I <sub>O</sub> = 200 μA		25°C	-13.8	-14.2		-13.8	-14.2		
		I <sub>O</sub> = 200 μA		Full range	-13.6			-13.6			
v	Maximum negative peak			25°C	-13.5	-14		-13.5	-14		.,
$V_{OM-}$	output voltage swing	$I_O = 2 \text{ mA}$		Full range	-13.3			-13.3			V
				25°C	-11.5	-12.4		-11.5	-12.4		
		$I_O = 20 \text{ mA}$		Full range	-11.4			-11.4			
			D 000 0	25°C	80	96		80	96		
			$R_L = 600 \Omega$	Full range	78			78			
	Large-signal differential	V 140.V	<b>D</b> 01:0	25°C	90	109		90	109		-ID
$A_{VD}$	voltage amplification	$V_O = \pm 10 \text{ V}$	$R_L = 2 k\Omega$	Full range	89			89			dB
			D 401-0	25°C	95	118		95	118		
			$R_L = 10 \text{ k}\Omega$	Full range	93			93			
rį	Input resistance	V <sub>IC</sub> = 0		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
Ci	Input capacitance	V <sub>IC</sub> = 0, See Figure 5	Common mode	25°C		7.5			7.5		pF
		See Figure 5	Differential	25°C		2.5			2.5		
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		80			80		Ω
CMEE	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> mir	n,	25°C	80	98		80	98		10
CMRR	rejection ratio	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	78			78			dB
	Supply-voltage rejection	V <sub>CC±</sub> = ±5 V t	to ±15 V,	25°C	82	99		82	99		į
k <sub>SVR</sub>	ratio $(\Delta V_{CC\pm}/\Delta V_{IO})$	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			dB

<sup>\*</sup>On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.



<sup>†</sup> Full range is –55°C to 125°C.

#### TLE2072M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = $\pm 15$ V (unless otherwise noted)

	DADAMETED	TEST CONDITIONS T. †		T.1		TLI	E2072A	М			
	PARAMETER	IESI CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
	Supply current	V 0	Nalaad	25°C	2.7	3.1	3.6	2.7	3.1	3.6	А
ICC	(both channels)	$V_{O} = 0$ ,	No load	Full range			3.6			3.6	mA
a <sub>x</sub>	Crosstalk attenuation	$V_{IC} = 0$ ,	$R_L = 2 k\Omega$	25°C		120			120		dB
	Short-circuit output	V 0	$V_{ID} = 1 V$	0500	-30	-45		-30	-45		А
los	current	$V_O = 0$	$V_{ID} = -1 V$	25°C	30	48		30	48		mA

<sup>†</sup> Full range is -55°C to 125°C.

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

				_	Т	LE2072M		T	LE2072AN	Л	
	PARAMETER	TEST CON	IDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C	28	40		28	40		
SR+	Positive slew rate	$V_{O(PP)} = 10 \text{ V},$		Full range	20			20			V/μs
		$R_L = 2 k\Omega$ , See Figure 1	$C_L = 100 pF,$	25°C	30	45		30	45		
SR-	Negative slew rate	3		Full range	20			20			V/μs
	Settling time	$A_{VD} = -1,$ 10-V step,	To 10 mV	25°C		0.4			0.4		
t <sub>s</sub>	Settling time	$R_L = 1 k\Omega$ , $C_L = 100 pF$	To 1 mV	25°C		1.5			1.5		μs
$V_n$	Equivalent input noise		f = 10 Hz	25°C		48	85*		48	85*	nV/√ <del>Hz</del>
v <sub>n</sub>	voltage	L	f = 10 kHz	25 C		12	17*		12	17*	110/ 1112
\ \ '	Peak-to-peak	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	0500		6			6		
V <sub>N(PP)</sub>	equivalent input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C		0.008%			0.008%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C	8*	10		8*	10		MHz
B <sub>OM</sub>	Maximum output-swing bandwidth	$V_{O(PP)} = 20 \text{ V},$ $R_L = 2 \text{ k}\Omega,$	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C	478*	637		478*	637		kHz
фm	Phase margin at unity gain	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		57°			57°		

<sup>\*</sup>On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.



<sup>†</sup> Full range is -55°C to 125°C.

## TLE207x, TLE207xA EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS SLOS181C - FEBRUARY 1997 - REVISED DECEMBER 2009

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

	DADAMETED		CONDITIO	NO.	Т	LE2072\	1	
	PARAMETER	lesi	CONDITIO	NS	MIN	TYP	MAX	UNIT
V <sub>IO</sub>	Input offset voltage	$V_{IC} = 0$ ,	V <sub>O</sub> = 0,	$R_S = 50 \Omega$		1.1	6	mV
I <sub>IO</sub>	Input offset current			0 =: 1		6	100	pА
I <sub>IB</sub>	Input bias current	$V_{IC} = 0,$	$V_{O} = 0$ ,	See Figure 4		20	175	pА
V <sub>ICR</sub>	Common-mode input voltage range	$R_S = 50 \Omega$			15 to –11	15 to 11.9		٧
		$I_O = -200 \mu\text{A}$			13.8	14.1		
V <sub>OM+</sub>	Maximum positive peak output voltage swing	$I_O = -2 \text{ mA}$			13.5	13.9		V
		$I_O = -20 \text{ mA}$			11.5	12.3		
		$I_O = 200  \mu A$			-13.8	-14.2		
$V_{OM-}$	Maximum negative peak output voltage swing	$I_O = 2 \text{ mA}$			-13.5	-14		V
	ou.put rottage offittig	$I_O = 20 \text{ mA}$		-11.5	-12.4			
			$R_{L} = 600$	Ω	80	96		
$A_{VD}$	Large-signal differential voltage amplification	$V_O = \pm 10 \text{ V}$	$R_L = 2 k\Omega$	Ω	90	109		dB
			$R_{L} = 10  \text{k}$	Ω	95	118		
r <sub>i</sub>	Input resistance	$V_{IC} = 0$				10 <sup>12</sup>		Ω
		$V_{IC} = 0$ ,	Common	n mode		7.5		
c <sub>i</sub>	Input capacitance	See Figure 5	Differenti	al		2.5		рF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz				80		Ω
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR}min,$	$V_O = 0$ ,	$R_S = 50 \Omega$	80	98		dB
k <sub>SVR</sub>	Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ )	$V_{CC\pm} = \pm 5 \text{ V to } \pm 1$ $R_S = 50 \Omega$	5 V,	V <sub>O</sub> = 0,	82	99		dB
I <sub>CC</sub>	Supply current (both channels)	$V_O = 0$ ,	No load		2.7	3.1	3.9	mA
	Chart size it autout august	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	V <sub>ID</sub> = 1 V	1	-30	-45		^
los	Short-circuit output current	$V_{O} = 0$ $V_{ID} = -1 \text{ V}$		V	30	48		mA



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

	DA DAME:		TF0T 00	NDITIONO	-+	TL	E2074	C	TL	E2074A	C	
	PARAME	IER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V	Innut offeet w	oltogo			25°C		-1.6	5		-0.5	3	m\/
$V_{IO}$	Input offset vo	oltage		$V_{O} = 0$ ,	Full range			7.1			5.1	mV
$\alpha_{\text{VIO}}$	Temperature of input offset		$R_S = 50 \Omega$		Full range		10.1	30		10.1	30	μV/°C
					25°C		15	100		15	100	4
I <sub>IO</sub>	Input offset cu	urrent	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			1400			1400	pA
	lanced bing according		See Figure 4		25°C		20	175		20	175	^
I <sub>IB</sub>	Input bias cur	rent			Full range			5000			5000	рA
.,	Common-mod	de input	<b>D 50</b> 0		25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9		V
V <sub>ICR</sub>	voltage range	•	$R_S = 50 \Omega$		Full range	5 to -0.9			5 to -0.9			٧
			J 000 A		25°C	3.8	4.1		3.8	4.1		
			$I_{O} = -200 \mu\text{A}$		Full range	3.7			3.7			
\ <i>\</i>	Maximum pos	sitive peak	1 0 m 1		25°C	3.5	3.9		3.5	3.9		V
V <sub>OM+</sub>	output voltage	e swing	$I_0 = -2 \text{ mA}$		Full range	3.4			3.4			V
			1 00 m A		25°C	1.5	2.3		1.5	2.3		
			$I_0 = -20 \text{ mA}$		Full range	1.5			1.5			
			I <sub>O</sub> = 200 μA		25°C	-3.8	-4.2		-3.8	-4.2		
			10 = 200 μΑ		Full range	-3.7			-3.7			
V	Maximum neg		I <sub>O</sub> = 2 mA		25°C	-3.5	-4.1		-3.5	-4.1		V
$V_{OM-}$	output voltage	e swing	10 = 2 IIIA		Full range	-3.4			-3.4			V
			I <sub>O</sub> = 20 mA		25°C	-1.5	-2.4		-1.5	-2.4		
			10 = 20 IIIA	_	Full range	-1.5			-1.5			
				$R_L = 600 \Omega$	25°C	80	91		80	91		
				11[ = 000 32	Full range	79			79			
$A_{VD}$	Large-signal		$V_{O} = \pm 2.3 \text{ V}$	$R_L = 2 k\Omega$	25°C	90	100		90	100		dB
, vD	voltage ampli	fication	VO = ±2.0 V	11[ - 2 1(32	Full range	89			89			ub.
				R <sub>L</sub> = 10 kΩ	25°C	95	106		95	106		
				11[ = 10 1/32	Full range	94			94			
rį	Input resistan	ce	$V_{IC} = 0$		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
0.	Input	Common mode	V 0	See Figure 5	25°C		11			11		pF
Ci	capacitance	Differential	$V_{IC} = 0,$	See Figure 5	25°C		2.5			2.5		þΓ
Z <sub>O</sub>	Open-loop ou	tput impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common mor	de rejection ratio	V <sub>IC</sub> = V <sub>ICR</sub> mir		25°C	70	89		70	89		dB
CIVIRK	COMMINION-MOR	ue rejection ratio	$V_{O} = 0,$	$R_S = 50 \Omega$	Full range	68			68			uD
kov-	Supply-voltag	•	$V_{CC\pm} = \pm 5 \text{ V}$		25°C	82	99		82	99		dB
k <sub>SVR</sub>	ratio (∆V <sub>CC±</sub> /	′ΔV <sub>IO</sub> )	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			ub

<sup>†</sup> Full range is 0°C to 70°C.



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

	DADAMETED	TEOT 00	NDITIONO	T <sub>A</sub> †			TL	E2074A	С				
	PARAMETER	TEST CO	NDITIONS	IAI	MIN	TYP	MAX	MIN	TYP	MAX	UNIT		
	Supply current	V 0	No local	25°C	5.2	6.3	7.5	5.2	6.3	7.5	A		
ICC	(four amplifiers)	$V_{O} = 0$ ,	No load	Full range			7.5			7.5	mA		
	Crosstalk attenuation	$V_{IC} = 0$ ,	$R_L = 2 k\Omega$	25°C		120			120		dB		
	Short-circuit output	V 0	$V_{ID} = 1 V$	0500		-35			-35		A		
IOS	current	$V_O = 0$ $V_{ID} = -1 V$	· Vo = ()	· 1/0 = 0		25°C		45			45		mA

<sup>†</sup> Full range is 0°C to 70°C.

