### 捷多邦,专业PCB打样工厂,24小时加

## TLE214x, TLE214xA, TLE214xY EXCALIBUR LOW-NOISE HIGH-SPEED PRECISION OPERATIONAL AMPLIFIERS

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Low Noise

10 Hz . . . 15 nV/√Hz 1 kHz . . . 10.5 nV/√Hz

- 10000-pF Load Capability
- 20-mA Min Short-Circuit Output Current
- 27-V/us Min Slew Rate
- High Gain-Bandwidth Product . . . 5.9 MHz
- Low V<sub>IO</sub> ... 500 μV Max at 25°C

- Single or Split Supply . . . 4 V to 44 V
- Fast Settling Time 340 ns to 0.1% 400 ns to 0.01%
- Saturation Recovery . . . 150 ns
- Large Output Swing
   V<sub>CC</sub> + 0.1 V to V<sub>CC</sub> + 1 V

#### description

The TLE214x and TLE214xA devices are high-performance, internally compensated operational amplifiers built using Texas Instruments complementary bipolar Excalibur process. The TLE214xA is a tighter offset voltage grade of the TLE214x. Both are pin-compatible upgrades to standard industry products.

The design incorporates an input stage that simultaneously achieves low audio-band noise of  $10.5 \text{ nV/}\sqrt{\text{Hz}}$  with a 10-Hz 1/f corner and symmetrical 40-V/ $\mu$ s slew rate typically with loads up to 800 pF. The resulting low distortion and high power bandwidth are important in high-fidelity audio applications. A fast settling time of 340 ns to 0.1% of a 10-V step with a 2-k $\Omega$ /100-pF load is useful in fast actuator/positioning drivers. Under similar test conditions, settling time to 0.01% is 400 ns.

The devices are stable with capacitive loads up to 10 nF, although the 6-MHz bandwidth decreases to 1.8 MHz at this high loading level. As such, the TLE214x and TLE214xA are useful for low-droop sample-and-holds and direct buffering of long cables, including 4-mA to 20-mA current loops.

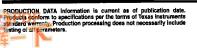
The special design also exhibits an improved insensitivity to inherent integrated circuit component mismatches as is evidenced by a 500-µV maximum offset voltage and 1.7-µV/°C typical drift. Minimum common-mode rejection ratio and supply-voltage rejection ratio are 85 dB and 90 dB, respectively.

Device performance is relatively independent of supply voltage over the  $\pm 2\text{-V}$  to  $\pm 22\text{-V}$  range. Inputs can operate between  $V_{CC-} = 0.3$  to  $V_{CC+} = 1.8$  V without inducing phase reversal, although excessive input current may flow out of each input exceeding the lower common-mode input range. The all-npn output stage provides a nearly rail-to-rail output swing of  $V_{CC-} = 0.1$  to  $V_{CC+} = 1$  V under light current-loading conditions. The device can sustain shorts to either supply since output current is internally limited, but care must be taken to ensure that maximum package power dissipation is not exceeded.

Both versions can also be used as comparators. Differential inputs of V<sub>CC±</sub> can be maintained without damage to the device. Open-loop propagation delay with TTL supply levels is typically 200 ns. This gives a good indication as to output stage saturation recovery when the device is driven beyond the limits of recommended output swing.

Both the TLE214x and TLE214xA are available in a wide variety of packages, including both the industry-standard 8-pin small-outline version and chip form for high-density system applications. The C-suffix devices are characterized for operation from 0°C to 70°C, I-suffix devices from -40°C to 105°C, and M-suffix devices over the full military temperature range of -55°C to 125°C.







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#### **TLE2141 AVAILABLE OPTIONS**

			PACKAGE	PACKAGED DEVICES						
TA	V <sub>IO</sub> max AT 25°C	SMALL OUT- LINE† (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	FORM‡ (Y)				
0°C to 70°C	500 μV 900 μV	TLE2141ACD TLE2141CD	_	_	TLE2141ACP TLE2141CP	_				
-40°C to 105°C	500 μV 900 μV	TLE2141AID TLE2141ID	_	_	TLE2141AIP TLE2141IP	TLE2141Y				
-55°C to 125°C	500 μV 900 μV	TLE2141AMD TLE2141MD	TLE2141AMFK TLE2141MFK	TLE2141AMJG TLE2141MJG	TLE2141AMP TLE2141MP	_				

The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2141ACDR).

#### **TLE2142 AVAILABLE OPTIONS**

				ADEL OF HORS			
			PACKAGED DEVI	CES			
TA	V <sub>IO</sub> max AT 25°C	SMALL OUTLINE† (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	TSSOP‡ (PW)	CHIP FORM§ (Y)
0°C to 70°C	750 μV	TLE2142ACD	_		TLE2142ACP	_	
0010700	1200 μV	TLE2142CD	_	_	TLE2142CP	TLE2142CPWLE	~
-40°C to 105°C	750 μV	TLE2142AID		_	TLC2142AIP		
-40 C to 105 C	1200 μV	TLE2142ID	_		TLC2142IP	_	TLE2142Y
-55°C to 125°C	750 μV	TLE2142AMD	TLE2142AMFK	TLE2142AMJG	TLC2142AMP		
-33 C to 123 C	1200 μV	TLE2142MD	TLE2142MFK	TLE2142MJG	TLC2142MP		_

<sup>†</sup> The D packages are available taped and reeled. Add R suffix to device type (e.g., TLC2142ACDR).

#### **TLE2144 AVAILABLE OPTIONS**

	\/		PACKAGED I	DEVICES		
тд	V <sub>IO</sub> max AT 25°C	SMALL OUTLINET (DW)	CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)	CHIP FORM‡ (Y)
0°C to 70°C	1.5 mV 2.4 mV	TLE2144CDW	_		TLE2144ACN TLE2144CN	_
-40°C to 105°C	1.5 mV 2.4 mV	TLE2144IDW	_	_	TLE2144AIN TLE2144IN	TLE2144Y
-55°C to 125°C	1.5 mV 2.5 mV	 TLE2144MDW	TLE2144AMFK TLE2144MFK	TLE2144AMJ TLE2144MJ	TLE2144AMN TLE2144MN	_

The DW packages are available taped and reeled. Add R suffix to device type (e.g., TLE2144CDWR).



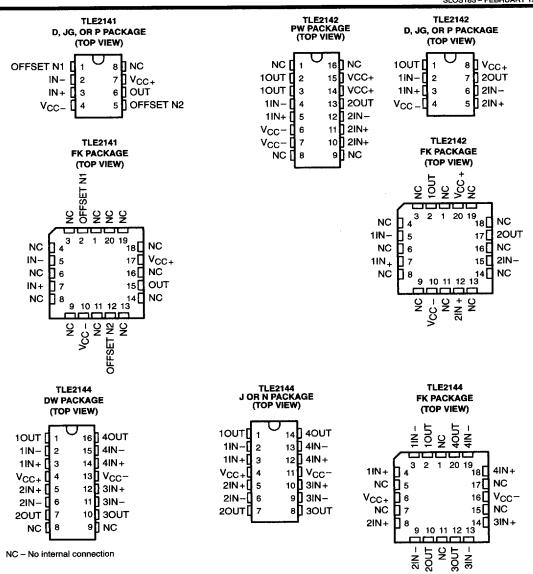
<sup>‡</sup> Chip forms are tested at TA = 25°C only.

The PW packages are available left-ended taped and reeled. Add LE the suffix to device type (e.g., TLC2142CPWLE).

<sup>§</sup> Chip forms are tested at TA = 25°C only.

<sup>‡</sup> Chip forms are tested at TA = 25°C only.

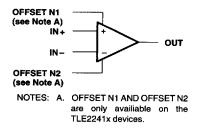
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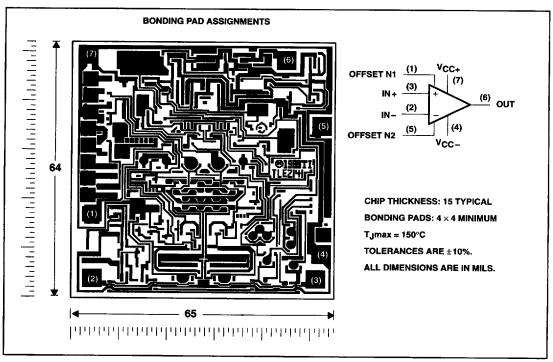
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#### symbol



#### TLE2141Y chip information

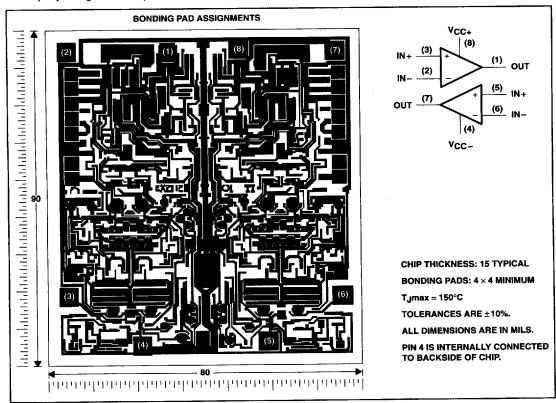
This chip, when properly assembled, displays characteristics similar to the TLE2141. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.



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#### **TLE2142Y chip information**

This chip, when properly assembled, displays characteristics similar to the TLE2142. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.

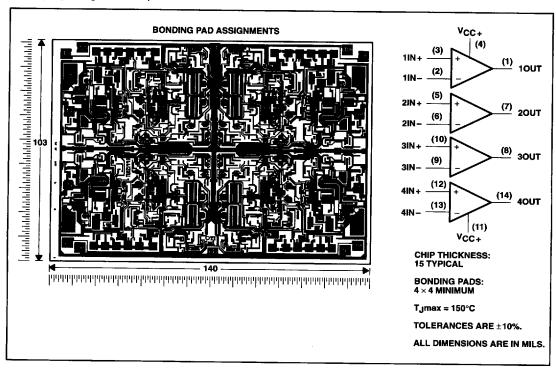


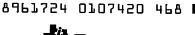
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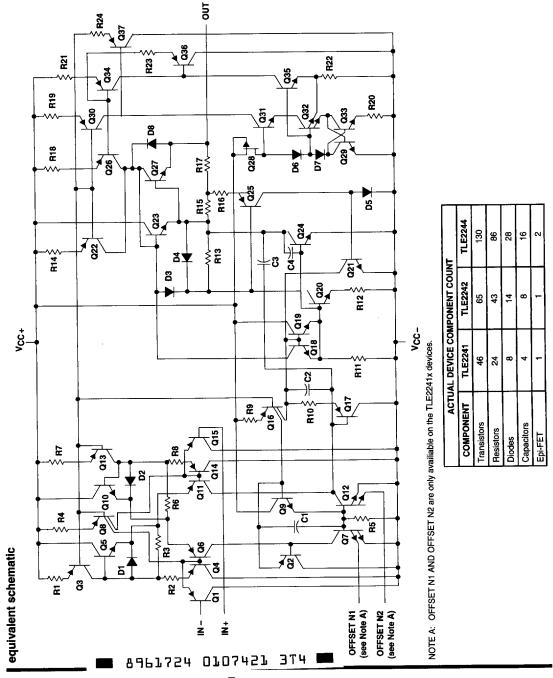
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#### **TLE2144Y chip information**

This chip, when properly assembled, displays characteristics similar to the TLE2144. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.







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

Supply voltage, V <sub>CC+</sub> (see Note 1)	22 V
Supply voltage, V <sub>CC</sub>	_22 V
Differential input voltage, V <sub>ID</sub> (see Note 2)	+44 V
Input voltage range, V <sub>I</sub> (any input)	Vcc. to Vcc. = 0.3 V
Input current, I <sub>I</sub> (each input)	+1 mA
Output current, IO	+80 mA
Total current into V <sub>CC+</sub>	80 mA
Total current out of V <sub>CC</sub> -	90 mA
Duration of short-circuit current at (or below) 25°C (see Note 3)	unlimited
Continuous total dissipation	Soc Dissipation Better Table
Operating free-air temperature range, T <sub>A</sub> : C suffix	See Dissipation Hating Table
Tariffic an temperature range, rg. O sum	0°C to 70°C
l suffix	
M suffix	55°C to 125°C
Storage temperature range	65°C to 150°C
Case temperature for 60 seconds: FK package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D, DW, N, P,	or PW package 260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J or JG packa	age

<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 IN+ with respect to IN-. Excessive current flows if input is brought below VCC - 0.3 V.
- The output may be shorted to either supply. Temperature and/or supply voltages must be limited to ensure that the maximum dissipation rating is not exceeded.