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

					TL	E20740		TL	E2074A	С	
	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C		35			35		
SR+	Positive slew rate	V <sub>O(PP)</sub> = ±2.3 \		Full range	22			22			V/μs
		$A_{VD} = -1,$ $C_{L} = 100 \text{ pF},$	$H_L = 2 \text{ K}\Omega$ , See Figure 1	25°C		38			38		
SR-	Negative slew rate	,,		Full range	22			22			V/μs
+	Settling time	$A_{VD} = -1,$ 2-V step,	To 10 mV	25°C		0.25			0.25		
t <sub>s</sub>	Settling time	$R_L = 1 \text{ k}\Omega,$ $C_L = 100 \text{ pF}$	To 1 mV	25 0		0.4			0.4		μS
V	Equivalent input noise		f = 10 Hz	25°C		48	85		48	85	nV/√ <del>Hz</del>
V <sub>n</sub>	voltage		f = 10 kHz	25 C		12	17		12	17	110/ 1112
V	Peak-to-peak equivalent	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	- 25°C		6			6		μV
V <sub>N(PP)</sub>	input noise voltage		f = 0.1Hz to 10 Hz	25 0		0.6			0.6		μν
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 5 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C	0	.013%		O	0.013%		
B <sub>1</sub>	Unity-gain bandwidth	$V_{I} = 10 \text{ mV},$ $C_{L} = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		9.4			9.4		MHz
B <sub>OM</sub>	Maximum output-swing bandwidth	$V_{O(PP)} = 4 \text{ V},$ $R_L = 2 \text{ k}\Omega$ ,	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C		2.8			2.8		MHz
φ <sub>m</sub>	Phase margin at unity gain	$V_{I} = 10 \text{ mV},$ $C_{L} = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		56°			56°		

<sup>&</sup>lt;sup>†</sup> 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)

	DADAMETED		TECT OO	NDITIONS	<b>T</b> +	T	LE20740	)	TL	E2074A	C	LINUT
	PARAMETER		TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V	Innut offeet veltee				25°C		-1.6	5		-0.5	3	m\/
$V_{IO}$	Input offset voltag	je		$V_{O} = 0$ ,	Full range			7.1			5.1	mV
$\alpha_{\text{VIO}}$	Temperature coef of input offset volt		$R_S = 50 \Omega$		Full range		10.1	30		10.1	30	μV/°C
	land the ffeet and a				25°C		15	100		15	100	4
I <sub>IO</sub>	Input offset currer	π	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			1400			1400	pΑ
	land this a summer		See Figure 4		25°C		25	175		25	175	A
I <sub>IB</sub>	Input bias current				Full range			5000			5000	рA
	Common-mode ir	nput			25°C	15 to –11	15 to -11.9		15 to –11	15 to -11.9		
V <sub>ICR</sub>	voltage range	•	$R_S = 50 \Omega$		Full range	15 to –10.9			15 to -10.9			V
					25°C	13.8	14.1		13.8	14.1		
			$I_{O} = -200 \mu\text{A}$		Full range	13.7			13.7			
	Maximum positive	e peak			25°C	13.5	13.9		13.5	13.9		
$V_{OM+}$	output voltage sw		$I_0 = -2 \text{ mA}$		Full range	13.4			13.4			V
					25°C	11.5	12.3		11.5	12.3		
			$I_O = -20 \text{ mA}$		Full range	11.5			11.5			
					25°C	-13.8	-14.2		-13.8	-14.2		
			$I_{O} = 200 \mu\text{A}$		Full range	-13.7			-13.7			
	Maximum negativ	e peak			25°C	-13.7	-14		-13.7	-14		
$V_{OM-}$	output voltage sw		$I_O = 2 \text{ mA}$		Full range	-13.6			-13.6			V
					25°C	-11.5	-12.4		-11.5	-12.4		
			$I_O = 20 \text{ mA}$		Full range	-11.5			-11.5			
					25°C	80	96		80	96		
				$R_L = 600 \Omega$	Full range	79			79			
	Large-signal diffe	rential			25°C	90	109		90	109		
$A_{VD}$	voltage amplificat		$V_0 = \pm 10 \text{ V}$	$R_L = 2 k\Omega$	Full range	89			89			dB
					25°C	95	118		95	118		
				$R_L = 10 \text{ k}\Omega$	Full range	94			94			
r <sub>i</sub>	Input resistance		V <sub>IC</sub> = 0		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
c <sub>i</sub>	Input capacitance	Common mode	V <sub>IC</sub> = 0,	See Figure 5	25°C		7.5			7.5		pF
	сараснансе	Differential			25°C		2.5			2.5		
Z <sub>O</sub>	Open-loop output	impedance	f = 1 MHz		25°C		80			80		Ω
	Common-mode		V <sub>IC</sub> = V <sub>ICR</sub> mir	١,	25°C	80	98		80	98		
CMRR	rejection ratio		$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	79			79			dB
	Supply-voltage re	jection ratio	$V_{CC\pm} = \pm 5 \text{ V}$	to ± 15 V,	25°C	82	99		82	99		
k <sub>SVR</sub>	$(\Delta V_{CC\pm}/\Delta V_{IO})$	-	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	81			81			dB

<sup>†</sup> Full range is 0°C to 70°C.



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

PARAMETER		TEST CONDITIONS		T <sub>A</sub> †	TLE2074C			TLE2074AC			
					MIN	TYP	MAX	MIN	TYP	MAX	UNIT
I <sub>CC</sub>	Supply current (four amplifiers)	V <sub>O</sub> = 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	$V_{IC} = 0$ ,	$R_L = 2 k\Omega$	25°C		120			120		dB
I <sub>OS</sub>	Short-circuit output current	V <sub>O</sub> = 0	$V_{ID} = 1 V$	25°C	-30	-45		-30	-45		mA
			$V_{ID} = -1 V$		30	48		30	48		

<sup>†</sup> Full range is 0°C to 70°C.

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

	DADAMETED				TLE2074C			TLE2074AC				
PARAMETER		TEST CONDITIONS		T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT	
	Positive slew rate	$V_{O(PP)}$ = 10 V, R <sub>L</sub> = 2 kΩ, See Figure 1	$A_{VD} = -1$ , $C_L = 100 pF$ ,	25°C	25	40		25	40			
SR+				Full range	22			22			V/μs	
				25°C	30	45		30	45		V/μs	
SR-	Negative slew rate			Full range	25			25				
t <sub>s</sub>	Settling time	$A_{VD} = -1,$ 10-V step,	To 10 mV	25°C		0.4			0.4		με	
		$R_L = 1 k\Omega$ , $C_L = 100 pF$	To 1 mV			1.5			1.5			
V	Equivalent input noise voltage	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz	25°C		48	85		48	85	nV/√ <del>Hz</del>	
$V_n$			f = 10 kHz			12	17		12	17		
V	Peak-to-peak equivalent input noise voltage		f = 10 Hz to 10 kHz	- 25°C		6			6		μV	
$V_{N(PP)}$			f = 0.1 Hz to 10 Hz			0.6			0.6		μν	
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>	
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C	0.008%		0.008%					
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C	8	10		8	10		MHz	
B <sub>OM</sub>	Maximum output-swing bandwidth	$V_{O(PP)} = 20 \text{ V},$ $R_L = 2 \text{ k}\Omega,$	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C	478	637		478	637		kHz	
φ <sub>m</sub>	Phase margin at unity gain	V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,	$R_L = 2 \text{ k}\Omega$ , See Figure 2	25°C	_	57°	_	_	57°	_		

<sup>†</sup> 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)

	DADAME	ren.	TEST OO	NDITIONS	T +	Т	LE2074	I	TL	E2074	AI .	LINUT
	PARAMET	IEK	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V	Innut offeet us	ltogo			25°C		-1.6	5		-0.5	3	m\/
$V_{IO}$	Input offset vo	itage		$V_{O} = 0$ ,	Full range			9			7	mV
$\alpha_{\text{VIO}}$	Temperature of input offset		$R_S = 50 \Omega$		Full range		10.1	30		10.1	30	μV/°C
	Innut offeet ou	wo mt			25°C		15	100		15	100	pА
I <sub>IO</sub>	Input offset cu	rrent	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			5			5	nA
1	Innut biog our	ont	See Figure 4		25°C		20	175		20	175	pА
I <sub>IB</sub>	Input bias curr	ent			Full range			10			10	nA
v	Common-mod	e input	B 50.0		25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9		٧
V <sub>ICR</sub>	voltage range		$R_S = 50 \Omega$		Full range	5 to -0.8			5 to -0.8			V
					25°C	3.8	4.1		3.8	4.1		
			$I_{O} = -200 \mu\text{A}$		Full range	3.7			3.7			
V	Maximum positive peak output voltage swing	la = 2 mA		25°C	3.5	3.9		3.5	3.9		V	
V <sub>OM+</sub>	output voltage	swing	$I_0 = -2 \text{ mA}$		Full range	3.4			3.4			V
			$I_{O} = -20 \text{ mA}$		25°C	1.5	2.3		1.5	2.3		
			10 = -20 IIIA		Full range	1.5			1.5			
			I <sub>O</sub> = 200 μA		25°C	-3.8	-4.2		-3.8	-4.2		
			10 = 200 μΑ		Full range	-3.7			-3.7			
$V_{OM-}$	Maximum neg		I <sub>O</sub> = 2 mA		25°C	-3.5	-4.1		-3.5	-4.1		٧
VOM –	output voltage	swing	10 – 2 1117		Full range	-3.4			-3.4			V
			I <sub>O</sub> = 20 mA		25°C	-1.5	-2.4		-1.5	-2.4		
			10 - 20 111/1	1	Full range	-1.5			-1.5			
				$R_L = 600 \Omega$	25°C	80	91		80	91		
					Full range	79			79			
A <sub>VD</sub>	Large-signal d		V <sub>O</sub> = ±2.3 V	$R_1 = 2 k\Omega$	25°C	90	100		90	100		dB
- VD	voltage amplifi	cation			Full range	89			89			
				$R_L = 10 \text{ k}\Omega$	25°C	95	106		95	106		
					Full range	94			94			
rį	Input resistand	e	V <sub>IC</sub> = 0		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
C.	Input	Common mode	V <sub>IC</sub> = 0,	See Figure 5	25°C		11			11		pF
c <sub>i</sub>	capacitance	Differential	VIC - 0,	Jee i igule 5	25°C		2.5			2.5		ρı
z <sub>o</sub>	Open-loop out	put impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	RR Common-mode rejection ratio	$V_{IC} = V_{ICR}mir$		25°C	70	89		70	89		dB	
OIVII II 1	John Mon-1110u	o rejection ratio	$V_{O} = 0,$	$R_S = 50 \Omega$	Full range	68			68			UD
keys	,	e rejection ratio	$V_{CC\pm} = \pm 5 \text{ V}$		25°C	82	99		82	99		dB
k <sub>SVR</sub>	$(\Delta V_{CC\pm}/\Delta V_{IO})$		$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			נ

<sup>†</sup> Full range is -40°C to 85°C.



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

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

	PARAMETER	TEOT OF	NIDITIONS	- +	Т	LE2074I		TL	E2074A	.l	
	PARAMETER	TEST CC	ONDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
	Supply current	\	Nalaad	25°C	5.2	6.3	7.5	5.2	6.3	7.5	A
ICC	(four amplifiers)	$V_{O} = 0$ ,	No load	Full range			7.5			7.5	mA
	Crosstalk attenuation	$V_{IC} = 0$ ,	$R_L = 2 k\Omega$	25°C		120			120		dB
	Object since it as to a to a second	., .	V <sub>ID</sub> = 1 V	0500		-35			-35		
los	Short-circuit output current	$V_O = 0$	$V_{ID} = -1 V$	25°C		45			45		mA

<sup>†</sup> Full range is -40°C to 85°C.