#### DISSIPATION RATING TABLE

PACKAGE	T <sub>A</sub> ≤ 25°C POWER RATING	DERATING FACTOR ABOVE TA = 25°C	T <sub>A</sub> = 70°C POWER RATING	T <sub>A</sub> = 105°C POWER RATING	T <sub>A</sub> = 125°C POWER RATING
D	725 mW	5.8 mW/°C	464 mW	261 mW	145 mW
DW	1025 mW	8.2 mW/°C	656 mW	369 mW	205 mW
FK	1375 mW	11.0 mW/°C	880 mW	495 mW	275 mW
J	1375 mW	11.0 mW/°C	880 mW	495 mW	275 mW
JG	1050 mW	8.4 mW/°C	672 mW	378 mW	210 mW
N	1150 mW	9.2 mW/°C	736 mW	414 mW	230 mW
P	1000 mW	8.0 mW/°C	640 mW	360 mW	200 mW
PW	525 mW	4.2 mW/°C	336 mW	_	_

#### recommended operating conditions

		C SU	FFIX	I SUI	FIX	M SU	FFIX	
		MIN	MAX	MIN	MAX	MIN	MAX	UNIT
Supply voltage, V <sub>CC±</sub>		±2	±22	±2	±22	±2	±22	V
Common-mode input voltage, VIC	V <sub>CC</sub> = 5 V	0	2.9	0	2.7	0	2.7	
Common-mode input voltage, VIC	V <sub>CC±</sub> = ±15 V	-15	12.9	-15	12.7	-15	12.7	V
Operating free-air temperature, TA		0	70	-40	105	55	125	°C

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#### TLE2141C electrical characteristics at specified free-air temperature, V<sub>CC</sub> = 5 V (unless otherwise noted)

				TI	E21410	;	TL	E2141A	C	UNIT
	PARAMETER	TEST CONDITIONS	TAT	MIN	TYP	MAX	MIN	TYP	MAX	UNII
			25°C		225	1400		200	1000	wV
۷IO	Input offset voltage		Full range			1700			1300	μν .
×VIO	Temperature coefficient of input offset voltage	V <sub>O</sub> = 2.5 V R <sub>S</sub> = 50 Ω,	Full range		1.7			1.7		μV/°C
		V <sub>IC</sub> = 2.5 V	25°C		8	100		8	100	nΔ
Ю	Input offset current		Full range			150			150	11/3
	t		25°C		0.8	-2		-0.8	-2	υA
IB	Input bias current		Full range			-2.1			-2.1	μ.
	Common-mode input	Βς = 50 Ω	25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		v
VICR	voltage range	ng = 50 12	Full range	0 to 2.9			0 to 2.9			
		4504	25°C	3.9	4.1		3.9	4.1		
		I <sub>OH</sub> = -150 μA	Full range	3.8			3.8			
	11. 1. 1	1.5 mA	25°C	3.8	4		3.8	4		v
V <sub>OH</sub> Hig	High-level output voltage	I <sub>OH</sub> = -1.5 mA	Full range	3.7			3.7			•
		I <sub>OH</sub> = -15 mA	25°C	3.2	3.7		3.2	3.7		μV μV/°C nA μA V  mV  V  V/mV  MΩ pF Ω dB dB dB
		IOH = - 19 IIIV	Full range	3.2			3.2			
		I <sub>OL</sub> = 150 μA	25°C		75	125		75	125	
		ΙΟΕ = 130 μΑ	Full range			150			150	l <sub>mV</sub>
V	Levelous subsubvoltogo	I <sub>OL</sub> = 1.5 mA	25°C		150	225		150	225	
VOL	Low-level output voltage	IOL = 1.5 IIIA	Full range	<u> </u>		250			250	
		I <sub>OL</sub> = 15 mA	25°C		1.2	1.6		1.2	1.6	V
		IOL = 15 IIIA	Full range	<u> </u>		1.7			1.7	
A	Large-signal differential	V <sub>CC</sub> = ±2.5 V, R <sub>L</sub> = 2 kΩ,	25°C	50	220		50	220		V/m\
AVD	voltage amplification	$V_0 = 1 \text{ V to } -1.5 \text{ V}$	Full range	25			25			
rį	Input resistance		25°C	·	70		<u> </u>	70		
ci	Input capacitance		25°C	<u> </u>	2.5			2.5		pF
zo	Open-loop output impedance	f = 1 MHz	25°C		30			30		Ω
	Common-mode rejection	V - V	25°C	85	118		85	118		de
CMRR	ratio	$V_{IC} = V_{ICR}min, R_S = 50 \Omega$	Full range	80			80			
	Supply-voltage rejection	$V_{CC\pm} = \pm 2.5 \text{ V to } \pm 15 \text{ V},$	25°C	90	106		90	106		dB
ksvr	ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	R <sub>S</sub> = 50 Ω	Full range	85			85			
	V <sub>O</sub> = 2.5 V, No load,	25°C		3.4	4.4		3.4	4.4	m4	
ICC		V <sub>IC</sub> = 2.5 V				4.6			4.6	L'`

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



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## TLE2141C operating characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

	PARAMETER	TEST CO.	MORTIONO	T	LE21410	;	TI	LE2141A	С	
	- AIAMETER	IESI COI	NDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	AVD = -1,	$R_L = 2 k\Omega^{\dagger}$ ,		45			45		
SR-	Negative slew rate	C <sub>L</sub> = 500 pF†		<u> </u>	42		42			V/μs
ts	Settling time	$A_{VD} = -1$ ,	To 0.1%		0.16			0.16		
·s	Cotting time	2.5-V step	To 0.01%		0.22			0.22		μs
V <sub>n</sub>	Equivalent input noise voltage	$R_S = 20 \Omega$ ,	f = 10 Hz		15			15		
*11	Equivalent input rioise voltage	$R_S = 20 \Omega$ ,	f = 1 kHz		10.5			10.5	~~~	nV/√Hz
V <sub>N(PP)</sub>	Peak-to-peak equivalent input	f = 0.1 Hz to 1 H;	z		0.48			0.48		
*N(PP)	noise voltage	f = 0.1 Hz to 10	Hz		0.51			0.51		μV
I <sub>n</sub>	Equivalent input noise current	f = 10 Hz			1.92			1.92	-	
·113	Eduvation input holse current	f = 1 kHz		0.5			0.5		pA/√Hz	
THD + N	Total harmonic distortion plus noise	$V_O = 1 V \text{ to } 3 V$ , $A_{VD} = 2$ ,			0.0052%		(	0.0052%		
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF†		5.9			5.9		MHz
	Gain-bandwidth product	$R_L = 2 k\Omega^{\dagger}$ , f = 100  kHz	C <sub>L</sub> = 100 pF†,		5.8		*****	5.8		MHz
Вом	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 2 V, A <sub>VD</sub> = 1,	$R_L = 2 k\Omega T$ , $C_L = 100 pF^{\dagger}$		660			660		kHz
φm	Phase margin at unity gain	$R_L = 2 k\Omega^{\dagger}$	C <sub>L</sub> = 100 pF†		57°			57°	***	

<sup>†</sup> RL and CL terminated to 2.5 V.

## TLE2141C electrical characteristics at specified free-air temperature, $V_{CC\pm}=\pm 15~V$ (unless otherwise noted)

			710110	- + L	TL	.E2141C		TL	E2141A	<u> </u>	UNIT
	PARAMETER	TEST COND	IIIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	
				25°C		200	900		175	500	μV
/10 <u> </u>	Input offset voltage			Full range			1300			800	
×VIO	Temperature coefficient of input offset voltage	V <sub>IC</sub> = 0,	R <sub>S</sub> = 50 Ω,	Full range		1.7			1.7		μV/°C
		V <sub>O</sub> = 0	,	25°C		7	100		7	100	n <b>A</b>
Ю	Input offset current			Full range			150			150	
				25°C		-0.7	-1.5		-0.7	-1.5	μА
ΙΒ	Input bias current			Full range			-1.6			-1.6	
	Common-mode input			25°C	-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		l v
VICR	voltage range	$R_S = 50 \Omega$	ľ	Full range	-15 to 12.9	-15.3 to 13.1		-15 to 12.9	-15.3 to 13.1		
				25°C	13.8	14.1		13.8	14.1		
		l <sub>O</sub> = -150 μA		Full range	13.7			13.7			ļ
	Maximum positive peak			25°C	13.7	14		13.7	14		V
VOM+	output voltage swing	l <sub>O</sub> = ~1.5 mA		Full range	13.6			13.6			
				25°C	13.1	13.7		13.1	13.7		1
		I <sub>O</sub> = -15 mA		Full range	13			13			
				25°C	-14.7	-14.9		-14.7	-14.9		
		I <sub>O</sub> = 150 μA	Full range	14.6			-14.6			1	
	Maximum negative			25°C	-14.5	-14.8		-14.5	-14.8		l v
∨ом–	peak output voltage swing	IO = 1.5 mA		Full range	-14.4			-14.4			ļ `
	Swing	45 1		25°C	-13.4	-13.8		-13.4	-13.8		Į
		IO = 15 mA		Full range	-13.3			-13.3		<u> </u>	<u> </u>
	Large-signal differential	14014		25°C	100	450		100	450		V/m\
AVD	voltage amplification	V <sub>O</sub> = ±10 V		Full range	75			75			
rį	Input resistance	R <sub>L</sub> = 2 kΩ		25°C		65			65		MΩ
c <sub>i</sub>	Input capacitance			25°C		2.5			2.5		pF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		30			. 30		Ω
	Common-mode	V V	Po = 50 C	25°C	85	108		85	108		dB
CMRR	rejection ratio	VIC = VICRMIN,	ng = 50 12	Full range	80			80			<del>                                     </del>
ksvr	Supply-voltage rejection ratio	V <sub>CC±</sub> = ±2.5 V to	o ± 15 V,	25°C	90	106		90			dB
	(ΔVCC±/ΔVIO)	R <sub>S</sub> = 50 Ω		Full range	85			85			
1	Short-circuit output	V <sub>O</sub> = 0	V <sub>ID</sub> = 1 V	25°C	-25	-50		-25			mA
los	current	¥0 = 0	$V_{ID} = -1 V$		20	31		20			—
1	Supply surrent	V <sub>O</sub> = 0,	No load	25°C		3.5		<del>-</del>	3.5		–l mA
ICC	Supply current	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		Full range			4.7	<u> </u>		4.7	

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



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## TLE2141C operating characteristics, $V_{CC\pm} = \pm 15$ V, $T_A = 25^{\circ}C$

	PARAMETER	TEST CO	NOTTIONS	TL	E21410	:	TL	E2141A	С	
		1201 001	10110113	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	$A_{VD} = -1$ ,	$R_L = 2 k\Omega$	27	45		27	45		
SR-	Negative slew rate	C <sub>L</sub> = 500 pF		27	42		27	42		V/μs
ts	Settling time	AVD = -1,	To 0.1%	,	0.34			0.34		
		10-V step	To 0.01%		0.4		***	0.4		μs
V <sub>n</sub>	Equivalent input noise voltage	$R_S = 20 \Omega$	f = 10 Hz		15			15		
*111		$R_S = 20 \Omega$ ,	f = 1 kHz		10.5		*	nV/√Hz		
V <sub>N(PP)</sub>	Peak-to-peak equivalent input	f = 0.1 Hz to 1 H;	z		0.48			0.48		-
· N(FF)	noise voltage	f = 0.1 Hz to 10	Hz		0.51		0.51			μV
In	Equivalent input noise current	f = 10 Hz			1.89					
·11		f = 1 kHz		0.47			0.47			pA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20 \text{ V},$ $A_{VD} = 10,$	R <sub>L</sub> = 2 kΩ, f = 10 kHz		0.01%			0.01%		
В1	Unity-gain bandwidth	$R_L = 2 k\Omega$ ,	C <sub>L</sub> = 100 pF		6			6		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ, f = 100 kHz	C <sub>L</sub> = 100 pF,		5.9			5.9		MHz
Вом	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 1,	R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 100 pF		668			668	-	kHz
m	Phase margin at unity gain	R <sub>L</sub> = 2 kΩ,	C <sub>L</sub> = 100 pF		58°		···········	58°		

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## TLE2142C electrical characteristics at specified free-air temperature, $V_{CC} = 5 \text{ V}$ (unless otherwise noted)