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

					Т	LE2074	l	TL	E2074A	.I	
	PARAMETER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C		35			35		
SR+	Positive slew rate	$V_{O(PP)} = \pm 2.3  \text{V}$	/, D 01:0	Full range	20			20			V/μs
		$A_{VD} = -1,$ $C_{I} = 100 \text{ pF},$		25°C		38			38		
SR-	Negative slew rate	,	3	Full range	20			20			V/μs
	Settling time	$H_L = 1 \text{ K}\Omega$ , $T_{0.1} \text{ m}V$	25°C		0.25			0.25			
t <sub>s</sub>	Settling time	$R_L = 1 \text{ k}\Omega,$ $C_L = 100 \text{ pF}$	To 1 mV	25 C		0.4			0.4		μs
.,	Equivalent input noise		f = 10 Hz	25°C		48	85		48	85	nV/√ <del>Hz</del>
V <sub>n</sub>	voltage	f = 10 kHz	25°C		12	17		12	17	IIV/∀⊓Z	
l <sub>v</sub>	Peak-to-peak equivalent	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	25°C		6			6		μV
V <sub>N(PP)</sub>	input noise voltage		f = 0.1 Hz to 10 Hz	25 C		0.6			0.6		μν
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 5 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C	0	.013%		0	.013%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		9.4			9.4		MHz
ВОМ	Maximum output-swing bandwidth	$V_{O(PP)} = 4 \text{ V},$ $R_L = 2 \text{ k}\Omega$ ,	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C		2.8			2.8		MHz
φ <sub>m</sub>	Phase margin at unity gain	$V_{I} = 10 \text{ mV},$ $C_{L} = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		56°			56°		

<sup>&</sup>lt;sup>†</sup> 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)

	DADAMETE	<u> </u>	TEST OF	NOTIONS	<b>-</b> +	Т	LE2074		TI	E2074A	NI .	LINUT
	PARAMETE	н	IESI CC	ONDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
v	Innut offeet velt				25°C		-1.6	5		-0.5	3	m\/
$V_{IO}$	Input offset volt	age	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			9			7	mV
$\alpha_{VIO}$	Temperature co		$R_S = 50 \Omega$		Full range		10.1	30		10.1	30	μV/°C
	land the standard				25°C		15	100		15	100	pА
I <sub>IO</sub>	Input offset cur	rent	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			5			5	nA
	lance Albina account		See Figure 4		25°C		25	175		25	175	pА
I <sub>IB</sub>	Input bias curre	ent			Full range			10			10	nA
	Common-mode	e input			25°C	15 to –11	15 to -11.9		15 to –11	15 to -11.9		
V <sub>ICR</sub>	ICR voltage range	<b></b>	$R_S = 50 \Omega$		Full range	15 to -10.8			15 to -10.8			V
					25°C	13.8	14.1		13.8	14.1		
			$I_{O} = -200 \mu\text{A}$		Full range	13.7			13.7			
	Maximum positive peak  OM+ output voltage swing			25°C	13.5	13.9		13.5	13.9			
V <sub>OM+</sub>		$I_O = -2 \text{ mA}$		Full range	13.4			13.4			V	
					25°C	11.5	12.3		11.5	12.3		
			$I_0 = -20 \text{ mA}$		Full range	11.5			11.5			
					25°C	-13.8	-14.2		-13.8	-14.2		
			$I_{O} = 200  \mu A$		Full range	-13.7			-13.7			
	Maximum nega	itive peak			25°C	-13.5	-14		-13.5	-14		
$V_{OM-}$	output voltage		$I_O = 2 \text{ mA}$		Full range	-13.4			-13.4			V
					25°C	-11.5	-12.4		-11.5	-12.4		
			$I_O = 20 \text{ mA}$		Full range	-11.5			-11.5			
					25°C	80	96		80	96		
				$R_L = 600 \Omega$	Full range	79			79			
	Large-signal di	fferential			25°C	90	109		90	109		
$A_{VD}$	voltage amplific		$V_0 = \pm 10 \text{ V}$	$R_L = 2 k\Omega$	Full range	89			89			dB
					25°C	95	118		95	118		
				$R_L = 10 \text{ k}\Omega$	Full range	94			94			
r <sub>i</sub>	Input resistance	е	V <sub>IC</sub> = 0	•	25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
c <sub>i</sub>	Input	Common mode	V <sub>IC</sub> = 0,	See Figure 5	25°C		7.5			7.5		рF
•	capacitance	Differential			25°C		2.5			2.5		
z <sub>o</sub>	Open-loop outpimpedance	out	f = 1 MHz		25°C		80			80		Ω
CMDD	Common-mode	)	V <sub>IC</sub> = V <sub>ICR</sub> min,	,	25°C	80	98		80	98		40
CMRR	rejection ratio		$V_{O} = 0$ ,	$R_S = 50 \Omega$	Full range	79			79			dB
ı.	Supply-voltage	rejection	$V_{CC\pm} = \pm 5 \text{ V t}$	o ± 15 V,	25°C	82	99		82	99		-10
k <sub>SVR</sub>		$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	80			80		_	dB	

<sup>†</sup> Full range is –40°C to 85°C.



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

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

	PARAMETER	TEOT 00	NIDITIONO	- +	Т	LE2074I		TL	.E2074A	1	
	PARAMETER	TEST CC	ONDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
I <sub>CC</sub>	Supply current	V 0	Nalaad	25°C	5.2	6.5	7.5	5.2	6.5	7.5	A
	(four amplifiers)	$V_{O} = 0$ ,	No load	Full range			7.5			7.5	mA
	Crosstalk attenuation	$V_{IC} = 0$ ,	$R_L = 2 k\Omega$	25°C		120			120		dB
	Short-circuit output	., .	V <sub>ID</sub> = 1 V	0500	-30	-45		-30	-45		4
los	current	$V_{O} = 0$	$V_{ID} = -1 V$	25°C	30	48		30	48		mA

<sup>†</sup> Full range is -40°C to 85°C.

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

	DADAMETED		IDITIONS		T	LE2074I		TL	.E2074A	VI	
	PARAMETER	TEST CON	IDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C	25	40		25	40		
SR+	Positive slew rate	$V_{O(PP)} = \pm 10 \text{ V},$		Full range	19			19			V/μs
		$A_{VD} = -1,$ $C_{L} = 100 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 1	25°C	30	45		30	45		
SR-	Negative slew rate		3	Full range	22			22			V/μs
t <sub>s</sub>	Settling time	$A_{VD} = -1,$ 10-V step,	To 10 mV	25°C		0.4			0.4		μs
's	Settling time	$ \begin{array}{c c} R_L = 1  k\Omega, \\ C_L = 100  pF \end{array} \qquad \begin{array}{c} To  1  mV \\ \hline \\ f = 10  Hz \end{array} $		25 0		1.5			1.5		μο
\ <u>'</u>	Equivalent input noise		f = 10 Hz	25°C		48	85		48	85	nV/√ <del>Hz</del>
V <sub>n</sub>	voltage	f	f = 10 kHz	25°C		12	17		12	17	IIV/VIIZ
V	Peak-to-peak equivalent	<u> </u>	f = 10 Hz to 10 kHz	25°C		6			6		μV
V <sub>N(PP)</sub>	input noise voltage		f = 0.1 Hz to 10 Hz	25 C		0.6			0.6		μν
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20 \text{ V},$ $f = 1 \text{ kHz},$ $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_{L} = 2 k\Omega,$	25°C	0	.008%		0	.008%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C	8	10		8	10		MHz
B <sub>OM</sub>	Maximum output-swing bandwidth	$V_{O(PP)} = 20 \text{ V},$ $R_L = 2 \text{ k}\Omega,$	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C	478	637		478	637		kHz
φ <sub>m</sub>	Phase margin at unity gain	V <sub>1</sub> = 10 mV R <sub>2</sub> = 2 kO		25°C	_	57°	_	_	57°	_	

<sup>†</sup> Full range is -40°C to 85°C.



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

	PARAMETER		NDITIONS.		TL	E2074	VI	TL	E2074A	M		
	PARAMET	TER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V	looset affactive	lt =			25°C		-1.6	5		-0.5	3	\/
$V_{IO}$	Input offset vo	ıtage	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			10.5			8.5	mV
$\alpha_{\text{VIO}}$	Temperature of input offset		$R_S = 50\Omega$		Full range		10.1	30 <sup>‡</sup>		10.1	30 <sup>‡</sup>	μV/°C
	l				25°C		15	100		15	100	pА
I <sub>IO</sub>	Input offset cu	rrent	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			20			20	nA
	Innut biog gur	ont.	See Figure 4		25°C		20	175		20	175	pА
I <sub>IB</sub>	Input bias curr	ent			Full range			60			60	nA
.,	Common-mod	e input	<b>D 50</b> 0		25°C	5 to -1	5 to -1.9		5 to -1	5 to -1.9		.,
V <sub>ICR</sub>	voltage range		$R_S = 50 \Omega$		Full range	5 to -0.8			5 to -0.8			>
					25°C	3.8	4.1		3.8	4.1		
			$I_{O} = -200 \mu\text{A}$		Full range	3.6			3.6			
V	Maximum positive peak output voltage swing				25°C	3.5	3.9		3.5	3.9		V
V <sub>OM+</sub>	output voltage	swing	$I_0 = -2 \text{ mA}$		Full range	3.3			3.3			V
			J 00 m A		25°C	1.5	2.3		1.5	2.3		
			$I_O = -20 \text{ mA}$		Full range	1.4			1.4			
			I <sub>O</sub> = 200 μA		25°C	-3.8	-4.2		-3.8	-4.2		
			10 = 200 μΑ		Full range	-3.6			-3.6			
V	Maximum neg		I <sub>O</sub> = 2 mA		25°C	-3.5	-4.1		-3.5	-4.1		V
$V_{OM-}$	output voltage	swing	10 - 2 111A		Full range	-3.3			-3.3			V
			I <sub>O</sub> = 20 mA		25°C	-1.5	-2.4		-1.5	-2.4		
			10 = 20 IIIA		Full range	-1.4			-1.4			
				$R_L = 600 \Omega$	25°C	80	91		80	91		
				11[ = 000 52	Full range	78			78			
Δ	Large-signal d		$V_{O} = \pm 2.3 \text{ V}$	$R_L = 2 k\Omega$	25°C	90	100		90	100		dB
$A_{VD}$	voltage amplif	ication	VO = ±2.5 V	11L - 2 KS2	Full range	88			88			uБ
				$R_L = 10 \text{ k}\Omega$	25°C	95	106		95	106		
				HL = 10 K22	Full range	93			93			
rį	Input resistand	ce	$V_{IC} = 0$		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
	Input	Common mode	., .	O Fi 5	25°C		11			11		
c <sub>i</sub>	capacitance	Differential	$V_{IC} = 0$ ,	See Figure 5	25°C		2.5			2.5		pF
Z <sub>0</sub>	Open-loop out	put impedance	f = 1 MHz		25°C		80			80		Ω
CMRR	Common was	lo rojection roti-	V <sub>IC</sub> = V <sub>ICR</sub> min	,	25°C	70	89		70	89		dB
CIVIRR	Common-mod	le rejection ratio	$V_{O} = 0,$	$R_S = 50 \Omega$	Full range	68			68			uB
		e rejection ratio	$V_{CC\pm} = \pm 5 \text{ V t}$		25°C	82	99		82	99		٩Đ
k <sub>SVR</sub>	$(\Delta V_{CC\pm}/\Delta V_{IO})$		$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			dB

<sup>†</sup> Full range is –55°C to 125°C.



<sup>&</sup>lt;sup>‡</sup> On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

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

SLOS181C - FEBRUARY 1997 - REVISED DECEMBER 2009

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

	DADAMETED	TEOT 00	NDITIONO	- +	TL	E2074	M	TL	E2074A	M	
	PARAMETER	IESI CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
	Supply current	V 0	Nalaad	25°C	5.2	6.3	7.5	5.2	6.3	7.5	A
ICC	(four amplifiers)	$V_{O} = 0$ ,	No load	Full range			7.5			7.5	mA
	Crosstalk attenuation	$V_{IC} = 0$ ,	$R_L = 2 k\Omega$	25°C		120			120		dB
	Object size it so to describe		V <sub>ID</sub> = 1 V	0500		-35			-35		4
IOS	Short-circuit output current	$V_O = 0$	$V_{ID} = -1 V$	25°C		45			45		mA

<sup>†</sup> Full range is –55°C to 125°C.

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

				- +	T	LE2074N	Л	TLI	E2074AI	M	
	PARAMETER	TEST CON	IDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C		35			35		
SR+	Positive slew rate	$V_{O(PP)} = \pm 2.3 \text{ V}$		Full range	18 <sup>‡</sup>			18 <sup>‡</sup>			V/μs
		$A_{VD} = -1,$ $C_{L} = 100 \text{ pF},$	See Figure 1	25°C		38			38		
SR-	Negative slew rate	12 11 7	<b>J</b>	Full range	18 <sup>‡</sup>			18 <sup>‡</sup>			V/μs
•	Settling time			25°C		0.25			0.25		
t <sub>s</sub>	Settling time			25 C		0.4			0.4		μs
	Equivalent input noise			25°C		48	85 <sup>‡</sup>		48	85 <sup>‡</sup>	nV/√ <del>Hz</del>
V <sub>n</sub>	voltage	f = 10	f = 10 kHz	25 C		12	17 <sup>‡</sup>		12	17 <sup>‡</sup>	IIV/ VIIZ
	Peak-to-peak equivalent	$R_S = 20 \Omega$ , $f = 1$	f = 10 Hz to 10 kHz	0500		6			6		.,
V <sub>N(PP)</sub>	input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
In	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 5 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C	(	).013%		0	.013%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		9.4			9.4		MHz
B <sub>OM</sub>	Maximum output-swing bandwidth	$V_{O(PP)} = 4 \text{ V},$ $R_L = 2 \text{ k}\Omega,$	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C		2.8			2.8		MHz
f <sub>m</sub>	Phase margin at unity gain	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C		56°			56°		

<sup>†</sup> Full range is -55°C to 125°C.



<sup>&</sup>lt;sup>‡</sup> On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

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

						TI	_E2074I	И	TL	E2074A	M	
	PARAME	TER	TEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
V	lanut affact	-14			25°C		-1.6	5		-0.5	3	\/
$V_{IO}$	Input offset vo	ortage	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			10.5			8.5	mV
$\alpha_{\text{VIO}}$	Temperature of input offset		$R_S = 50 \Omega$		Full range		10.1	30 <sup>‡</sup>		10.1	30 <sup>‡</sup>	μV/°C
					25°C		15	100		15	100	pА
I <sub>IO</sub>	Input offset cu	urrent	$V_{IC} = 0$ ,	$V_{O} = 0$ ,	Full range			20			20	nA
	land the second		See Figure 4		25°C		25	175		25	175	pА
I <sub>IB</sub>	Input bias cur	rent			Full range			60			60	nA
	Common-moo	de input			25°C	15 to –11	15 to -11.9		15 to –11	15 to -11.9		
V <sub>ICR</sub>	voltage range	·	$R_S = 50 \Omega$		Full range	15 to -10.8			15 to -10.8			V
					25°C	13.8	14.1		13.8	14.1		
			$I_{O} = -200 \mu\text{A}$		Full range	13.6			13.6			
l.,	Maximum pos	sitive peak			25°C	13.5	13.9		13.5	13.9		.,
V <sub>OM+</sub>	output voltage	e swing	$I_0 = -2 \text{ mA}$		Full range	13.3			13.3			V
					25°C	11.5	12.3		11.5	12.3		
			$I_O = -20 \text{ mA}$		Full range	11.4			11.4			
			J 000 A		25°C	-13.8	-14.2		-13.8	-14.2		
			I <sub>O</sub> = 200 μA		Full range	-13.6			-13.6			
.,	Maximum neg	gative peak			25°C	-13.5	-14		-13.5	-14		V
$V_{OM-}$	output voltage	e swing	$I_O = 2 \text{ mA}$		Full range	-13.3			-13.3			V
			1 00 mA		25°C	-11.5	-12.4		-11.5	-12.4		
			$I_O = 20 \text{ mA}$		Full range	-11.4			-11.4			
				B 600 O	25°C	80	96		80	96		
				$R_L = 600 \Omega$	Full range	78			78			
_	Large-signal	differential	V 110 V	D 0k0	25°C	90	109		90	109		dB
$A_{VD}$	voltage ampli	fication	$V_{O} = \pm 10 \text{ V}$	$R_L = 2 k\Omega$	Full range	88			88			uБ
				D 1010	25°C	95	118		95	118		
				$R_L = 10 \text{ k}\Omega$	Full range	93			93			
ri	Input resistan	се	V <sub>IC</sub> = 0		25°C		10 <sup>12</sup>			10 <sup>12</sup>		Ω
	Input	Common mode			25°C		7.5			7.5		_
Ci	capacitance	Differential	$V_{IC} = 0$ ,	See Figure 5	25°C		2.5			2.5		pF
z <sub>o</sub>	Open-loop ou	tput impedance	f = 1 MHz		25°C		80			80		Ω
	_		V <sub>IC</sub> = V <sub>ICR</sub> mir	າ,	25°C	80	98		80	98		
CMRR	Common-mod	de rejection ratio	$V_O = 0$ ,	$R_S = 50 \Omega$	Full range	78			78			dB
	Supply-voltag	e rejection	$V_{CC\pm} = \pm 5 \text{ V}$	to ±15 V,	25°C	82	99		82	99		
k <sub>SVR</sub>	ratio (ΔV <sub>CC±</sub> /		$V_{O} = 0$ ,	$R_S = 50 \Omega$	Full range	80			80			dB

<sup>†</sup> Full range is –55°C to 125°C.



<sup>&</sup>lt;sup>‡</sup> On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

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

SLOS181C - FEBRUARY 1997 - REVISED DECEMBER 2009

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

	DADAMETED	TEOT 001	NDITIONO	- +	TL	E2074	И	TL	E2074A	М	
	PARAMETER	IEST CO	NDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
	Supply current	V 0	Nalaad	25°C	5.2	6.5	7.5	5.2	6.5	7.5	A
I <sub>CC</sub>	(four amplifiers)	$V_{O} = 0$ ,	No load	Full range			7.5			7.5	mA
	Crosstalk attenuation	$V_{IC} = 0$ ,	$R_L = 2 k\Omega$	25°C		120			120		dB
	Oh aut aine iit autuu ta auurant	V 0	$V_{ID} = 1 V$	0500	-30	-45		-30	-45		A
IOS	Short-circuit output current	$V_O = 0$	$V_{ID} = -1 V$	25°C	30	48		30	48		mA

<sup>&</sup>lt;sup>†</sup> Full range is -55°C to 125°C.

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

				- +	TL	E2074N	Л	TL	E2074A	M	
	PARAMETER	TEST CON	IDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C	25	40		25	40		
SR+	Positive slew rate	$V_{O(PP)} = 10 \text{ V},$		Full range	17			17			V/μs
		$R_L = 2 kΩ$ , See Figure 1	C <sub>L</sub> = 100 pr,	25°C	30	45		30	45		
SR-	Negative slew rate	July 1941		Full range	20			20			V/μs
t <sub>s</sub>	Settling time	$A_{VD} = -1,$ 10-V step,	To 10 mV	25°C		0.4			0.4		μs
is	Setting time	$R_L = 1 k\Omega$ , $C_L = 100 pF$	To 1 mV			1.5			1.5		μο
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Equivalent input noise		f = 10 Hz	ر دور	3 48	85 <sup>‡</sup>		48	85 <sup>‡</sup>	nV/√ <del>Hz</del>	
V <sub>n</sub>	voltage		f = 10 kHz	25°C		12	17 <sup>‡</sup>		12	17 <sup>‡</sup>	IIV/√⊓Z
V	Peak-to-peak equivalent	$R_S = 20 \Omega$ , See Figure 3	f = 10 Hz to 10 kHz	0500		6			6		.,
V <sub>N(PP)</sub>	input noise voltage		f = 0.1 Hz to 10 Hz	25°C		0.6			0.6		μV
I <sub>n</sub>	Equivalent input noise current	V <sub>IC</sub> = 0,	f = 10 kHz	25°C		2.8			2.8		fA/√ <del>Hz</del>
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20 \text{ V},$ f = 1  kHz, $R_S = 25 \Omega$	$A_{VD} = 10,$ $R_L = 2 \text{ k}\Omega,$	25°C				0	.008%		
B <sub>1</sub>	Unity-gain bandwidth	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 k\Omega$ , See Figure 2	25°C	8 <sup>‡</sup>	10		8 <sup>‡</sup>	10		MHz
ВОМ	Maximum output-swing bandwidth	$V_{O(PP)} = 20 \text{ V},$ $R_L = 2 \text{ k}\Omega,$	$A_{VD} = -1,$ $C_{L} = 25 \text{ pF}$	25°C	478 <sup>‡</sup>	637		478 <sup>‡</sup>	637		kHz
фm	Phase margin at unity gain	$V_I = 10 \text{ mV},$ $C_L = 25 \text{ pF},$	$R_L = 2 \text{ k}\Omega$ , See Figure 2	25°C		57°	_	_	57°	_	

<sup>&</sup>lt;sup>†</sup> Full range is –55°C to 125°C.

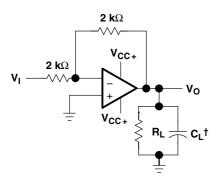


<sup>&</sup>lt;sup>‡</sup> On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

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

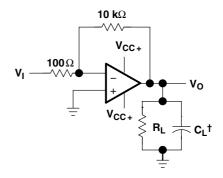
	PARAMETER	TEST OF	TEST CONDITIONS			TLE2074Y				
	PARAMETER		lesi co	ONDITIONS	MIN	TYP	MAX	UNIT		
V <sub>IO</sub>	Input offset voltage		$V_{IC} = 0,$ $R_S = 50 \Omega$	$V_O = 0$ ,			5	mV		
I <sub>IO</sub>	Input offset current		$V_{IC} = 0$ ,	V <sub>O</sub> = 0,		15	100	pА		
I <sub>IB</sub>	Input bias current		See Figure 4			25	175	pА		
V <sub>ICR</sub>	Common-mode input voltage range		R <sub>S</sub> = 50 Ω		15 to –11	15 to 11.9		٧		
			$I_{O} = -200  \mu A$		13.8	14.1				
$V_{OM+}$	Maximum positive peak output volta	ge swing	$I_O = -2 \text{ mA}$		13.5	13.9		V		
			$I_O = -20 \text{ mA}$	11.5	12.3					
			$I_O = 200 \mu\text{A}$	-13.8	-14.2		V			
$V_{OM-}$	Maximum negative peak output volta	age swing	I <sub>O</sub> = 2 mA		-13.5	-14				
			I <sub>O</sub> = 20 mA	-11.5	-12.4					
			V <sub>O</sub> = ±10 V	$R_L = 600 \Omega$	80	96				
$A_{VD}$	Large-signal differential voltage amp	olification		$R_L = 2 k\Omega$	90	109		dB		
				$R_L = 10 \text{ k}\Omega$	95	118				
rį	Input resistance		$V_{IC} = 0$			10 <sup>12</sup>		Ω		
c <sub>i</sub>	Input capacitance	Common mode Differential	V <sub>O</sub> = 0,	See Figure 5		7.5 2.5		pF		
z <sub>o</sub>	Open-loop output impedance	•	f = 1 MHz			80		Ω		
CMRR	Common-mode rejection ratio		$V_{IC} = V_{ICR}$ min, $R_S = 50 \Omega$	$V_O = 0$ ,	80	98		dB		
k <sub>SVR</sub>	Supply-voltage rejection ratio (ΔV <sub>CC</sub>	$_{1\pm}/\Delta V_{IO}$ )	$V_{CC\pm} = \pm 5 \text{ V to } \pm 1$ $V_{O} = 0$ ,	15 V, R <sub>S</sub> = 50 Ω	82	99		dB		
I <sub>CC</sub>	Supply current (four amplifiers)		$V_O = 0$ ,	No load	5.2	6.5	7.5	mA		
	Chart aircuit autaut aurrent		l ,	V <sub>ID</sub> = 1 V	-30	-45		A		
los	Short-circuit output current		V <sub>O</sub> = 0	$V_{ID} = -1 V$	30	48		mA		