	<del> </del>		. 1	TL	E2142C	: 1	ŢLI	E2142A		UNIT
	PARAMETER	TEST CONDITIONS	TAT	MIN	TYP	MAX	MIN	TYP	MAX	ONII
			25°C		220	1900		200	1500	μV
10	Input offset voltage		Full range			2200			1800	μ,
vio	Temperature coefficient of input offset voltage	$V_{O} = 2.5 \text{ V},  \text{Rs} = 50 \Omega,$	Full range		1.7			1.7		μV/°C
		V <sub>IC</sub> = 2.5 V	25°C		8	100,		8	100	nA
10	Input offset current		Full range			150			150	
	· · · · · · · · · · · · · · · · · · ·	1	25°C		-0.8	-2		-0.8	-2	μА
ΙB	Input bias current		Full range			-2.1			-2.1	F
	Common-mode input		25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		v
VICR	voltage range	$R_S = 50 \Omega$	Full range	0 to 2.9			0 to 2.9			
			25°C	3.9	4.1		3.9	4.1		
		I <sub>OH</sub> = -150 μA	Full range	3.8			3.8			
			25°C	3.8	4		3.8	4		l v
VOH High	High-level output voltage	I <sub>OH</sub> = -1.5 mA	Full range	3.7			3.7			<u> </u>
			25°C	3.4	3.7		3.4	3.7	3.7	
		I <sub>OH</sub> = -15 mA	Full range	3.4			3.4			
			25°C		75	125	<u> </u>	75	125	
		I <sub>OL</sub> = 150 μA	Full range	Ī		150	<u> </u>		150	mV
		454	25°C	l	150	225		150	225	1
VOL	Low-level output voltage	I <sub>OL</sub> = 1.5 mA	Full range			250	ļ		250	Ь
		1- 15 mA	25°C		1.2	1.4		1.2	1.4	V
		I <sub>OL</sub> = 15 mA	Full range			1.5			1.5	<u> </u>
	Large-signal differential	$V_{CC} = \pm 2.5 \text{ V},  R_L = 2 \text{ k}\Omega,$	25°C	50	220		50	220		\ V/m\
AVD	voltage amplification	$V_0 = 1 \text{ V to } -1.5 \text{ V}$	Full range	25			25			
ri	Input resistance		25°C		70			70		MΩ
ci	Input capacitance		25°C		2.5		ļ	2.5		pF
z <sub>O</sub>	Open-loop output impedance	f = 1 MHz	25°C		30			30		Ω
	Common-mode	W. Warmin Ba 500	25°C	85	118		85			dB
CMRR	rejection ratio	$V_{IC} = V_{ICR}min, R_S = 50 \Omega$	Full range	80			80			
	Supply-voltage rejection	$V_{CC\pm} = \pm 2.5 \text{ V to } \pm 15 \text{ V},$	25°C	90	106		90			dB
ksvr.	ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	$R_S = 50 \Omega$ For	Full range	85			85			
<u> </u>		V <sub>O</sub> = 2.5 V, No load,	25°C		6.6		-	6.6		–l m/
ICC	Supply current	V <sub>IC</sub> = 2.5 V	Full range	1		9.2	<u>:                                    </u>		9.2	<u>.                                    </u>

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



## TLE2142C operating characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

	PARAMETER	TEST CO	NOITIONS	TI	E21420	•	TL	E2142A	c	
		120.00		MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	Avp = -1,	$R_L = 2 k\Omega^{\dagger}$ ,		45			45		
SR-	Negative slew rate	C <sub>L</sub> = 500 pF			42			42		V/μs
ts	Settling time	A <sub>VD</sub> = -1,	To 0.1%		0.16		· · · · · ·	0.16		
		2.5-V step	To 0.01%		0.22			0.22		μs
V <sub>n</sub>	Equivalent input noise voltage	$R_S = 20 \Omega$ ,	f = 10 Hz		15			15		$\vdash$
	-quitalist input holds voltage	$R_S = 20 \Omega$ ,	f = 1 kHz		10.5			10.5		nV/√Hz
V <sub>N(PP)</sub>	Peak-to-peak equivalent	f = 0.1 Hz to 1 H	z		0.48					
	input noise voltage	f = 0.1 Hz to 10 i	-lz		0.51 0.5		0.51		μV	
I <sub>n</sub>	Equivalent input noise current	f = 10 Hz			1.92		1.92			
<u>''</u>		f = 1 kHz		0.5		0.5			pA∕√Hz	
THD + N	Total harmonic distortion plus noise	$V_O = 1 \text{ V to 3 V},$ $A_{VD} = 2,$	H <sub>L</sub> = 2 kن, f = 10 kHz	0.0	052%		0.0	052%		
B1	Unity-gain bandwidth	$R_L = 2 k\Omega t$ ,	C <sub>L</sub> = 100 pF		5.9			5.9		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ <sup>†</sup> , f = 100 kHz	C <sub>L</sub> = 100 pF,		5.8			5.8		MHz
3ом	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 2 V, A <sub>VD</sub> = 1,	R <sub>L</sub> = 2 kن, C <sub>L</sub> = 100 pF		660		<del>-</del>	660		kHz
m	Phase margin at unity gain	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF		57°			57°		-

TRL terminates at 2.5 V.

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## TLE2142C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = $\pm 15$ V (unless otherwise noted)

				T	TL	E2142C		TL	E2142A		HAUT
	PARAMETER	TEST CONDI	TIONS	TA <sup>†</sup>	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
				25°C		290	1200		275	750	μV
10	Input offset voltage			Fult range			1600			1200	μν
×VIO	Temperature coefficient of input offset voltage	V <sub>IC</sub> = 0, F	R <sub>S</sub> = 50 Ω,	Full range		1.7			1.7		μV/°C
		V <sub>O</sub> = 0	3-33-4	25°C		7	100		7	100	nA
Ю	Input offset current		[	Full range			150			150	
				25°C		-0.7	-1.5		-0.7	-1.5	μА
IB	Input bias current			Full range			1.6			-1.6	
	Common-mode input			25°C	15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		v
ViCR	voltage range	$R_S = 50 \Omega$		Full range	-15 to 12.9	-15.3 to 13.1		-15 to 12.9	-15.3 to 13.1		•
				25°C	13.8	14.1		13.8	14.1		
		I <sub>O</sub> = -150 μA		Full range	13.7			13.7			
	Maximum positive peak			25°C	13.7	14		13.7	14		٧
VOM+	output voltage swing	$I_0 = -1.5 \text{ mA}$		Full range	13.6			13.6			
		1 - 4E - A		25°C	13.3	13.7		13.3	13.7		
		$I_{O} = -15 \text{ mA}$		Full range	13.2			13.2			
		150.1		25°C	-14.7	-14.9		14.7	-14.9		
		I <sub>O</sub> = 150 μA		Full range	-14.6			-14.6			
	Maximum negative peak			25°C	14.5	-14.8		-14.5	14.8		l v
VOM−	output voltage swing	IO = 1.5 mA		Full range	-14.4			-14.4			l i
				25°C	-13.4	13.8		-13.4	-13.8		1
		l <sub>O</sub> = 15 mA		Full range	-13.3			-13.3			
	Large-signal differential			25°C	100	450		100	450		V/mV
AVD	voltage amplification	$V_{O} = \pm 10 \text{ V}$		Full range	75			75			
rj	Input resistance	$R_L = 2 k\Omega$		25°C		65			65	<u> </u>	MΩ
ci	Input capacitance			25°C		2.5			2.5		pF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		30			30		Ω
	Common-mode	VIC = VICEMIN.		25°C	85	108		85	108		dB
CMRR	rejection ratio	R <sub>S</sub> = 50 Ω	,	Full range	80			80			
	Supply-voltage rejection	V <sub>CC±</sub> = ± 2.5 \	/ to ± 15 V,	25°C	90	106		90	106		dB
ksvr	ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	R <sub>S</sub> = 50 Ω	·	Full range	85			85			ļ
<del></del>		\ , .	V <sub>ID</sub> = 1 V	25°C	-25	-50		-25	-50		_ mA
los	Short-circuit output current	VO = 0	V <sub>ID</sub> = -1 V	25.0	20	31		20	31		<u> </u>
		14- 0		25°C		6.9	9		6.9		–t mA
ICC	Supply current	V <sub>O</sub> = 0,	No load	Full range			9.4	L		9.4	

† Full range is 0°C to 70°C.



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## TLE2142C operating characteristics, $V_{CC\pm}$ = ±15 V, $T_A$ = 25°C

	PARAMETER	TEST COM	PAOITIONS	T	LE21420	;	TL	E2142A	С	
		1201 001	10110113	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	$A_{VD} = -1$ ,	$R_L = 2 k\Omega$	27	45		27	45	_	· · · · · ·
SR-	Negative slew rate	C <sub>L</sub> = 500 pF		27	42		27	42		V/μs
ts	Settling time	$A_{VD} = -1$ ,	To 0.1%		0.34	`		0.34		
		10-V step	To 0.01%		0.4			0.4		μs
v <sub>n</sub>	Equivalent input noise voltage	$H_S = 20 \Omega$	f = 10 Hz		15			15		
-11		$R_S = 20 \Omega$ ,	f = 1 kHz		10.5			10.5		nV/√Hz
V <sub>N(PP)</sub>	Peak-to-peak equivalent input	f = 0.1 Hz to 1 H	z		0.48			0.48		
*N(FF)	noise voltage	f = 0.1 Hz to 10 l	Hz		0.51			0.51		μV
In	Equivalent input noise current	f = 10 Hz			1.89			1.89		
-11 	Equivalent input noise current	f = 1 kHz			0.47			0.47		pA∕√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20 \text{ V},$ $A_{VD} = 10,$	R <sub>L</sub> = 2 kΩ, f = 10 kHz		0.01%			0.01%		
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 2 k\Omega$ ,	C <sub>L</sub> = 100 pF		6			6		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ,, f =100 kHz	C <sub>L</sub> = 100 pF,		5.9			5.9		MHz
Вом	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 1,	R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 100 pF		668		<del></del>	668		kHz
φm	Phase margin at unity gain	$R_L = 2 k\Omega$ ,	C <sub>L</sub> = 100 pF		58°		~	58°	-	

#### TLE2144C electrical characteristics at specified free-air temperature, V<sub>CC</sub> = 5 V (unless otherwise noted)

		TEST CONSTITUTE	7.1	TI	E21440	; ]	TL	E2144A	C	UNIT
	PARAMETER	TEST CONDITIONS	TA <sup>†</sup>	MIN	TYP	MAX	MIN	TYP	MAX	UNII
			25°C		0.5	3.8		0.5	3	тV
VIO	Input offset voltage		Full range			4.4			3.6	mv
αVIO	Temperature coefficient of input offset voltage	Vn = 2.5 V,	Full range		1.7			1.7		μV/°C
		$V_{IC} = 2.5 \text{ V}$ $R_S = 50 \Omega$	25°C		8	100		8	100	пA
lO.	Input offset current		Full range			150			150	117
	tthis summed		25°C		-0.8	-2		-0.8	-2	μА
lB	Input bias current		Full range			-2.1			-2.1	μπ
	Common-mode input	D 500	25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		v
VICR	voltage range	R <sub>S</sub> = 50 Ω	Full range	0 to 2.9			0 to 2.9			•
		4504	25°C	3.9	4.1		3.9	4.1		
		I <sub>OH</sub> = -150 μA	Full range	3.8			3.8			
	High-level output		25°C	3.8	4		3.8	4		l v
VOH	voltage	I <sub>OH</sub> = -1.5 mA	Fuil range	3.7			3.7			<b>'</b>
			25°C	3.4	3.7		3.4	3.7		
		IOH = -15 mA	Full range	3.4			3.4			
			25°C		75	125		75	125	
		IOL = 150 μΑ	Full range			150			150	mV
	Low-level output		25°C		150	225		150	225	''' <b>'</b>
VOL	voitage	I <sub>OL</sub> = 1.5 mA	Full range			250			250	l
		45 4	25°C		1.2	1.6		1.2	1.6	V
		IOL ≈ 15 mA	Full range			1.7			1.7	L
	Large-signal differential	V <sub>CC</sub> = ±2.5 V, R <sub>L</sub> = 2 kg	25°C	50	95		50	95		V/m\
AVD	voltage amplification	V <sub>O</sub> = 1 V to -1.5 V	Full range	25			25			V/III
ri	Input resistance		25°C		70			70		MΩ
ci	Input capacitance		25°C		2.5			2.5		pF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz	25°C		30			30		Ω
OMBE	Common-mode	Via Viannia Br. 50.0	25°C	85	118		85	118		dB
CMRR	rejection ratio	V <sub>IC</sub> = V <sub>ICR</sub> min, R <sub>S</sub> = 50 Ω	Full range	80			80			
ksvr	Supply-voltage rejection ratio	$V_{CC\pm} = \pm 2.5 \text{ V to } \pm 15 \text{ V},$ $R_S = 50 \Omega$	25°C	90	106		90	106		dB
	(ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	U2 = 30 12	Full range	85			85			<u> </u>
loo	Supply current	$V_O = 2.5 \text{ V}$ , No load,	25°C		13.2	17.6		13.2	17.6	m <sub>A</sub>
<sub>1</sub> CC	эцрру сипепс	V <sub>IC</sub> = 2.5 V	Full range			18.5	1		18.5	L

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



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## TLE2144C operating characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

	PARAMETER	TEST CO	MOITIONS	TI	E21440	•	TL	E2144A	C	
		lesi coi	NUTTIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	A <sub>VD</sub> = -1,	$R_L = 2 k\Omega^{\dagger}$ ,		45			45		
SR~	Negative slew rate	C <sub>L</sub> = 500 pF			42			42		V/μs
ts	Settling time	AVD = -1,	To 0.1%		0.16			0.16		
's	Settining time	2.5-V step	To 0.01%		0.22	Ī		0.22		μs
Vn	Equivalent input	$R_S = 20 \Omega$ ,	f = 10 Hz		15			15		
٧n	noise voltage	$R_S = 20 \Omega$ ,	f = 1 kHz		10.5			10.5		nV/√Hz
V <sub>N(PP)</sub>	Peak-to-peak equivalent	f = 0.1 Hz to 1 Hz			0.48			0.48		
VN(PP)	input noise voltage	f = 0.1 Hz to 10 H	z		0.51			0.51		μ۷
l <sub>n</sub>	Equivalent input	f = 10 Hz			1.92			1.92		
'n	noise current	f = 1 kHz			0.5			0.5		p <b>A</b> /√Hz
THD + N	Total harmonic distortion plus noise	V <sub>O</sub> = 1 V to 3 V, A <sub>VD</sub> = 2,	$R_L = 2 k\Omega^{\dagger}$ , f = 10 kHz	0.0	052%		0.0	0052%		
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF		5.9			5.9		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ <sup>†</sup> , f = 100 kHz	C <sub>L</sub> = 100 pF,		5.8			5.8		MHz
ВОМ	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 2 V, A <sub>VD</sub> = 1,	$R_L = 2 k\Omega^{\dagger}$ , $C_L = 100 pF$		660			660		kHz
φm	Phase margin at unity gain	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF		57°			57°		