### PARAMETER MEASUREMENT INFORMATION



† Includes fixture capacitance

Figure 1. Slew-Rate Test Circuit

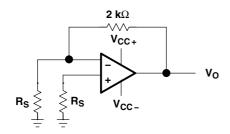


† Includes fixture capacitance

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



### PARAMETER MEASUREMENT INFORMATION



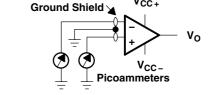


Figure 3. Noise-Voltage Test Circuit

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

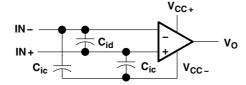


Figure 5. Internal Input Capacitance

### 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.

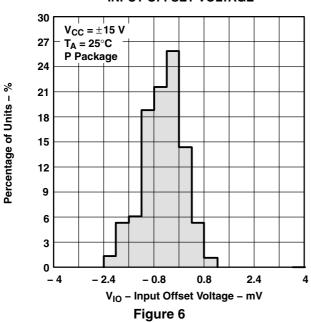
### **Table of Graphs**

			FIGURE
V <sub>IO</sub>	Input offset voltage	Distribution	6, 7, 8
$\alpha_{\text{VIO}}$	Temperature coefficient of input offset voltage	Distribution	9, 10, 11
I <sub>IO</sub>	Input offset current	vs Free-air temperature	12, 13
I <sub>IB</sub>	Input bias current	vs Free-air temperature vs Total supply voltage	12, 13 14
V <sub>ICR</sub>	Common-mode input voltage range	vs Free-air temperature	15
Vo	Output voltage	vs Differential input voltage	16, 17
V <sub>OM+</sub>	Maximum positive peak output voltage	vs Output current	18
$V_{OM-}$	Maximum negative peak output voltage	vs Output current	19
V <sub>OM</sub>	Maximum peak output voltage	vs Free-air temperature vs Supply voltage	20, 21 22
V <sub>O(PP)</sub>	Maximum peak-to-peak output voltage	vs Frequency	23
Vo	Output voltage	vs Settling time	24
A <sub>VD</sub>	Large-signal differential voltage amplification	vs Load resistance vs Free-air temperature	25 26, 27
A <sub>VD</sub>	Small-signal differential voltage amplification	vs Frequency	28, 29
CMRR	Common-mode rejection ratio	vs Frequency vs Free-air temperature	30 31
k <sub>SVR</sub>	Supply-voltage rejection ratio	vs Frequency vs Free-air temperature	32 33
I <sub>CC</sub>	Supply current	vs Supply voltage vs Free-air temperature vs Differential input voltage	34, 35, 36 37, 38, 39 40 – 45
I <sub>OS</sub>	Short-circuit output current	vs Supply voltage vs Elapsed time vs Free-air temperature	46 47 48
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B <sub>1</sub>	Unity-gain bandwidth	vs Load capacitance	59
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φ <sub>m</sub>	Phase margin	vs Free-air temperature vs Supply voltage vs Load capacitance	63 64 65
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	Small-signal pulse response	vs Time	67
z <sub>o</sub>	Closed-loop output impedance	vs Frequency	68
	Crosstalk attenuation	vs Frequency	69



Percentage of Units - %

### **DISTRIBUTION OF TLE2071 INPUT OFFSET VOLTAGE**



### **DISTRIBUTION OF TLE2072 INPUT OFFSET VOLTAGE**

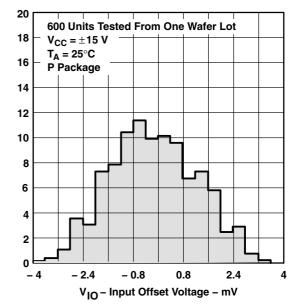
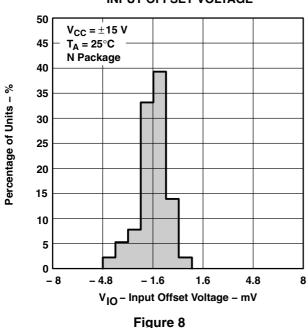


Figure 7

### **DISTRIBUTION OF TLE2074 INPUT OFFSET VOLTAGE**



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

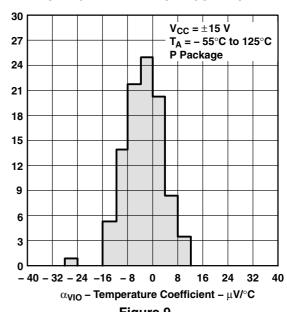
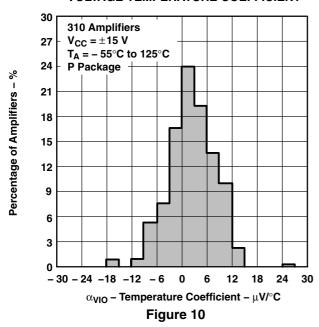


Figure 9

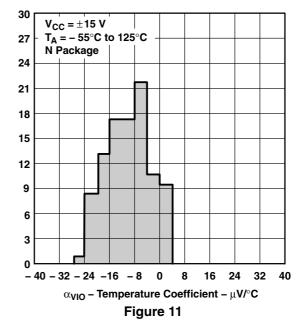
Percentage of Amplifiers –

Percentage of Amplifiers –

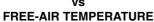
### **DISTRIBUTION OF TLE2072 INPUT OFFSET VOLTAGE TEMPERATURE COEFFICIENT**

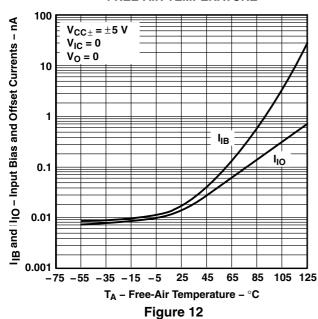


### **DISTRIBUTION OF TLE2074 INPUT OFFSET VOLTAGE TEMPERATURE COEFFICIENT**



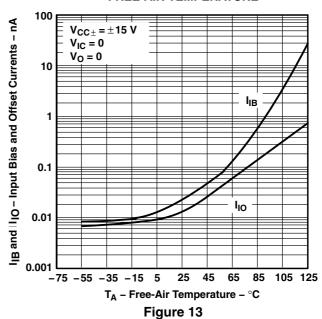
### **INPUT BIAS CURRENT AND** INPUT OFFSET CURRENT† vs





# **INPUT BIAS CURRENT AND** INPUT OFFSET CURRENT†

# FREE-AIR TEMPERATURE

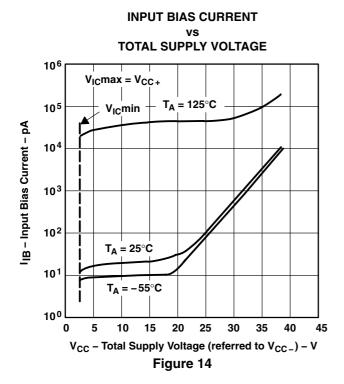


<sup>†</sup> Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.



COMMON-MODE INPUT VOLTAGE RANGE†

### TYPICAL CHARACTERISTICS



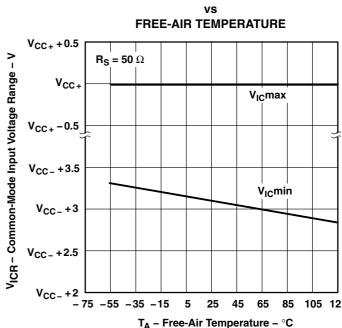
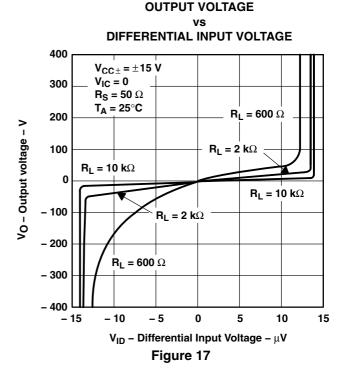


Figure 15

### **OUTPUT VOLTAGE** vs **DIFFERENTIAL INPUT VOLTAGE** 400 $V_{CC\pm} = \pm 5 V$ $V_{IC} = 0$ 300 $R_S = 50 \Omega$ T<sub>A</sub> = 25°C $R_L = 600 \Omega$ 200 Vo - Output voltage - V 100 $R_L = 2 k\Omega$ $R_L = 10 \text{ k}\Omega$ 0 $R_L = 10 \text{ k}\Omega$ - 100 $R_1 = 2 k\Omega$ - 200 $R_L = 600 \Omega$ - 300 - 400 -2 -10 0 - 3 3 V<sub>ID</sub> - Differential Input Voltage - μV Figure 16



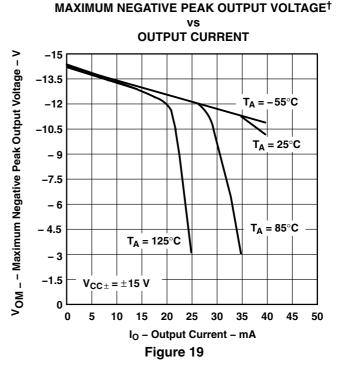
<sup>†</sup> Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.



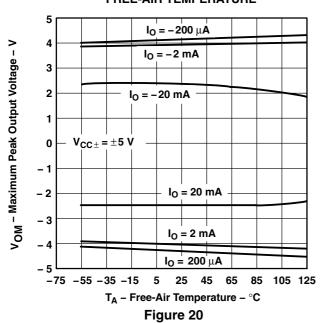
### **MAXIMUM POSITIVE PEAK OUTPUT VOLTAGE† OUTPUT CURRENT** 15 V<sub>OM+</sub>- Maximum Positive Peak Output Voltage - V 13.5 12 $T_{\Delta} = -55^{\circ}C$ 10.5 9 7.5 T<sub>A</sub> = 25°C T<sub>A</sub> = 125°C 4.5 $T_{\Delta} = 85^{\circ}C$ 3 1.5 $V_{CC\pm} = \pm 15 \text{ V}$ 0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50

Figure 18

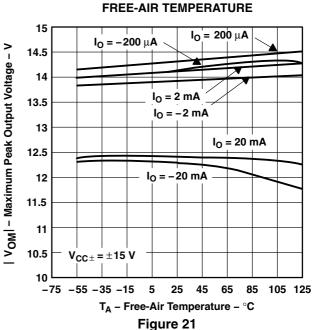
IO - Output Current - mA



# **MAXIMUM PEAK OUTPUT VOLTAGE**<sup>†</sup> FREE-AIR TEMPERATURE



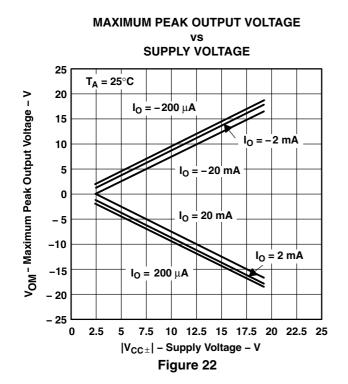
# MAXIMUM PEAK OUTPUT VOLTAGE†

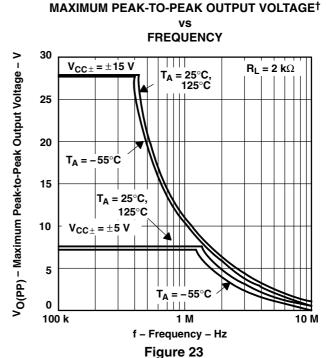


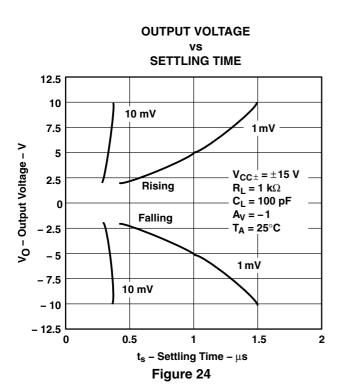
<sup>†</sup> Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

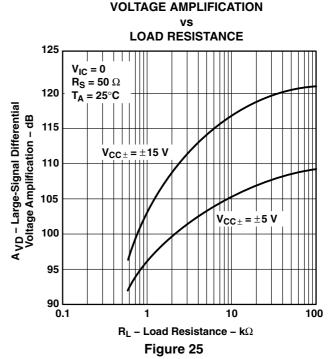


### TYPICAL CHARACTERISTICS









LARGE-SIGNAL DIFFERENTIAL

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



# LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION<sup>†</sup>

# FREE-AIR TEMPERATURE

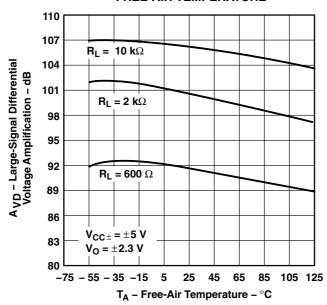


Figure 26

# LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION<sup>†</sup>

#### vs FREE-AIR TEMPERATURE

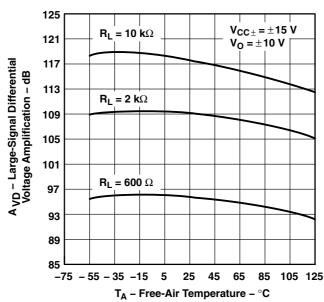


Figure 27

<sup>&</sup>lt;sup>†</sup> Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.