TRL terminates at 2.5 V

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## TLE2144C electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = $\pm 15$ V (unless otherwise noted)

	DADAMETED	TEST CON	DITIONS	TA <sup>†</sup>	Т	LE21440	;	TL	E2144A	С	UNIT
	PARAMETER	TEST CONI	DITIONS	'A'	MIN	TYP	MAX	MIN	TYP	MAX	UNII
				25°C		0.6	2.4		0.5	1.5	
۷iO	Input offset voltage			Full range			3.2			2.4	mV
αVIO	Temperature coefficient of input offset voltage	V <sub>IC</sub> = 0,	Rs = 50 Ω,	Full range		1.7			1.7		μV/°C
		V <sub>O</sub> = 0	3 - 55	25°C		7	100		7	100	
10	Input offset current			Full range			150			150	nA
				25°C		-0.7	-1.5		-0.7	-1.5	
lВ	Input bias current			Full range			-1.6			-1.6	μА
	Common-mode input			25°C	-15 to 13	15.3 to 13.2		-15 to 13	-15.3 to 13.2		
VICR	voltage range	$R_S = 50 \Omega$		Full range	-15 to 12.9	-15.3 to 13.1		-15 to 12.9	-15 to 13.1		V
				25°C	13.8	14.1		13.8	14.1		
		I <sub>O</sub> = -150 μA		Full range	13.7			13.7			
	Maximum positive peak			25°C	13.7	14	•	13.7	14		
VOM+	output voltage swing	I <sub>O</sub> = −1.5 mA		Full range	13.6		-	13.6			٧
		I <sub>O</sub> = –15 mA		25°C	13.1	13.7		13.1	13.7		
				Full range	13	110		13	440		
		I <sub>O</sub> = 150 μA		25°C		-14.9		-14.7	-14.9		
	Maximum negative			Full range	-14.6	11.0		-14.6 -14.5	-14.8		
V <sub>OM</sub> -	•	I <sub>O</sub> = 1.5 mA		25°C	-14.5 -14.4	-14.8		-14.5	-14.6		V
	swing			Full range 25°C	-14.4	-13.8		-13.4	13.8		
		IO = 15 mA				- 13.0		-13.4	13.0		
		-		Full range	-13.3	170	•	100	170		
AVD	Large-signal differential voltage amplification	V <sub>O</sub> = ±10 V		25°C	100 75	170		75	170		V/mV
_		D. Olio		Full range	/5	65		/3	65		MΩ
r <sub>i</sub>	Input resistance	R <sub>L</sub> = 2 kΩ			<u> </u>	2.5		<del> </del>	2.5		pF
ci	Input capacitance			25°C		2.5		<b> </b>	2.5		PF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		30			30		Ω
CMRR	Common-mode	VIC = VICEmin,	Be = 50 Ω	25°C	85	108		85	108		dB
	rejection ratio	TIC - TICHTIM		Full range	80			80			
ksvr	Supply-voltage rejection ratio	$V_{CC\pm} = \pm 2.5 \text{ V}$ R <sub>S</sub> = 50 $\Omega$	to ± 15 V,	25°C	90	106	• "	90	106		dB
	(ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	ns = 50 12		Full range	85			85			
loo	Short-circuit output	V <sub>O</sub> = 0	V <sub>ID</sub> = 1 V	25°C	-25	-50		-25	-50		mA
los	current		V <sub>ID</sub> = -1 V	230	20	31		20	31		
loc	Cupply ourrant	Vo = 0	No load	25°C		13.8	18		13.8	18	mA
lcc	Supply current	V <sub>O</sub> = 0,	พบางสน	Full range			18.8			18.8	

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

TEXAS INSTRUMENTS

## TLE2144C operating characteristics, $V_{CC\pm} = \pm 15$ V, $T_A = 25^{\circ}C$

	PARAMETER	TEOT 001	IDITIONS	Т	LE21440	;	TI	E2144A	C	
	PARAMETER	TEST COM	ADITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	AvD = -1,	$R_1 = 2 k\Omega$ ,	27	45		27	45		
SR-	Negative slew rate	C <sub>L</sub> = 500 pF		27	42		27	42		V/μs
	Settling time	A <sub>VD</sub> = -1,	To 0.1%		0.34			0.34		
t <sub>s</sub>	Setting time	10-V step	To 0.01%		0.4			0.4		μs
٧n	Equivalent input noise voltage	$R_S = 20 \Omega$ ,	f = 10 Hz		15			15		
٧n	Equivalent input noise voltage	$R_S = 20 \Omega$ ,	f = 1 kHz		10.5			10.5		nV/√Hz
Verre	Peak-to-peak equivalent input	f = 0.1 Hz to 1 H	z		0.48			0.48		
VN(PP)	noise voltage	f = 0.1 Hz to 10 l	Hz		0.51			0.51		μV
1	Equivalent input noise current	f = 10 Hz			1.89			1.89		/2
ln	Equivalent input noise current	f = 1 kHz			0.47			0.47		pA/√Hz
THD + N	Total harmonic distortion plus noise	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10,	R <sub>L</sub> = 2 kΩ, f = 10 kHz		0.01%			0.01%		
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 2 k\Omega$ ,	C <sub>L</sub> = 100 pF		6			6		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ, f = 100 kHz	C <sub>L</sub> = 100 pF,		5.9			5.9		MHz
ВОМ	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 1,	R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 100 pF		668		-	668		kHz
φm	Phase margin at unity gain	R <sub>L</sub> = 2 kΩ,	C <sub>L</sub> = 100 pF		58°			58°		

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## TLE2141I electrical characteristics at specified free-air temperature, $V_{CC} = 5 \text{ V}$ (unless otherwise noted)

				Т	LE2141		TL	E2141A	í i	
	PARAMETER	TEST CONDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
	1		25°C		225	1400		200	1000	μV
VIO	Input offset voltage		Full range			1900			1500	μν
ανιο	Temperature coefficient of input offset voltage	$V_{O} = 2.5 \text{ V},  R_{S} = 50 \Omega,$	Full range		1.7			1.7		μV/°C
1	land affect account	V <sub>IC</sub> = 2.5 V	25°C		8	100		8	100	nA
ō	Input offset current		Full range			200			200	
1	Input bias current		25°C		-0.8	-2		-0.8	-2	μА
lΒ	input bias current		Full range			-2.2			-2.2	μΛ
V	Common-mode input	D- F0.0	25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		V
VICR	voltage range	$R_S = 50 \Omega$	Full range	0 to 2.7	-0.3 to 2.9		0 to 2.7	-0.3 to 2.9		•
		I <sub>OH</sub> = -150 μA		3.9	4.1		3.9	4.1		
		I <sub>OH</sub> = -1.5 mA	25°C	3.8	4		3.8	4		
	I Cala Javal android college	I <sub>OH</sub> = -15 mA		3.2	3.7		3.2	3.7		v
∨он	High-level output voltage	I <sub>OH</sub> = -100 μA		3.8			3.8			٧
		I <sub>OH</sub> = -1 mA	Full range	3.7			3.7			
		I <sub>OH</sub> = -10 mA		3.3			3.3			
		I <sub>OL</sub> = 150 μA			75	125		75	125	mV
		I <sub>OL</sub> = 1.5 μA	25°C		150	225		150	225	1114
	Low lovel output voltage	I <sub>OL</sub> = 15 mA			1.2	1.6		1.2	1.6	٧
VOL	Low-level output voltage	I <sub>OL</sub> = 100 μA				175			175	mV
		I <sub>OL</sub> = 1 mA	Full range			225			225	
		I <sub>OL</sub> = 10 mA				1.4			1.4	٧
Δ	Large-signal differential	$V_{CC} = \pm 2.5 \text{ V},  R_L = 2 \text{ k}\Omega,$	25°C	50	220		50	220		V/mV
AVD	voltage amplification	V <sub>O</sub> = 1 V to -1.5 V	Full range	10			10			•,,,,,
rį	Input resistance		25°C		70			70		МΩ
cį	Input capacitance		25°C		2.5			2.5		pF
zo	Open-loop output impedance	f = 1 MHz	25°C		30			30		Ω
CMRR	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> min, R <sub>S</sub> = 50 Ω	25°C	85	118		85	118		dB
LININA	rejection ratio	VIC - VICHIIII, FIS = 50 12	Full range	80			80			
kour	Supply-voltage rejection	$V_{CC\pm} = \pm 2.5 \text{ V to } \pm 15 \text{ V},$	25°C	90	106		90	106		dB
ksvr	ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ )	$R_S = 50 \Omega$	Full range	85			85			
loc	Supply current	V <sub>O</sub> = 2.5 V, No load,	25°C		3.4	4.4		3.4	4.4	mA
Icc	oupply outlone	V <sub>IC</sub> = 2.5 V	Full range			4.6			4.6	"

<sup>†</sup> Full range is -40°C to 105°C.



## TLE2141I operating characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

	PARAMETER				TLE2141		T	LE2141A	1	
	PARAMETER	TEST CO	NOTTIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	AVD = -1,	$R_L = 2 k\Omega^{\dagger}$ ,	1	45			45		
SR-	Negative slew rate	C <sub>L</sub> = 500 pF			42			42	,	V/μs
ts	Settling time	A <sub>VD</sub> = -1,	To 0.1%		0.16			0.16		
'S	Setting time	2.5-V step	To 0.01%		0.22			0.22		μs
V <sub>n</sub>	Equivalent input noise voltage	$R_S = 20 \Omega$ ,	f = 10 Hz		15			15		\
٧n	Equivalent input noise voltage	$R_S = 20 \Omega$ ,	f = 1 kHz		10.5			10.5		лV/√Hz
Vaunn	Peak-to-peak equivalent input	f = 0.1 Hz to 1 Hz	z		0.48			0.48		.,
V <sub>N(PP)</sub>	noise voltage	f = 0.1 Hz to 10	Hz		0.51			0.51		μV
I <sub>n</sub>	Equivalent input noise current	f = 10 Hz			1.92			1.92		
'n 	Equivalent input noise current	f = 1 kHz			0.5	-		0.5		pA/√Hz
THD + N	Total harmonic distortion plus noise	$V_0 = 1 \text{ V to 3 V},$ $A_{VD} = 2,$	$R_L = 2 k\Omega^{\dagger}$ , f = 10 kHz		0.0052%			0.0052%		
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF†		5.9			5.9		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ <sup>†</sup> f = 100 kHz	C <sub>L</sub> = 100 pF†,		5.8			5.8		MHz
ВОМ	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 2 V, A <sub>VD</sub> = 1,	R <sub>L</sub> = 2 kΩ <sup>†</sup> , C <sub>L</sub> = 100 pF <sup>†</sup>		660			660		kHz
φm	Phase margin at unity gain	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF†	<u> </u>	57°			57°		

<sup>†</sup> RL and CL terminated to 2.5 V.

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## TLE21411 electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = $\pm 15$ V (unless otherwise noted)

	PARAMETER	TEST CO	NDITIONS	TAT		TLE2141	1	T	LE2141A	NI .	UNIT
	PARAMETER	1231 00	NOTIONS	'A'	MIN	TYP	MAX	MIN	TYP	MAX	UNII
ViO	Input offset voltage			25°C		200	900		175	500	V
¥10	input onset voltage			Full range			1500			1000	μV
αVIO	Temperature coefficient of input offset voltage	V <sub>IC</sub> = 0,	$R_S = 50 \Omega$	Full range		1.7	2,		1.7		μV/°C
lio	Input offset current	V <sub>O</sub> = 0		25°C		7	100		7	100	- 1
טוי	input onset current	]		Full range			200			200	nΑ
lв	Input bias current	}		25°C		-0.7	-1.5		-0.7	-1.5	
ΊΒ	input bias current			Full range			-1.7			-1.7	μА
Vion	Common-mode input	B F0 O		25°C	-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		v
VICR	voltage range	R <sub>S</sub> = 50 Ω		Full range	-15 to 12.7	-15.3 to 12.9		-15 to 12.7	-15.3 to 12.9		V
		$I_{O} = -150 \mu\text{A}$			13.8	14.1		13.8	14.1		
		$I_0 = -1.5 \text{ mA}$		25°C	13.7	14		13.7	14		
Va	Maximum positive peak	I <sub>O</sub> = -15 mA			13.1	13.7		13.1	13.7		٠.,
VOM+	output voltage swing	$I_{O} = -100 \mu A$			13.7			13.7			٧
		I <sub>O</sub> = -1 mA		Full range	13.6			13.6			
		I <sub>O</sub> = -10 mA		1	13.1			13.1			
		I <sub>O</sub> = 150 μA			-14.7	-14.9		-14.7	-14.9		
		I <sub>O</sub> = 1.5 mA		25°C	-14.5	-14.8		-14.5	-14.8		
	Maximum negative peak	I <sub>O</sub> = 15 mA		1	-13.4	-13.8		-13.4	-13.8		٠
VOM-	output voltage swing	I <sub>O</sub> = 100 μA			-14.6			-14.6			٧
		1 <sub>O</sub> = 1 mA		Full range	-14.5			-14.5			
		I <sub>O</sub> = 10 mA			-13.4			-13.4			
A	Large-signal differential	V 140V	5 010	25°C	100	450		100	450		
<sup>A</sup> VD	voltage amplification	$V_0 = \pm 10 \text{ V},$	$R_L = 2 k\Omega$	Full range	40			40			V/m¹
rį	Input resistance			25°C		65			65		MΩ
ci	Input capacitance			25°C		2.5			2.5		pF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		30	•		30		Ω
CMRR	Common-mode	V V	- D- FAC	25°C	85	108		85	108		-
CIVITH	rejection ratio	VIC = VICRMI	n, HS = 50 Ω	Full range	80	•		80			dB
lear ea	Supply-voltage rejection	V <sub>CC±</sub> = ±2.5	V to ±15 V,	25°C	90	106		90	106		
ksvr	ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	$R_S = 50 \Omega$	·	Full range	85			85			d₿
laa	Short-circuit output	V C	V <sub>ID</sub> = 1 V	0500	-25	-50		-25	-50		
os	current	VO = 0	V <sub>ID</sub> = -1 V	25°C	20	31		20	31		mA
	Curaly surrent	V- 0	NI- II	25°C		3.5	4.5		3.5	4.5	
CC	Supply current	$V_{O} = 0$ ,	No load	Full range			4.7			4.7	mA

† Full range is -40°C to 105°C.