# SMALL-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT

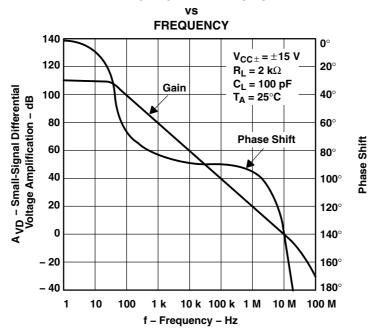


Figure 28

# SMALL-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT

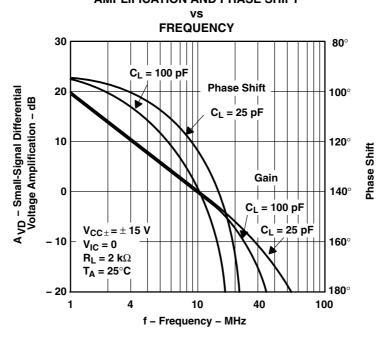
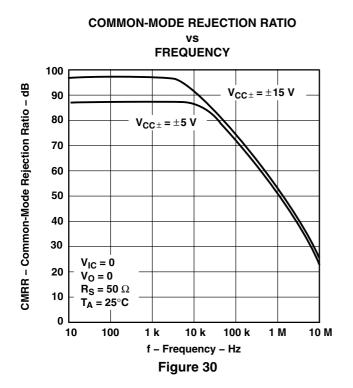
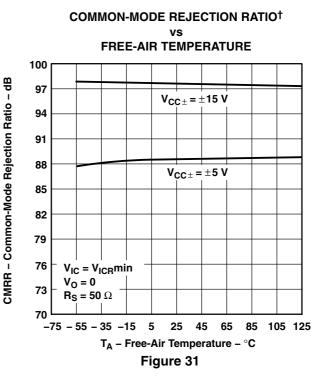
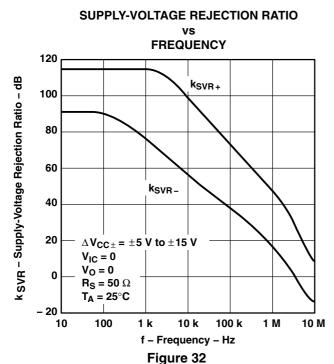


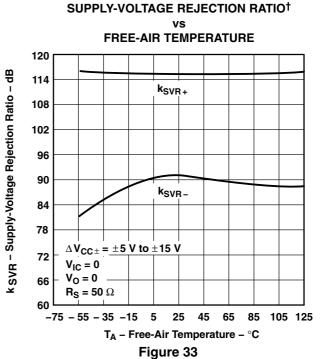
Figure 29





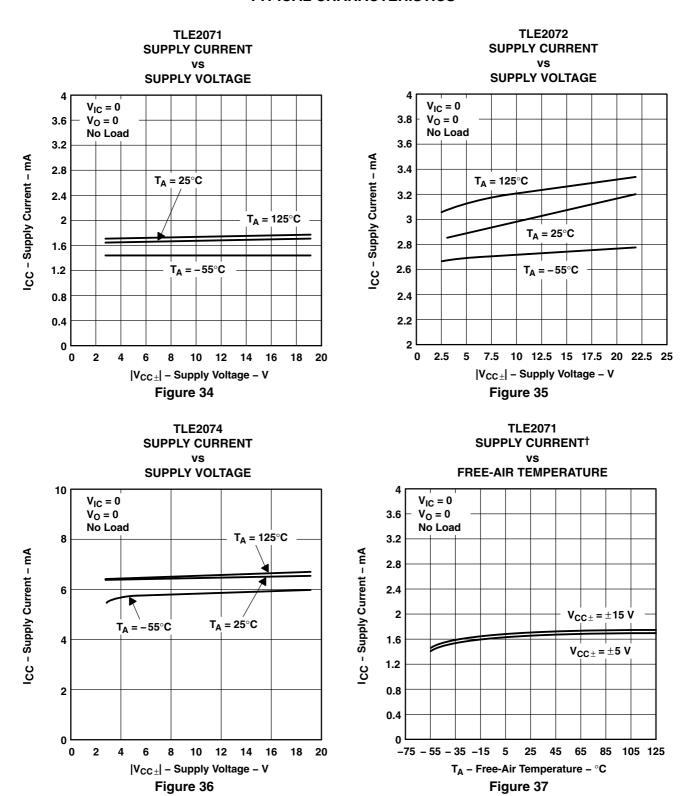






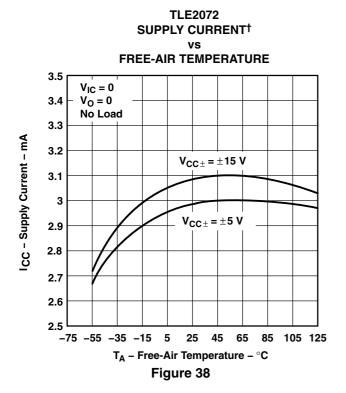
<sup>†</sup> Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

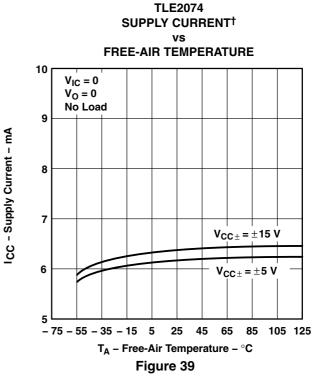


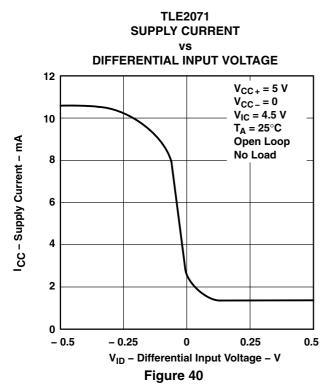


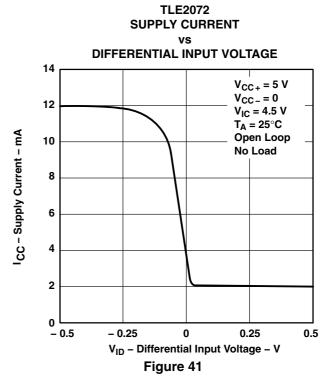
<sup>†</sup> Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.





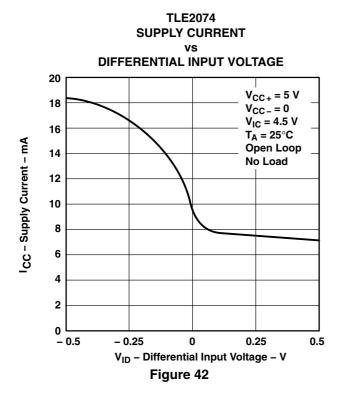


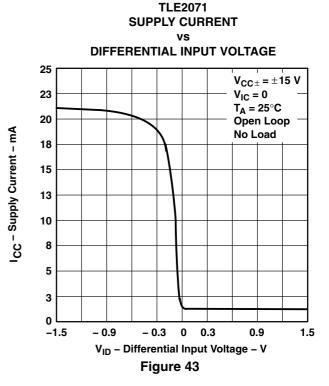


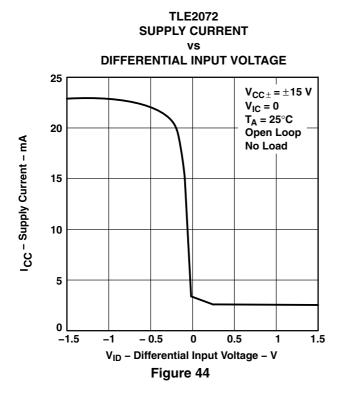


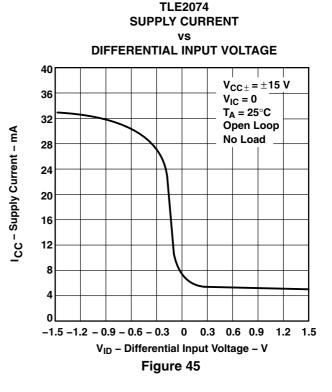
<sup>†</sup> Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.



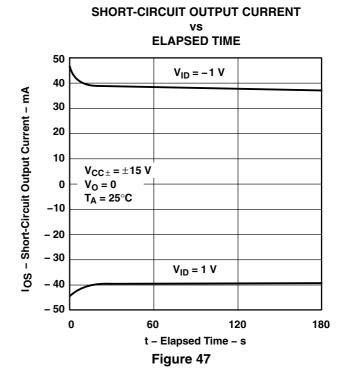


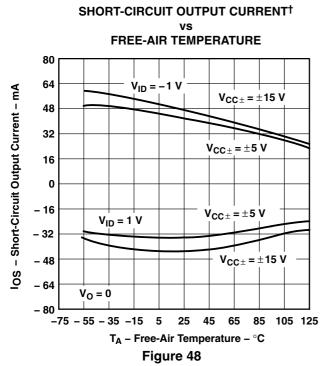


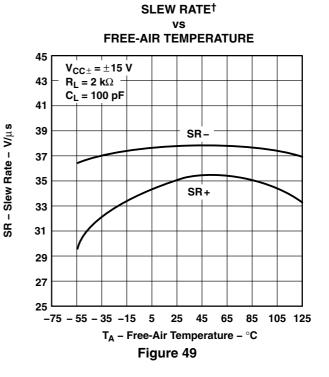




### SHORT-CIRCUIT OUTPUT CURRENT VS **SUPPLY VOLTAGE** 60 48 IOS - Short-Circuit Output Current - mA $V_{ID} = -1 V$ 36 24 12 $V_0 = 0$ 0 $T_A = 25^{\circ}C$ -12 - 24 $V_{ID} = 1 V$ - 36 - 48 - 60 2.5 5 7.5 10 12.5 15 17.5 20 22.5 25 |V<sub>CC±</sub>| - Supply Voltage - V Figure 46



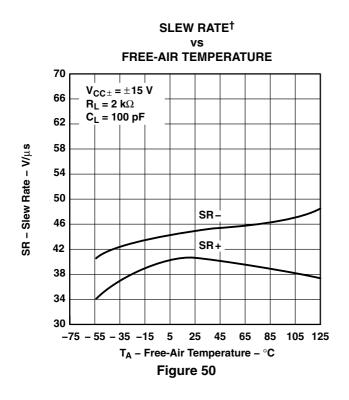


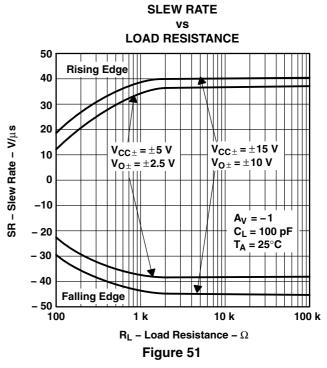


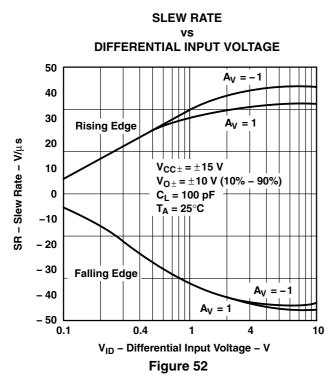
<sup>†</sup> Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.



### TYPICAL CHARACTERISTICS







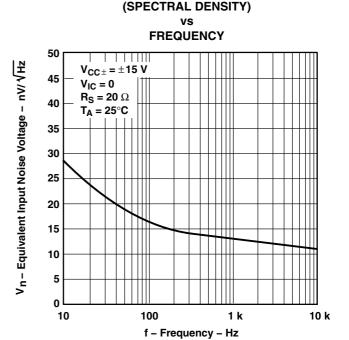


Figure 53

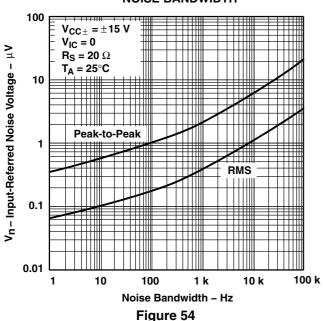
**EQUIVALENT INPUT NOISE VOLTAGE** 

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

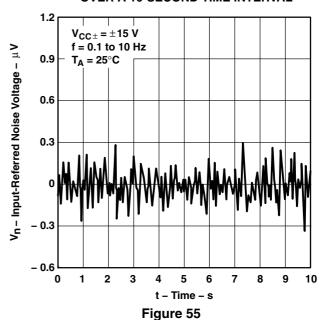


### **INPUT-REFERRED NOISE VOLTAGE**

# NOISE BANDWIDTH

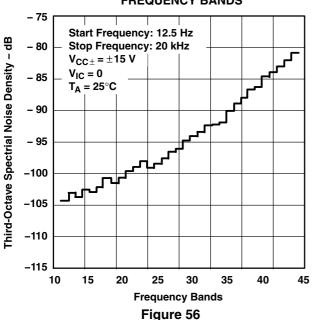


### INPUT-REFERRED NOISE VOLTAGE OVER A 10-SECOND TIME INTERVAL



# THIRD-OCTAVE SPECTRAL NOISE DENSITY

# FREQUENCY BANDS



### **TOTAL HARMONIC DISTORTION PLUS NOISE**

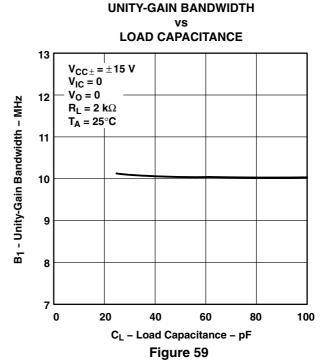
### vs **FREQUENCY** THD + N - Total Harmonic Distortion + Noise - % $A_V = 100, R_L = 600 \Omega$ 0.1 $A_V = 100$ , $R_L = 2 k\Omega$ $A_V = 10, R_L = 600 \Omega$ $A_V = 10, R_L = 2 k\Omega$ 0.01 $V_{CC\pm} = \pm 5 V$ $V_{O(PP)} = 5 V$ $T_A = 25^{\circ}C$ Filter: 10-Hz to 500-kHz Band Pass 0.001 10 100 10 k 100 k f - Frequency - Hz

Figure 57



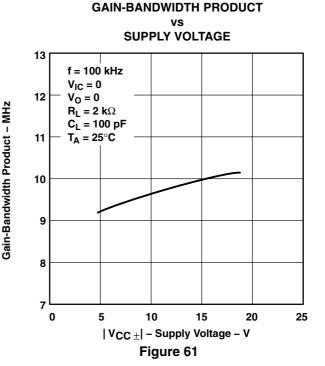
### TYPICAL CHARACTERISTICS

### **TOTAL HARMONIC DISTORTION PLUS NOISE** vs **FREQUENCY** THD + N - Total Harmonic Distortion + Noise - % Filter: 10-Hz to 500-kHz Band Pass $V_{CC\pm} = \pm 15 \text{ V}$ $V_{O(PP)} = 20 V$ $T_A = 25^{\circ}C$ 0.1 $A_V = 100$ , $R_L = 600 \Omega$ $A_V = 100, R_1 = 2 k\Omega$ $A_V = 10, R_L = 600 \Omega$ 0.01 $A_V = 10$ , $R_L = 2 k\Omega$ 0.001 10 100 1 k 10 k 100 k f - Frequency - Hz Figure 58



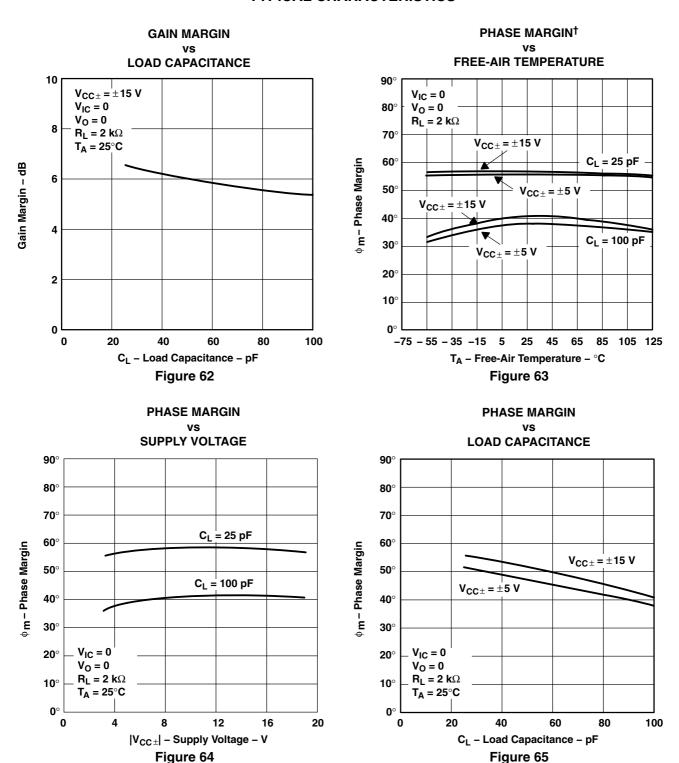
# **GAIN-BANDWIDTH PRODUCT**† FREE-AIR TEMPERATURE 13 f = 100 kHz $V_{IC} = 0$ $V_0 = 0$ 12 $R_L = 2 k\Omega$ Gain-Bandwidth Product - MHz $C_L = 100 pF$ 11 $V_{CC\pm} = \pm 15 \text{ V}$ 10 $V_{CC\pm} = \pm 5 \text{ V}$ 9 8 -75 - 55 - 35 -15 5 25 45 65 85 105 125 T<sub>A</sub> - Free-Air Temperature - °C

Figure 60



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





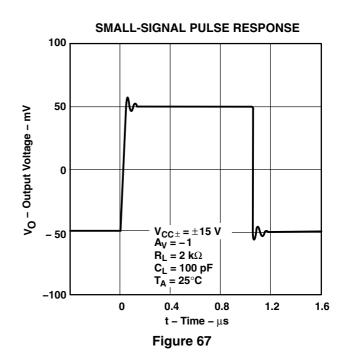
<sup>†</sup> Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

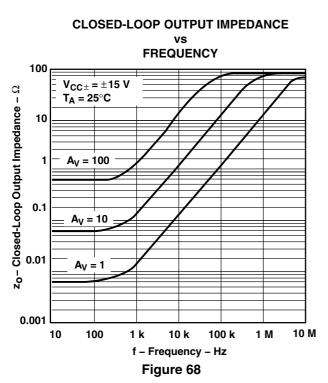


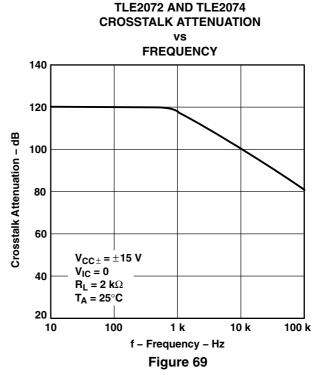
### TYPICAL CHARACTERISTICS

### **NONINVERTING LARGE-SIGNAL PULSE RESPONSE**† 15 T<sub>A</sub> = 25°C, 125°C 10 $T_A = -55^{\circ}C$ V<sub>O</sub> - Output Voltage - V $T_A = -55^{\circ}C$ 5 $T_A = 25^{\circ}C$ 125°C $V_{CC\pm} = \pm 15 \text{ V}$ $A_V = 1$ -10 $R_L = 2 k\Omega$ $C_{L} = 100 pF$ 0 2 t – Time – $\mu$ s

Figure 66







<sup>&</sup>lt;sup>†</sup> Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.



### **APPLICATION INFORMATION**

### input characteristics

The 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.

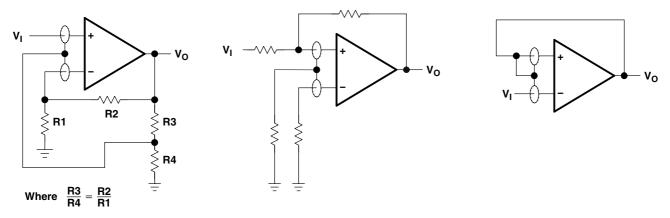


Figure 70. Use of Guard Rings

### 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.

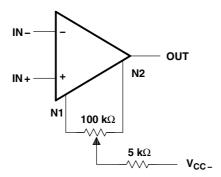


Figure 71. Input Offset Voltage Nulling



### **APPLICATION INFORMATION**

#### macromodel information

Macromodel information provided was derived using  $PSpice^{TM}$  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  $T_A = 25^{\circ}C$ . 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).