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## TLE2141I operating characteristics, $V_{CC\pm}$ = $\pm 15$ V, $T_A$ = $25^{\circ}C$

	DADAMETED	TEST 001	IDITIONS	T	LE21411		TL	E2141A	ı	11507
	PARAMETER	TEST COM	IDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	$A_{VD} = -1$ ,	$R_1 = 2 k\Omega$	27	45		27	45		Mus
SR-	Negative slew rate	C <sub>L</sub> = 500 pF	_	27	42		27	42		V/µs
	Cattling time	A <sub>VD</sub> = -1,	To 0.1%		0.34			0.34		6
t <sub>S</sub>	Settling time	10-V step	To 0.01%		0.4			0.4		μs
	Facility in the same walks as	R <sub>S</sub> = 20 Ω,	f = 10 Hz		15			15		nV/√Hz
∨ <sub>n</sub>	Equivalent input noise voltage	$R_S = 20 \Omega$ ,	f = 1 kHz		10.5			10.5		Π <b>V</b> /VHZ
	Peak-to-peak equivalent input	f = 0.1 Hz to 1 H	z		0.48			0.48		/
V <sub>N(PP)</sub>	noise voltage	f = 0.1 Hz to 10	Hz		0.51			0.51		μV
		f = 10 Hz			1.89			1.89		- 1/11
I <sub>n</sub>	Equivalent input noise current	f = 1 kHz			0.47			0.47		pA/√Hz
THD + N	Total harmonic distortion plus noise	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10,	R <sub>L</sub> = 2 kΩ, f = 10 kHz		0.01%			0.01%		
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 2 k\Omega$ ,	C <sub>L</sub> = 100 pF		6			6		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ, f = 100 kHz	C <sub>L</sub> = 100 pF,		5.9			5.9		MHz
вом	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 1,	R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 100 pF		668			668		kHz
φm	Phase margin at unity gain	$R_L = 2 k\Omega$ ,	C <sub>L</sub> = 100 pF		58°			58°		

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## TLE2142I electrical characteristics at specified free-air temperature, $V_{CC}$ = 5 V (unless otherwise noted)

	PARAMETER	TEST CON	IDITIONS	T.+	T	LE2142		TI	E2142	NI .	
	ANAMETEN	1231 001	DITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
v <sub>IO</sub>	Input offset voltage			25°C		220	1900		220	1500	
10	input onect voltage			Full range			2400			2000	μV
αVIO	Temperature coefficient of input offset voltage	V <sub>O</sub> = 2.5 V,	$R_S = 50 \Omega$	Full range		1.7			1.7		μV/°C
lio	Input offset current	V <sub>IC</sub> = 2.5 V	,	25°C		8	100		8	100	
10	input onset current	j		Full range			200			200	nA
Iв	Input bias current	1		25°C		-0.8	-2		-0.8	-2	
'IB	input bius current			Full range			-2.2			-2.2	μΑ
VICR	Common-mode input	Rs = 50 Ω		25°C	о to з	-0.3 to 3.2		0 to 3	-0.3 to 3.2		v
TICH	voltage range	115 - 30 22		Full range	0 to 2.7	-0.3 to 2.9		0 to 2.7	-0.3 to 2.9		V
		I <sub>OH</sub> ≃ −150 μA			3.9	4.1		3.9	4.1		
		$I_{OH} = -1.5 \text{ mA}$		25°C	3.8	4		3.8	4		
VOH	High-level output voltage	$I_{OH} = -15 \text{ mA}$			3.4	3.7		3.4	3.7		v
VOn	riigirieverbuipat voitage	I <sub>OH</sub> = 100 μA			3.8			3.8			
		IOH = 1 mA		Full range	3.7			3.7			
		I <sub>OH</sub> = 10 mA			3.5			3.5			
		lO <sub>i</sub> = 150 μA		]		75	125		75	125	mV
		I <sub>OL</sub> = 1.5 mA		25°C		150	225		150	225	1114
VOL	Low-level output voltage	I <sub>OL</sub> = 15 mA				1.2	1.4		1.2	1.4	٧
- OL		I <sub>OL</sub> = 100 μA		.			175			175	mV
		IOL = 1 mA		Full range			225			225	
		I <sub>OL</sub> = 10 mA					1.2			1.2	V
AVD	Large-signal differential	$V_{IC} = \pm 2.5 V$ ,	$R_L = 2 k\Omega$	25°C	50	220		50	220		V/mV
	voltage amplification	$V_O = 1 \text{ V to } -1.$	5 V	Full range	10			10			.,,,,,
rį	Input resistance			25°C		70			70		MΩ
ci	Input capacitance			25°C		2.5			2.5		pF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		30			30		Ω
CMRR	Common-mode rejection	V <sub>IC</sub> = V <sub>ICB</sub> min,	Bo = 50 O	25°C	85	118		85	118		dB
- min in t	ratio	TIC - TICHITIIII	115 - 30 32	Full range	80			80			ub
ksvr	Supply-voltage rejection	V <sub>CC±</sub> = ±2.5 V	to ± 15 V,	25°C	90	106		90	106		dB
··ovn	ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	$R_S = 50 \Omega$		Full range	85			85			ub
lcc	Supply current	$V_0 = 2.5 V$ ,	No load,	25°C		6.6	8.8		6.6	8.8	mA
		V <sub>IC</sub> = 2.5 V		Full range			9.2			9.2	1107

<sup>†</sup> Full range is - 40°C to 105°C.

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### TLE2142I operating characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

			DITIONS		TLE2142I		Т	LE2142AI		UNIT
	PARAMETER	TEST CON	DITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNII
SR+	Positive slew rate	A <sub>VD</sub> = -1,	$R_1 = 2 k\Omega^{\dagger}$		45			45		V/μs
SR-	Negative slew rate	C <sub>L</sub> = 500 pF	_ ,		42			42		V/μS
	0-111	A <sub>VD</sub> = -1,	To 0.1%		0.16			0.16		
ts	Settling time	2.5-V step	To 0.01%		0.22			0.22		μs
	Equivalent input noise	R <sub>S</sub> = 20 Ω,	f = 10 Hz		15			15		nV/√ <del>Hz</del>
v <sub>n</sub>	voltage	$R_S = 20 \Omega$ ,	f = 1 kHz		10.5			10.5		IIV/VIIZ
	Peak-to-peak equivalent	f = 0.1 Hz to 1 Hz	Z		0.48			0.48		
V <sub>N(PP)</sub>	input noise voltage	f = 0.1 Hz to 10 H	łz		0.51			0.51		μV
	Equivalent input noise	f = 10 Hz			1.92			1.92		- 4 6 575
<sup>l</sup> n	current	f = 1 kHz			0.5			0.5		pA∕√Ĥz
THD + N	Total harmonic distortion plus noise	V <sub>O</sub> = 1 V to 3 V, A <sub>VD</sub> = 2,	$R_L = 2 k\Omega^{\dagger}$ , f = 10 kHz		0.0052%			0.0052%		
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 2 k\Omega^{\dagger}$	C <sub>L</sub> = 100 pF		5.9			5.9		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ <sup>†</sup> , f = 100 kHz	C <sub>L</sub> = 100 pF,		5.8			5.8		MHz
Вом	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 2 V, A <sub>VD</sub> = 1,	$R_L = 2 k\Omega^{\dagger}$ , $C_L = 100 pF$		660			660		kHz
φm	Phase margin at unity gain	$R_L = 2 k\Omega^{\dagger}$	C <sub>L</sub> = 100 pF		57°			57°		

TRL terminates at 2.5 V.

## TLE2142I electrical characteristics at specified free-air temperature, $V_{CC\pm}=\pm 15~V$ (unless otherwise noted)

	PARAMETER	TEST	NDITIONS	- +	]	TLE2142	ı		TLE2142	I T	
	ranameten	IESI CC	MUITIONS	TAT	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
Via	Input offset voltage			25°C		290	1200		275	750	
VIO	Input onset voitage			Full range			1800			1400	μV
αVΙΟ	Temperature coefficient of input offset voltage	V <sub>IC</sub> = 0,	$R_S = 50 \Omega$ ,	Full range		1.7			1.7		μV/°C
lo lo	Input offset current	VO = 0		25°C		7	100		7	100	
·10	input onset current			Full range			200			200	nA
l <sub>B</sub>	Input bias current			25°C		-0.7	1.5		-0.7	-1.5	
10	par alao oanone	<u> </u>		Full range			-1.7			-1.7	μΑ
VICR	Common-mode input	R <sub>S</sub> = 50 Ω		25°C	-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		
TICH	voltage range	115 - 30 12		Full range	-15 to 12.7	-15.3 to 12.9		-15 to 12.7	-15.3 to 12.9		V
		lo = -150 μ	A		13.8	14.1		13.8	14.1		
		$I_0 = -1.5  \text{m/s}$	١	25°C	13.7	14		13.7	14		
V <sub>OM+</sub>	Maximum positive peak	$I_{O} = -15 \text{ mA}$			13.3	13.7		13.3	13.7		.,
*UM+	output voltage swing	$I_{O} = -100  \mu$	4	]	13.7			13.7			٧
		$I_0 = -1 \text{ mA}$		Full range	13.6			13.6			
		$I_0 = -10 \text{ mA}$			13.3			13.3			
		l <sub>O</sub> = 150 μA			-14.7	14.9		-14.7	-14.9		
		$I_O = 1.5 \text{ mA}$		25°C	-14.5	-14.8		-14.5	-14.8		
V <sub>OM</sub> -	Maximum negative peak	i <sub>O</sub> = 15 mA			-13.4	-13.8		-13.4	-13.8		v
· OM-	output voltage swing	$I_O = 100 \mu A$			-14.6			-14.6			٧
		I <sub>O</sub> = 1 mA		Full range	-14.5			-14.5			
		I <sub>O</sub> = 10 mA			-13.4			-13.4			
Avd	Large-signal differential	V <sub>O</sub> = ±10 V,	D 210	25°C	100	450		100	450		24424
טעיי	voltage amplification	VO = ± 10 V,	UE - 5 K25	Full range	40			40			V/mV
rį	Input resistance			25°C		65			65		МΩ
ci	Input capacitance			25°C		2.5			2.5		pF
z <sub>o</sub>	Open-loop output imped- ance	f = 1 MHz		25°C		30			30		Ω
CMRR	Common-mode rejection	VIC = VICRI	nin	25°C	85	108		85	108		
CWITT	ratio	$R_S = 50 \Omega$		Full range	80			80			dB
kovo	Supply-voltage rejection	$V_{CC\pm} = \pm 2.5 \text{ V to } \pm 15 \text{ V},$		25°C	90	106		90	106		
ksvr	ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	$R_S = 50 \Omega$		Full range	85			85			dB
los	Short-circuit output current	Vo = 0	V <sub>ID</sub> = 1 V	2500	-25	50		-25	-50		^
-05	Onort official output current	rent $V_O = 0$ $V_{ID} = -1 \text{ V}$ 25°C	V ( = 1)	20	31		20	31		mA	
lcc	Supply current	V <sub>O</sub> = 0,	No load	25°C		6.9	9		6.9	9	
	- Cappiy Current	1.0 - 0,	INU IUAU	Full range			9.4			9.4	mA

<sup>†</sup> Full range is -40°C to 105°C.