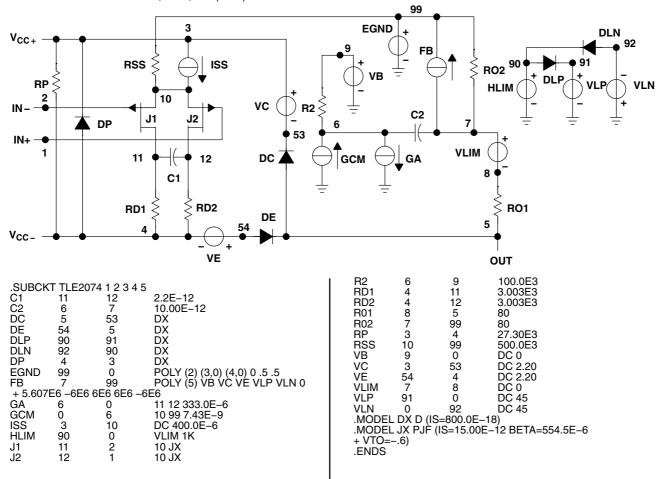


Figure 72. Boyle Macromodel and Subcircut

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# TLE207x, TLE207xA EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS SLOS181C – FEBRUARY 1997 – REVISED DECEMBER 2009

# **Revision History**

Version	Date	Changes
С	Dec-2009	$-$ For TLE2071M/1AM (VCC $\pm$ 5V) changed V <sub>n</sub> 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 <sub>n</sub> 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 <sub>n</sub> 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 $_{\rm n}$ 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 <sub>n</sub> 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 <sub>n</sub> NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 44







9-Mar-2021

### **PACKAGING INFORMATION**

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





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Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead finish/ Ball material	MSL Peak Temp	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9460205QPA	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	9460205QPA TLE2072AM	Samples
5962-9460206Q2A	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 9460206Q2A TLE2074 AMFKB	Samples
5962-9460206QCA	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9460206QC A TLE2074AMJB	Samples
5962-9460206QDA	ACTIVE	CFP	W	14	1	Non-RoHS & Non-Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9460206QD A TLE2074AMWB	Samples
TLE2071ACD	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	2071AC	Samples
TLE2071ACDR	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		2071AC	Samples
TLE2071ACP	ACTIVE	PDIP	Р	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2071AC	Samples
TLE2071ACPE4	ACTIVE	PDIP	Р	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2071AC	Samples
TLE2071AID	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	2071AI	Samples
TLE2071AIDG4	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	2071AI	Samples
TLE2071AIDR	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		2071AI	Samples
TLE2071AIP	ACTIVE	PDIP	Р	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2071AI	Samples
TLE2071AMFKB	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962 9460204Q2A TLE2071 AMFKB	Samples
TLE2071AMJG	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	TLE2071 AMJG	Samples
TLE2071AMJGB	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	9460204QPA TLE2071AM	Samples
TLE2071AMUB	ACTIVE	CFP	U	10	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	9460204QHA TLE2071AM	Samples





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Orderable Device	Status	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead finish/ Ball material	MSL Peak Temp	Op Temp (°C)	Device Marking (4/5)	Samples
TLE2071CD	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	2071C	Samples
TLE2071CDG4	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	2071C	Samples
TLE2071CP	ACTIVE	PDIP	Р	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2071CP	Samples
TLE2071CPE4	ACTIVE	PDIP	Р	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2071CP	Samples
TLE2071ID	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	20711	Samples
TLE2071IDG4	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	20711	Samples
TLE2071IDR	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		20711	Samples
TLE2071IP	ACTIVE	PDIP	Р	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2071IP	Samples
TLE2071MFKB	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 9460201Q2A TLE2071 MFKB	Sample
TLE2071MJG	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	TLE2071MJG	Sample
TLE2071MJGB	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	9460201QPA TLE2071M	Sample
TLE2072ACD	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	2072AC	Sample
TLE2072ACP	ACTIVE	PDIP	Р	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2072AC	Sample
TLE2072ACPE4	ACTIVE	PDIP	Р	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2072AC	Sample
TLE2072AID	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	2072AI	Sample
TLE2072AIDG4	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	2072AI	Sample
TLE2072AIDR	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		2072AI	Sample
TLE2072AIP	ACTIVE	PDIP	Р	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2072AI	Sample
TLE2072AMFKB	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 9460205Q2A TLE2072	Sample



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9-Mar-2021

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead finish/ Ball material	MSL Peak Temp	Op Temp (°C)	Device Marking (4/5)	Samples
							(0)			AMFKB	
TLE2072AMJG	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	TLE2072 AMJG	Samples
TLE2072AMJGB	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	9460205QPA TLE2072AM	Samples
TLE2072AMUB	ACTIVE	CFP	U	10	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	9460205QHA TLE2072AM	Samples
TLE2072CD	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		2072C	Samples
TLE2072CDR	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		2072C	Samples
TLE2072CDRG4	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		2072C	Samples
TLE2072CP	ACTIVE	PDIP	Р	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2072CP	Samples
TLE2072ID	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		20721	Samples
TLE2072IDR	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	20721	Samples
TLE2072IDRG4	ACTIVE	SOIC	D	8	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	2072	Samples
TLE2072IP	ACTIVE	PDIP	Р	8	50	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2072IP	Samples
TLE2072MFKB	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 9460202Q2A TLE2072 MFKB	Samples
TLE2072MJG	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	TLE2072MJG	Samples
TLE2072MJGB	ACTIVE	CDIP	JG	8	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	9460202QPA TLE2072M	Samples
TLE2072MUB	ACTIVE	CFP	U	10	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	9460202QHA TLE2072M	Samples
TLE2074ACDW	ACTIVE	SOIC	DW	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	TLE2074AC	Samples
TLE2074ACN	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2074ACN	Samples
TLE2074ACNE4	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2074ACN	Samples



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Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead finish/ Ball material	MSL Peak Temp	Op Temp (°C)	Device Marking (4/5)	Samples
TLE2074AIDW	ACTIVE	SOIC	DW	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TLE2074AI	Samples
TLE2074AIN	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2074AIN	Samples
TLE2074AINE4	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2074AIN	Samples
TLE2074AMFKB	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 9460206Q2A TLE2074 AMFKB	Samples
TLE2074AMJ	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	TLE2074AMJ	Samples
TLE2074AMJB	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9460206QC A TLE2074AMJB	Samples
TLE2074AMWB	ACTIVE	CFP	W	14	1	Non-RoHS & Non-Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9460206QD A TLE2074AMWB	Samples
TLE2074CDW	ACTIVE	SOIC	DW	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	TLE2074C	Samples
TLE2074CDWR	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		TLE2074C	Samples
TLE2074CN	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2074CN	Sample
TLE2074CNE4	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2074CN	Sample
TLE2074IDW	ACTIVE	SOIC	DW	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TLE2074I	Sample
TLE2074IDWG4	ACTIVE	SOIC	DW	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TLE2074I	Sample
TLE2074IDWR	ACTIVE	SOIC	DW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		TLE2074I	Sample
TLE2074IN	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type		TLE2074IN	Sample
TLE2074MFKB	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 9460203Q2A TLE2074 MFKB	Sample
TLE2074MJ	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	TLE2074MJ	Sample



#### PACKAGE OPTION ADDENDUM

9-Mar-2021

Orderable Device	Status	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead finish/ Ball material	MSL Peak Temp	Op Temp (°C)	Device Marking (4/5)	Samples
TLE2074MJB	ACTIVE	CDIP	J	14	1	Non-RoHS & Green	SNPB	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) RoHS: TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (CI) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

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OTHER QUALIFIED VERSIONS OF TLE2071, TLE2071A, TLE2071AM, TLE2071M, TLE2072A, TLE2072AM, TLE2072AM, TLE2072AM, TLE2074AM, TLE2074AM, TLE2074M:



## **PACKAGE OPTION ADDENDUM**

9-Mar-2021

- Catalog: TLE2071A, TLE2071, TLE2072A, TLE2072, TLE2074A, TLE2074
- Automotive: TLE2071A-Q1, TLE2071A-Q1, TLE2072A-Q1, TLE2072A-Q1
- Military: TLE2071M, TLE2071AM, TLE2072M, TLE2072AM, TLE2074AM

#### NOTE: Qualified Version Definitions:

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- 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

## PACKAGE MATERIALS INFORMATION

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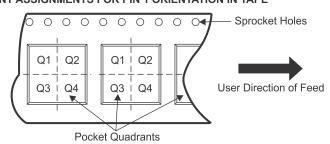
## TAPE AND REEL INFORMATION



# TAPE DIMENSIONS KO P1 BO W Cavity AO

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

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



#### \*All dimensions are nominal

All dimensions are nominal												
Device	Package Type	Package Drawing		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
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

# **PACKAGE MATERIALS INFORMATION**

www.ti.com 18-Nov-2020



\*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
TLE2072AIDR	SOIC	D	8	2500	367.0	367.0	35.0
TLE2072CDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2072IDR	SOIC	D	8	2500	350.0	350.0	43.0
TLE2072IDR	SOIC	D	8	2500	340.5	338.1	20.6
TLE2072IDR	SOIC	D	8	2500	853.0	449.0	35.0
TLE2074CDWR	SOIC	DW	16	2000	350.0	350.0	43.0
TLE2074IDWR	SOIC	DW	16	2000	350.0	350.0	43.0

# W (R-GDFP-F14)

## CERAMIC DUAL FLATPACK



- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only.
- E. Falls within MIL STD 1835 GDFP1-F14



7.5 x 10.3, 1.27 mm pitch

SMALL OUTLINE INTEGRATED CIRCUIT

This image is a representation of the package family, actual package may vary. Refer to the product data sheet for package details.





SOIC



- 1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing
- per ASME Y14.5M.

  2. This drawing is subject to change without notice.

  3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
- 4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.
- 5. Reference JEDEC registration MS-013.



SOIC



#### NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOIC



#### NOTES: (continued)

- 8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
- 9. Board assembly site may have different recommendations for stencil design.



CERAMIC DUAL IN LINE PACKAGE



Images above are just a representation of the package family, actual package may vary. Refer to the product data sheet for package details.

4040083-5/G





CERAMIC DUAL IN LINE PACKAGE



- 1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- 2. This drawing is subject to change without notice.
- 3. This package is hermitically sealed with a ceramic lid using glass frit.
- His package is remitted by sealed with a ceramic its using glass mit.
   Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
   Falls within MIL-STD-1835 and GDIP1-T14.



CERAMIC DUAL IN LINE PACKAGE





SMALL OUTLINE INTEGRATED CIRCUIT



- 1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
- 2. This drawing is subject to change without notice.
- 3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.
- 4. This dimension does not include interlead flash.
- 5. Reference JEDEC registration MS-012, variation AA.



SMALL OUTLINE INTEGRATED CIRCUIT



NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SMALL OUTLINE INTEGRATED CIRCUIT



NOTES: (continued)

- 8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
- 9. Board assembly site may have different recommendations for stencil design.



### JG (R-GDIP-T8)

#### **CERAMIC DUAL-IN-LINE**



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

- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification.
- E. Falls within MIL STD 1835 GDIP1-T8

# P (R-PDIP-T8)

## PLASTIC DUAL-IN-LINE PACKAGE



- 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\*\*)

## PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN

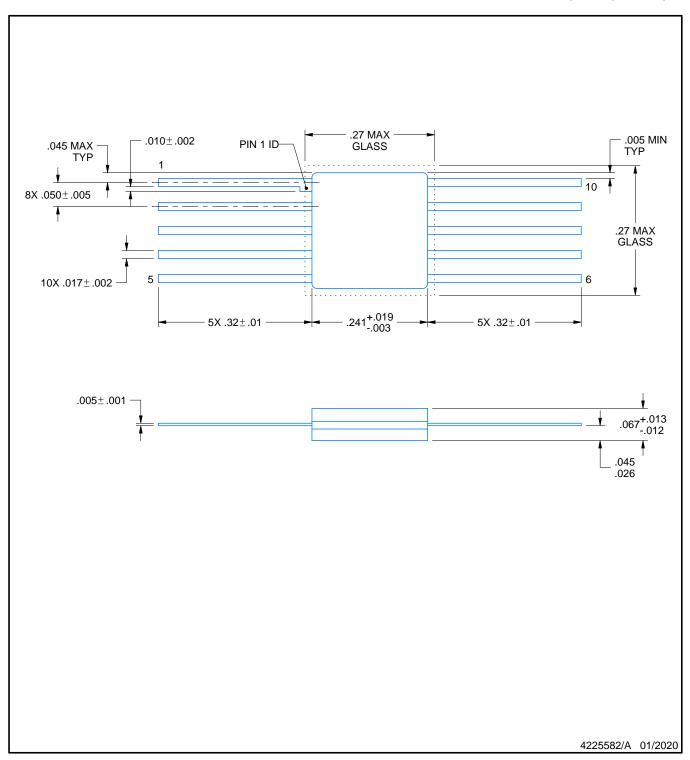


- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
- The 20 pin end lead shoulder width is a vendor option, either half or full width.





CERAMIC FLATPACK



- 1. All linear dimensions are in inches. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
  2. This drawing is subject to change without notice.



# FK (S-CQCC-N\*\*)

## LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



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



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