## TLE2142I operating characteristics, $V_{CC\pm} = \pm 15$ V, $T_A = 25^{\circ}C$

				Т	LE2142I		TL	E2142A	ı	
	PARAMETER	TEST CON	IDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	$A_{VD} = -1$ ,	$R_1 = 2 k\Omega$ ,	30	45		30	45		V/µs
SR-	Negative slew rate	C <sub>L</sub> = 500 pF		30	42		30	42		ν/μ5
	0-111	Avp = -1,	To 0.1%		0.34			0.34		μs
ts	Settling time	10-V step	To 0.01%		0.4			0.4		μδ
		$R_S = 20 \Omega$ ,	f = 10 Hz		15			15		->16/II=
V <sub>n</sub>	Equivalent input noise voltage	$R_S = 20 \Omega$ ,	f = 1 kHz		10.5			nV/√Hz		
	Peak-to-peak equivalent input	f = 0.1 Hz to 1 H	z		0.48			0.48		
V <sub>N(PP)</sub>	noise voltage	f = 0.1 Hz to 10 l		0.51			0.51		μV	
		f = 10 Hz			1.89			1.89		- A / D I=
<sup>l</sup> n	Equivalent input noise current	f = 1 kHz			0.47		0.47			pA/√Hz
THD + N	Total harmonic distortion plus noise	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10,	R <sub>L</sub> = 2 kΩ, f = 10 kHz		0.01%			0.01%		
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 2 k\Omega$ ,	C <sub>L</sub> = 100 pF		6			6		MHz
	Gain-bandwidth product	H <sub>L</sub> = 2 kΩ, f =100 kHz	C <sub>L</sub> = 100 pF,		5.9			5.9		MHz
Вом	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 1,	R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 100 pF		668			668		kHz
φm	Phase margin at unity gain	$R_L = 2 k\Omega$ ,	C <sub>L</sub> = 100 pF		58°			58°		



#### TLE21441 electrical characteristics at specified free-air temperature, $V_{CC} = 5 \text{ V}$ (unless otherwise noted)

	PARAMETER	TEST CONDITIONS	TAT	Т	LE2144		T	LE2144	AI .	
		1201 CONDITIONS	'A'	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
ν <sub>IO</sub>	Input offset voltage		25°C		0.5	3.8		0.5	3	mV
L."			Full range			4.8			4	l mv
ανιο	Temperature coefficient of input offset voltage	$V_{IC} = 0$ , $R_S = 50 \Omega$ ,	Full range		1.7	_		1.7		μV/°C
110	Input offset current	VO = 0	25°C		8	100		8	100	
			Full range			200			200	nA
Iв	Input bias current		25°C		-0.8	-2		-0.8	-2	
			Full range			-2.2			-2.2	μА
V <sub>ICR</sub>	Common-mode input	R <sub>S</sub> = 50 Ω	25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		٧
1011	voltage range		Full range	0 to 2.7	-0.3 to 2.9		0 to 2.7	-0.3 to 2.9		v
		I <sub>OH</sub> = -150 μA		3.9	4.1		3.9	4.1		
		I <sub>OH</sub> = ~1.5 mA	25°C	3.8	4		3.8	4		
Vон	High-level	I <sub>OH</sub> = -15 mA		3.4	3.7		3.4	3.7		٠,,
100	output voltage	I <sub>OH</sub> = 100 μA		3.8			3.8			٧
		I <sub>OH</sub> = 1 mA	Full range	3.7			3.7			
		I <sub>OH</sub> = 10 mA		3.5			3.5			
		I <sub>OL</sub> = 150 μA			75	125		75	125	
	,	I <sub>OL</sub> ≈ 1.5 μA	25°C		150	225		150	225	mV
VOL	Low-level	I <sub>OL</sub> = 15 mA			1.2	1.6		1.2	1.6	V
·OL	output voltage	I <sub>OL</sub> = 100 μA				175			175	
		I <sub>OL</sub> = 1 mA	Full range			225			225	mV
		I <sub>OL</sub> = 10 mA	] [			1.4			1.4	٧
AVD	Large-signal differential	$V_{IC} = \pm 2.5 \text{ V}, \qquad R_L = 2 \text{ k}\Omega,$	25°C	50	95		50	95		147 14
	voltage amplification	V <sub>O</sub> = 1 V to -1.5 V	Full range	10			10			V/mV
rį	Input resistance		25°C		70			70		МΩ
ci	Input capacitance		25°C		2.5			2.5		ρF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz	25°C		30			30		Ω
CMRR	Common-mode	$V_{IC} = V_{ICR}min$ , $R_S = 50 \Omega$	25°C	85	118		85	118		.ID
	rejection ratio	•1C = •1CHmm, 13 = 30 12	Full range	80			80			dΒ
ksvr	Supply-voltage rejection ratio	$V_{CC\pm} = \pm 2.5 \text{ V to } \pm 15 \text{ V},$ $R_S = 50 \Omega$	25°C	90	106		90	106		dB
	(ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	115 = 30 12	Full range	85			85			
lcc	Supply current	V <sub>O</sub> = 2.5 V, No load,	25°C		13.2	17.6		13.2	17.6	A
	rge is -40°C to 105°C	V <sub>IC</sub> = 2.5 V	Full range			18.4			18.4	mA

<sup>†</sup> Full range is -40°C to 105°C.



## TLE2144I operating characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

			TEST CONDITIONS		TLE2144I			TLE2144AI		
	PARAMETER	TEST CO	NDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	A <sub>VD</sub> = -1,	$R_L = 2 k\Omega^{\dagger}$		45			45		V/µs
SR-	Negative slew rate	C <sub>L</sub> = 500 pF			42			42		ν/μ3
		Avp = -1,	To 0.1%		0.16			0.16		μs
ts	Settling time	2.5-V step	To 0.01%		0.22			0.22		μο
		$R_S = 20 \Omega$ ,	f = 10 Hz		15			15		nV/√Hz
V <sub>n</sub>	Equivalent input noise voltage	$H_S = 20 \Omega$ ,	f = 1 kHz		10.5			10.5		1107 1112
	Peak-to-peak equivalent input	f = 0.1 Hz to 1 H	z		0.48			0.48		μV
VN(PP)	noise voltage	f = 0.1 Hz to 10 l	Hz		0.51			0.51		μ,
		f = 10 Hz			1.92			1.92		pA/√Hz
ln	Equivalent input noise current	f = 10 kHz			0.5			0.5		pA/ YHZ
THD + N	Total harmonic distortion plus noise	V <sub>O</sub> = 1 V to 3 V, A <sub>VD</sub> = 2,	R <sub>L</sub> = 2 kΩ <sup>†</sup> , f = 10 kHz	0.	0052%		0.4	0052%		
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF		5.9			5.9		MHz
	Gain-bandwidth product	$R_L = 2 k\Omega^{\dagger}$ , f = 100 kHz	C <sub>L</sub> = 100 pF,		5.8			5.8		MHz
ВОМ	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 2 V, A <sub>VD</sub> = 1,	$R_L = 2 k\Omega T$ , $C_L = 100 pF$		660			660		kHz
φm	Phase margin at unity gain	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF		57°			57°		

<sup>†</sup>R<sub>I</sub> terminates at 2.5 V

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## TLE2144l electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = $\pm 15$ V (unless otherwise noted)

	PARAMETER	TEST CON	PITIONS	T-+	L	TLE2144	<u> </u>	Т	LINUT		
	TATAMETER	1EST CONE	DITIONS	TAT	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
VIO	Input offset voltage			25°C		0.6	2.4		0.5	1.5	
10	- Input onset voltage			Full range	L		3.2			2.8	m∨
αVIO	Temperature coefficient of input offset voltage	V <sub>IC</sub> = 0,	R <sub>S</sub> = 50 Ω	Full range		1.7			1.7		μV/°Ç
lio	Input offset current	VO = 0		25°C		7	100		7	100	
10	input onoct danient			Full range			200			200	nA
lв	Input bias current			25°C		-0.7	-1.5		-0.7	-1.5	
-10				Full range			-1.7			-1.7	μA
VICR	Common-mode input	B- 50.0		25°C	-15 to 13	-15.3 to 13.2		-15 to 13	15.3 to 13.2		_
VICH	voltage range	$R_S = 50 \Omega$		Full range	-15 to 12.7	-15.3 to 12.9		-15 to 12.7	-15.3 to 12.9		V
		l <sub>O</sub> = -150 μA	***		13.8	14.1		13.8	14.1		
		I <sub>O</sub> = –1.5 mA	·	25°C	13.7	14	-	13.7	14		
V <sub>OM+</sub>	Maximum positive peak	l <sub>O</sub> = -15 mA		1	13.1	13.7		13.1	13.7		
VOM+	10 = -100	I <sub>O</sub> = -100 μA			13.7			13.7			٧
		i <sub>O</sub> = −1 mA		Full range	13.6			13.6			
		$I_{O} = -10 \text{ mA}$		1	13.1			13.1			
		l <sub>O</sub> = 150 μA		1	-14.7	-14.9		-14.7	-14.9		
		l <sub>O</sub> = 1.5 mA		25°C	-14.5	-14.8		-14.5	-14.8		
Vом-	Maximum negative peak output voltage	l <sub>O</sub> = 15 mA		1	-13.4	-13.8		-13.4	-13.8		
VOM-	swing	I <sub>O</sub> = 100 μA			-14.6			-14.6			٧
	v	lo = 1 mA		Full range	-14.5		-	-14.5			
		IO = 10 mA		1	-13.4			-13.4			
Δ. /Δ	Large-signal differential	V= ±10.V	D. Olio	25°C	100	170		100	170		
AVD	voltage amplification	V <sub>O</sub> = ±10 V,	$R_L = 2 k\Omega$	Full range	40			40			V/mV
rį	Input resistance			25°C		65			65		MΩ
c <sub>i</sub>	Input capacitance			25°C		2.5			2.5		рF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		30			30		Ω
CMRR	Common-mode	Via – Vianmin	D- 50.0	25°C	85	108		85	108		
CIVITI	rejection ratio	V <sub>IC</sub> = V <sub>ICR</sub> min,	$R_S = 50 \Omega$	Full range	80			80			dB
ksvr	Supply-voltage rejection ratio	$V_{CC\pm} = \pm 2.5 \text{ V to}$ R <sub>S</sub> = 50 $\Omega$	± 15 V,	25°C	90	106		90	106		dB
	(ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	112 - 20 75		Full range	85			85			
los	Short-circuit output	V <sub>O</sub> = 0	V <sub>ID</sub> = 1 V	25°C	-25	-50		-25	-50		A
.03	current	.0-0	V <sub>ID</sub> = -1 V	25.0	20	31		20	31		mA
lcc	Supply current	V <sub>O</sub> = 0,	No load	25°C		13.8	18		13.8	18	^
.00	Cuppiy dundin	<del>-</del> 0 - 0,	NO IOAU	Full range			18.8			18.8	mA

<sup>†</sup> Full range is -40°C to 105°C.

TEXAS INSTRUMENTS

## TLE2144I operating characteristics, $V_{CC\pm} = \pm 15 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

			TEST CONDITIONS		LE2144		TL			
	PARAMETER	TEST CON	IDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	Avp = -1,	$R_1 = 2 k\Omega$	27	45		27	45		V/μs
SR-	Negative slew rate	CL = 500 pF		27	42		27	42		ν/μ8
	0-40	Avp = -1,	To 0.1%		0.34			0.34		μs
ts	Settling time	10-V step	To 0.01%		0.4			0.4		μο
	Equivalent input	$R_S = 20 \Omega$ ,	f = 10 Hz		15			15		nV/√Hz
v <sub>n</sub>	noise voltage	$R_S = 20 \Omega$ , $f = 1 \text{ kHz}$		10.5		10.5			IIV/VIIIZ	
	Peak-to-peak equivalent	f = 0.1 Hz to 1 H	z	0.48			0.48			μV
VN(PP)	input noise voltage	f = 0.1 Hz to 10	Hz		0.51			0.51		μν
	Equivalent input	f = 10 Hz		1.89			1.89		pA/√Hz	
<sup>1</sup> n	noise current	f = 1 kHz	0.47			0.47			PAVHZ	
THD + N	Total harmonic distortion plus noise	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10,	R <sub>L</sub> = 2 kΩ, f = 10 kHz		0.01%			0.01%		
B <sub>1</sub>	Unity-gain bandwidth	R <sub>L</sub> = 2 kΩ,	C <sub>L</sub> = 100 pF		6			6		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ, f = 100 kHz	C <sub>L</sub> = 100 pF,		5.9			5.9		MHz
ВОМ	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 1,			668			668		kHz
φm	Phase margin at unity gain	$R_L = 2 k\Omega$ ,	C <sub>L</sub> = 100 pF		58°			58°		

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## TLE2141M electrical characteristics at specified free-air temperature, $V_{CC} = 5 \text{ V}$ (unless otherwise noted)

	PARAMETER	TEST CONDITIONS	TAT	TI	LE2141	A .	TL					
	- ANAMETEN	TEST CONDITIONS	'A'	MIN	TYP	MAX	MIN	TYP	MAX	UNIT		
VIO	Input offset voltage		25°C		225	1400		200	1000			
10	mpat onset voltage		Full range			2100			1700	μ۷		
∝vio	Temperature coefficient of input offset voltage	$V_{O} = 2.5 \text{ V}$ $R_{S} = 50 \Omega$ ,	Full range		1.7			1.7		μV/°C		
<u> </u>	Input offset current	V <sub>IC</sub> = 2.5 V	25°C		8	100		8	100			
·ΙΟ	- Input onset current	]	Full range		-	250			250	nΑ		
Iв	Input bias current		25°C		-0.8	-2		-0.8	-2			
чв	input bias current		Full range			-2.3			-2.3	μΑ		
VICR	Common-mode input	R <sub>S</sub> = 50 Ω	25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2				
FICH	voltage range	NS = 30 12	Full range	0 to 2.7	-0.3 to 2.9		0 to 2.7	-0.3 to 2.9		V		
		I <sub>OH</sub> = -150 μA		3.9	4.1		3.9	4.1				
		I <sub>OH</sub> = -1.5 mA	25°C	3.8	4		3.8	4				
Vон	High-level output	I <sub>OH</sub> = -15 mA	1	3.2	3.7		3.2	3.7				
νОН	voltage	I <sub>OH</sub> = -100 μA		3.75	-		3.75			٧		
		I <sub>OH</sub> = -1 mA	Full range	3.65			3.65					
		I <sub>OH</sub> = -10 mA	1	3.25			3.25					
		I <sub>OL</sub> = 150 μA			75	125		75	125			
		l <sub>OL</sub> = 1.5 μA	25°C		150	225	-	150	225	mV		
VOL	Low-level output	I <sub>OL</sub> = 15 mA			1.2	1.4		1.2	1.4	V		
·OL	voltage	I <sub>OL</sub> = 100 μA				200			200			
		I <sub>OL</sub> = 1 mA	Full range		_	250			225	mV		
		I <sub>OL</sub> = 10 mA				1.25			1.25	V		
AVD	Large-signal differential	$V_{IC} = \pm 2.5 \text{ V}, \qquad R_L = 2 \text{ k}\Omega,$	25°C	50	220		50	220		V/mV		
	voltage amplification	V <sub>O</sub> = 1 V to -1.5 V	Full range	5			5			V/111V		
ri	Input resistance		25°C		70			70		МΩ		
C <sub>i</sub>	Input capacitance		25°C		2.5			2.5		рF		
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz	25°C		30			30		Ω		
CMRR	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> min, R <sub>S</sub> = 50 Ω	25°C	85	118		85	118		-40		
	rejection ratio	-IC - VICHIIII, NS = 50 12	Full range	80			80			₫B		
ksvr	Supply-voltage rejection	$V_{CC\pm} = \pm 2.5 \text{ V to } \pm 15 \text{ V},$	Supply-voltage rejection $V_{CC\pm} = \pm 2.5 \text{ V to } \pm 15 \text{ V}$ ,		25°C	90	106		90	106		dB
-ovn	ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	$R_S = 50 \Omega$	Full range	85			85			aв		
lcc	Supply current	V <sub>O</sub> = 2.5 V, No load,	25°C		3.4	4.4		3.4	4.4	A		
		V <sub>IC</sub> = 2.5 V	Full range			4.6			4.6	mA		

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



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## TLE2141M operating characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

				1	ΓLE2141N	ı	T	LE2141A	M	UNIT
	PARAMETER	TEST CON	IDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNII
SR+	Positive slew rate	Avn = -1,	$R_1 = 2 k\Omega^{\dagger}$ ,		45			45		V/μs
SR-	Negative slew rate	C <sub>L</sub> = 500 pF			42			42		V/μS
	0.41.	AvD = -1,	$A_{VD} = -1$ , To 0.1% 0.16		0.16		0.16		μs	
ts	Settling time	2.5-V step	To 0.01%		0.22			, Jus		
	- 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	$R_S = 20 \Omega$ ,	f = 10 Hz		15			nV/√Hz		
Vn	Equivalent input noise voltage	$R_S = 20 \Omega$ ,	f = 1 kHz	10.5			110/(112			
	Peak-to-peak equivalent input	f = 0.1 Hz to 1 Hz	f = 0.1 Hz to 1 Hz		0.48		0.48			μ۷
V <sub>N(PP)</sub>	noise voltage	f = 0.1 Hz to 10 h		0.51			0.51		μ۷	
		f = 10 Hz			1.92			1.92		pA/√Hz
ln	Equivalent input noise current	f = 1 kHz			0.5		0.5			pA/VHZ
THD + N	Total harmonic distortion plus noise	$V_O = 1 \text{ V to 3 V},$ $A_{VD} = 2,$	$R_L = 2 k\Omega^{\dagger}$ , f = 10  kHz		0.0052%			0.0052%		
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF <sup>†</sup>		5.9			5.9		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ <sup>†</sup> , f = 100 kHz	C <sub>L</sub> = 100 pF†,		5.8			5.8		MHz
Вом	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 2 V, A <sub>VD</sub> = 1	$R_L = 2 k\Omega^{\dagger}$ ,		660			660		kHz
φm	Phase margin at unity gain	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF†		57°			57°		

<sup>†</sup>R<sub>L</sub> and C<sub>L</sub> terminated to 2.5 V.

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## TLE2141M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = $\pm 15$ V (unless otherwise noted)

	PARAMETER	TEST CON	PAOITIONS	TAT	T	LE21411	И	TI	.E2141A	М	
	TANAMETEN	1231 001	ibilions	'A'	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
VIO	Input offset voltage			25°C		200	900		175	500	
10	input onoct voltage			Full range	<u> </u>		1700			1200	μV
αVIO	Temperature coefficient of input offset voltage	V 0	D- 50.0	Full range		1.7			1.7		μV/°C
lio	Input offset current	V <sub>IC</sub> = 0,	$R_S = 50 \Omega$	25°C		7	100		7	100	- 4
10	- Input onsot current			Full range			250			250	nA
lв	Input bias current			25°C		-0.7	-1.5	-	-0.7	-1.5	
סוי	Input blue current			Full range			-1.8			-1.8	μA
V <sub>ICR</sub>	Common-mode input	R <sub>S</sub> = 50 Ω	A <sub>S</sub> = 50 Ω		-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		· ·
	voltage range			Full range	-15 to 12.7	-15.3 to 12.9		-15 to 12.7	-15.3 to 12.9		
		$I_O = -150 \mu A$		_	13.8	14.1		13.8	14.1		
		$I_{O} = -1.5 \text{ mA}$		25°C	13.7	14	_	13.7	14		
V <sub>OM+</sub>	Maximum positive peak	$I_0 = -15 \text{ mA}$			13.1	13.7		13.1	13.7		
· OWI +	output voltage swing	$I_0 = -100 \mu\text{A}$			13.7			13.7			<b>v</b>
		$I_O = -1 \text{ mA}$		Full range	13.6			13.6			
		$I_0 = -10 \text{ mA}$			13.1			13.1			
		I <sub>O</sub> = 150 μA			-14.7	-14.9		-14.7	-14.9		
		I <sub>O</sub> = 1.5 mA		25°C	-14.5	-14.8		-14.5	-14.8		
V	Maximum negative peak	I <sub>O</sub> = 15 mA			-13.4	-13.8		-13.4	-13.8		
VOM-	output voltage swing	IO = 100 μA			-14.6			-14.6			V
		IO = 1 mA		Full range	-14.5			-14.5	·		
		I <sub>O</sub> = 10 mA		1	-13.4	·		-13.4			
	Large-signal differential			25°C	100	450		100	450		
AVD	voltage amplification	$V_{O} = \pm 10 \text{ V},$	$R_L = 2 k\Omega$	Full range	20			20			V/mV
rį	Input resistance			25°C		65			65		MΩ
cį	Input capacitance			25°C		2.5			2.5		pF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		30			30		Ω
CMRR	Common-mode	V V	D- 50.0	25°C	85	108		85	108		
CIVINN	rejection ratio	V <sub>IC</sub> = V <sub>ICR</sub> min,	HS = 50 12	Full range	80			80			dΒ
ka	Supply-voltage rejection	V <sub>CC±</sub> = ±2.5 V	to ±15 V,	25°C	90	106		90	106		
ksvr	ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	R <sub>S</sub> = 50 Ω	•	Full range	85			85			dB
los	Short-circuit output	VO = 0	V <sub>ID</sub> = 1 V	25°C	-25	-50		-25	-50		mA
	current		V <sub>ID</sub> = -1 V		20	31		20	31		
lcc	Supply current	Vo = 0,	No load,	25°C		3.5	4.5		3.5	4.5	mA.
	,	V <sub>IC</sub> = 2.5 V		Full range	L		4.7			4.7	

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

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### TLE2141M operating characteristics, $V_{CC\pm} = \pm 15 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

			IDITIONS	TL	.E2141N	A	TLI	E2141A	M	UNIT
	PARAMETER	TEST CO	ROUTIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNII
SR+	Positive slew rate	Avp = -1,	$R_L = 2 k\Omega$ ,	27	45		27	45		V/µs
SR-	Negative slew rate	C <sub>L</sub> = 100 pF	_	27	42		27	42		V/μS
	Cattling time	A <sub>VD</sub> = -1,	To 0.1%		0.34		0.34			μs
ts	Settling time	10-V step	To 0.01%		0.4			0.4		μ5
.,		$R_S = 20 \Omega$ ,	f = 10 Hz		15			15		nV/√Hz
v <sub>n</sub>	Equivalent input noise voltage	$R_S = 20 \Omega$	f = 1 kHz	10.5		10.5			IIV/VIIZ	
	Peak-to-peak equivalent input	f = 0.1 Hz to 1 H	12		0.48		0.48			
V <sub>N(PP)</sub>	noise voltage	f = 0.1 Hz to 10	Hz		0.51			0.51		μV
		f = 10 Hz			1.89			1.89		- A 6/11/2
l <sub>n</sub>	Equivalent input noise current	f = 1 kHz		0.4			0.47	0.47		pA/√Hz
THD + N	Total harmonic distortion plus noise	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10,	R <sub>L</sub> = 2 kΩ, f = 10 kHz		0.01%			0.01%		
В1	Unity-gain bandwidth	$R_L = 2 k\Omega$ ,	C <sub>L</sub> = 100 pF		6			6		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ, f = 100 kHz	C <sub>L</sub> = 100 pF,		5.9			5.9		MHz
ВОМ	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 1,	R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 100 pF		668			668		kHz
φm	Phase margin at unity gain	$R_L = 2 k\Omega$ ,	C <sub>L</sub> = 100 pF		58°			58°		

### TLE2142M electrical characteristics at specified free-air temperature, $V_{CC} = 5 \text{ V}$ (unless otherwise noted)

	DADAMETER	TEST COMPITIONS	<b>+</b> +	TL	E2142N	A	TL	E2142A	М	
	PARAMETER	TEST CONDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
1/	Input offeet veltees		25°C		220	1900		200	1500	.,
VIO	Input offset voltage		Full range			2600			2200	μV
ανιο	Temperature coefficient of input offset voltage	$V_{O} = 2.5 \text{ V},  R_{S} = 50 \Omega,$	Full range		1.7			1.7		μV/°C
li o	Input offset current	V <sub>IC</sub> = 2.5 V	25°C		8	100		8	100	- ^
10	input onset current		Full range			200			200	nΑ
l.o	Input bias current		25°C		-0.8	-2		-0.8	-2	
lB	input bias corrent		Full range			-2.3			-2.3	μΑ
VICR	Common-mode input	Rs = 50 Ω	25°C	0 to. 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		V
TICH	voltage range	115 - 30 12	Full range	0 to 2.7	-0.3 to 2.9		0 to 2.7	-0.3 to 2.9		v
		I <sub>OH</sub> = -150 μA		3.9	4.1		3.9	4.1		
		I <sub>OH</sub> = -1.5 mA	25°C	3.8	4		3.8	4		
Vон	High-level output	I <sub>OH</sub> = -15 mA	1	3.4	3.7		3.4	3.7		٧
∙ОН	voltage	I <sub>OH</sub> = 100 μA		3.75			3.75			٧
		IOH = 1 mA	Full range	3.65			3.65			
		I <sub>OH</sub> = 10 mA		3.45			3.45			
		I <sub>OL</sub> = 150 μA			75	125		75	125	m۷
		I <sub>OL</sub> = 1.5 mA	25°C		150	225		150	225	1111
VOL	Low-level output	I <sub>OL</sub> = 15 mA			1.2	1.4		1.2	1.4	>
*OL	voltage	I <sub>OL</sub> = 100 μA	_			200			200	m۷
		IOL = 1 mA	Full range			250			250	1111
		I <sub>OL</sub> = 10 mA				1.25			1.25	٧
Avd	Large-signal differential	$V_{IC} = \pm 2.5 \text{ V},  R_L = 2 \text{ k}\Omega,$	25°C	50	220		50	220		V/m
טעיי	voltage amplification	V <sub>O</sub> = 1 V to -1.5 V	Full range	5			5			V/111
rį	Input resistance		25°C		70			70		MΩ
Cį	Input capacitance		25°C		2.5			2.5		рF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz	25°C		30			30		Ω
CMRR	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> min, R <sub>S</sub> = 50 Ω	25°C	85	118		85	118		dВ
OWINA	rejection ratio	AIC - AICHUIN' HZ = 20.77	Full range	80			80			ub
kovo	Supply-voltage rejec-	$V_{CC\pm} = \pm 2.5 \text{ V to } \pm 15 \text{ V},$	25°C	90	106		90	106		dB
KSVR	tionratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	$R_S = 50 \Omega$	Full range	85			85			ub
loo	Supply current	V <sub>O</sub> = 2.5 V, No load,	25°C		6.6	8.8		6.6	8.8	m.A
lcc	ouppry current	V <sub>1C</sub> = 2.5 V	Full range			9.2			9.2	IIIA

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



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### TLE214x, TLE214xA, TLE214xY EXCALIBUR LOW-NOISE HIGH-SPEED PRECISION OPERATIONAL AMPLIFIERS SLOS183 - FEBRUARY 1997

### TLE2142M operating characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

		oou	DITIONS		TLE2142M		Т	LE2142AN	A	LINET
	PARAMETER	TEST CON	DITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	A <sub>VD</sub> = -1,	$R_1 = 2 k\Omega^{\dagger}$		45			45		V/μs
SR-	Negative slew rate	C <sub>L</sub> = 500 pF			42			42		V/μS
	0-41	A <sub>VD</sub> = ~1,	To 0.1%		0.16			0.16		
ts	Settling time	2.5-V step	To 0.01%		0.22			0.22		μs
14	Equivalent input noise volt-	$R_S = 20 \Omega$ ,	f = 10 Hz		15			15		->44 ( <u>1 1-</u>
v <sub>n</sub>	age	$R_S = 20 \Omega$ ,	f = 1 kHz		10.5			10.5		nV/√Hz
	Peak-to-peak equivalent	f = 0.1 Hz to 1 Hz	z		0.48			0.48		
VN(PP)	input noise voltage	f = 0.1 Hz to 10 H	łz		0.51			0.51		μ۷
	Equivalent input noise cur-	f = 10 Hz			1.92			1.92		A 4 (T S=
<sup>1</sup> n	rent	f = 1 kHz			0.5			0.5		pA/√Hz
THD + N	Total harmonic distortion plus noise	$V_O = 1 \text{ V to 3 V},$ $A_{VD} = 2,$			0.0052%			0.0052%		
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF		5.9			5.9		MHz
	Gain-bandwidth product	H <sub>L</sub> = 2 kΩ <sup>†</sup> , f = 100 kHz	C <sub>L</sub> = 100 pF		5.8			5.8		MHz
вом	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 2 V, A <sub>VD</sub> = 1,	$R_L = 2 k\Omega^{\dagger}$ , $C_L = 100 pF$		660			660		kHz
φm	Phase margin	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF	1	57°			57°		

<sup>†</sup> R<sub>L</sub> terminates at 2.5 V.

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### TLE2142M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = $\pm 15$ V (unless otherwise noted)

	DADAMETED	TECT CO	IDITIONE	T. +	T	LE2142N	A .	TL	E2142A	М	UNIT
	PARAMETER	TEST CO	ADITIONS	TAT	MIN	TYP	MAX	MIN	TYP	MAX	UNII
14	lanut offeet valteen			25°C		290	1200		275	750	μV
VIO	Input offset voltage			Full range			2000			1600	μν
αVIO	Temperature coefficient of input offset voltage	]	_	Full range		1.7			1.7		μV/°C
		VIC = 0,	$R_S = 50 \Omega$	25°C		7	100		7	100	
lo lo	Input offset current			Full range			250			250	nA
		1		25°C		-0.7	-1.5		-0.7	-1.5	
ÌΒ	Input bias current			Full range			-1.8			-1.8	μА
	Common-mode input			25°C	15 to 13	-15.3 to 13.2		-15 to	-15.3 to 13.2		
VICR	voltage range	$R_S = 50 \Omega$		Full range	-15 to 12.7	-15.3 to 12.9		-15 to 12.7	-15.3 to 12.9		V
		l <sub>O</sub> = -150 μA			13.8	14.1		13.8	14.1		
		I <sub>O</sub> = -1.5 mA		25°C	13.7	14		13.7	14		
	Maximum positive peak	I <sub>O</sub> = -15 mA		1	13.3	13.7		13.3	13.7		
VOM+	output voltage swing	I <sub>O</sub> = ~100 μA			13.7			13.7			٧
		I <sub>O</sub> =1 mA		Full range	13.6			13.6			
		IO = -10 mA		1	13.3			13.3			
		I <sub>O</sub> = 150 μA			-14.7	-14.9		-14.7	-14.9		
		I <sub>O</sub> = 1.5 mA		25°C	~14.5	-14.8		-14.5	-14.8		
	Maximum negative peak	I <sub>O</sub> = 15 mA		1	-13.4	-13.8		-13.4	-13.8		
VOM−	output voltage swing	I <sub>O</sub> = 100 μA			-14.6			-14.6			٧
		I <sub>O</sub> = 1 mA		Full range	-14.5			14.5			
		IO = 10 mA		1	-13.4			-13.4			
	Large-signal differential	1		25°C	100	450		100	450		
AVD	voltage amplification	$V_0 = \pm 10 V$	$R_L \approx 2 k\Omega$	Full range	20			20	•••		V/mV
rį	Input resistance	Ì		25°C		65			65		MΩ
c <sub>i</sub>	Input capacitance	1		25°C		2.5			2.5		pF
z <sub>O</sub>	Open-loop output impedance	f = 1 MHz	,	25°C		30			30		Ω
	Common-mode rejection	V <sub>IC</sub> = V <sub>ICB</sub> m	in.	25°C	85	108		85	108		
CMRR	ratio	$R_S = 50 \Omega$	,	Full range	80			80			₫B
	Supply-voltage rejection	V <sub>CC±</sub> = ±2.5	V to ±15 V	25°C	90	106		90	106		
ksvr	ratio (ΔV <sub>CC ±</sub> /ΔV <sub>IO</sub> )	$R_S = 50 \Omega$	,	Full range	85			85			d₿
		l	V <sub>ID</sub> = 1 V		-25	-50		-25	-50		
los	Short-circuit output current	VO = 0	V <sub>ID</sub> = -1 V	25°C	20	31		20	31		mA
		VO = 0,	No load,	25°C		6.9	9	····	6.9	9	
ICC	Supply current	V <sub>IC</sub> = 2.5 V		Full range			9.4			9.4	mA

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

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### TLE214x, TLE214xA, TLE214xY EXCALIBUR LOW-NOISE HIGH-SPEED PRECISION OPERATIONAL AMPLIFIERS SLOS183 - FEBRUARY 1997

### TLE2142M operating characteristics, $V_{CC\pm}$ = $\pm 15$ V, $T_A$ = $25^{\circ}C$

	PARAMETER	TEST COL	IDITIONS	TI	E2142N	4	TL	E2142A	M	
	PARAMEIER	TEST CON	IDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	R <sub>L</sub> = 2 kΩ,	Avp = -1,	27	45		27	45		
SR-	Negative slew rate	C <sub>L</sub> = 100 pF		27	42		27	42		V/µs
	Settling time	AvD = -1,	To 0.1%		0.34			0.34		
t <sub>s</sub>	Setting time	10-V step	To 0.01%		0.4			0.4		μs
lu l	Equity plant in put paige veltage	$R_S = 20 \Omega$	f = 10 Hz		15			15		
V <sub>n</sub>	Equivalent input noise voltage	$R_S = 20 \Omega$ ,	f = 1 kHz		10.5			10.5		nV/√Hz
	Peak-to-peak equivalent input	f = 0.1 Hz to 1 H	lz		0.48			0.48		٠,,
VN(PP)	noise voltage	f = 0.1 Hz to 10	Hz		0.51			0.51		μV
	Environment in the second	f = 10 Hz			1.89			1.89		4.5
¹n	Equivalent input noise current	f = 1 kHz			0.47	Ī		0.47		pA/√Hz
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = 20 \text{ V},$ $A_{VD} = 10,$			0.01%		,	0.01%	·	
В1	Unity-gain bandwidth	R <sub>L</sub> ≈ 2 kΩ,	C <sub>L</sub> = 100 pF		6			6		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ, f = 100 kHz	C <sub>L</sub> = 100 pF,		5.9			5.9		MHz
ВОМ	Maximum output-swing band- width	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 1,	R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 100 pF		668			668		kHz
φm	Phase margin at unity gain	R <sub>L</sub> = 2 kΩ,	C <sub>L</sub> = 100 pF		58°			58°		

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### TLE2144M electrical characteristics at specified free-air temperature, $V_{CC} = 5 \text{ V}$ (unless otherwise noted)

	DADAMETED	TEST CONDITIONS	T. +	TL	E2144N	4	TL	E2144A	М	LIMIT
	PARAMETER	TEST CONDITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
Vio	Input offset voltage		25°C		0.5	3.8		0.5	3	mV
٧IO	Input onset voltage		Full range			5.2			4.4	IIIV
αVIO	Temperature coefficient of input offset voltage	V <sub>O</sub> = 2.5 V, R <sub>S</sub> = 50 Ω,	Full range		1.7			1.7		μV/°C
lio	Input offset current	V <sub>IC</sub> = 2.5 V	25°C		8	100		8	100	nA
·10	Input onset content		Full range			250			250	- 15
lıв	Input bias current		25°C		-0.8	-2		-0.8	-2	μА
4B	input bias current		Full range			-2.3			-2.3	μл
ViCR	Common-mode input	R <sub>S</sub> = 50 Ω	25°C	0 to 3	-0.3 to 3.2		0 to 3	-0.3 to 3.2		٧
TICH	voltage range	11.5 - 30 22	Full range	0 to 2.7	-0.3 to 2.9		0 to 2.7	-0.3 to 2.9		•
		iOH = -150 μA		3.9	4.1		3.9	4.1		
		I <sub>OH</sub> = ~1.5 mA	25°C	3.8	4		3.8	4		
Vон	High-level output	I <sub>OH</sub> =15 mA		3.4	3.7		3.4	3.7		v
VOH	voltage	i <sub>OH</sub> = 100 μA		3.75			3.75			٧
		IOH = 1 mA	Full range	3.65			3.65			
		l <sub>OH</sub> = 10 mA		3.45			3.45			
		I <sub>OL</sub> = 150 μA			75	125		75	125	mV
		l <sub>OL</sub> = 1.5 μA	25°C		150	225		150	225	1114
VOL ·	Low-level output	I <sub>OL</sub> = 15 mA			1.2	1.6		1.2	1.6	>
· OL	voltage	l <sub>OL</sub> = 100 μA				200			200	mV
		IOL = 1 mA	Full range			250			250	
		I <sub>OL</sub> = 10 mA				1.45			1.45	٧
AVD	Large-signal differential	$V_{IC} = \pm 2.5 \text{ V}, \qquad R_L = 2 \text{ k}\Omega,$	25°C	50	95		50	95		V/mV
	voltage amplification	V <sub>O</sub> = 1 V to -1.5 V	Full range	5			5			•////•
η	Input resistance		25°C		70			70		MΩ
Ci	Input capacitance		25°C		2.5			2.5		pF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz	25°C		30			30		Ω
CMRR	Common-mode	V <sub>IC</sub> = V <sub>ICR</sub> min, R <sub>S</sub> = 50 Ω	25°C	85	118		85	118		dB
J	rejection ratio	-10 - 10n, 115 - 50 12	Full range	80			80			40
ksvr	Supply-voltage rejection ratio	$V_{CC\pm} = \pm 2.5 \text{ V to } \pm 15 \text{ V,}$ Rs = 50 \Omega	25°C	90	106		90	106		dB
	(ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )		Full range	85			85			
lcc	Supply current	V <sub>O</sub> = 2.5 V, No load,	25°C	ļ	13.2	17.6		13.2	17.6	mA
50	er. /	V <sub>IC</sub> = 2.5 V	Full range	L		18.4			18.4	

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



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### TLE2144M operating characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

·				TL	E2144	И	TL	E2144A	M	
	PARAMETER	TEST CO	NOTIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	A <sub>VD</sub> = -1,	$R_L = 2 k\Omega^{\dagger}$ ,		45			45		W
SR-	Negative slew rate	C <sub>L</sub> = 500 pF	- '		42			42		V/μs
	Saulina dina	Avp = -1,	To 0.1%		0.16			0.16		
ts	Settling time	2.5-V step	To 0.01%		0.22			0.22		μ\$
v	Facilitation in the same and a same a same a same a same a same a	R <sub>S</sub> = 20 Ω,	f = 10 Hz		15			15		->4//
∨ <sub>n</sub>	Equivalent input noise voltage	$R_S = 20 \Omega$ ,	f = 1 kHz		10.5			10.5		nV/√Hz
	Peak-to-peak equivalent input	f = 0.1 Hz to 1 H;	z		0.48			0.48		
VN(PP)	noise voltage	f = 0.1 Hz to 10 H	-lz		0.51			0.51		μV
	5	f = 10 Hz			1.92			1.92		
I <sub>n</sub>	Equivalent input noise current	f = 1 kHz			0.5			0.5		pA/√Hz
THD + N	Total harmonic distortion plus noise	V <sub>O</sub> = 1 V to 3 V, A <sub>VD</sub> = 2,	R <sub>L</sub> = 2 kΩ <sup>†</sup> , f = 10 kHz	0.0	0052%		0.0	0052%		
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF		5.9			5.9		MHz
	Gain-bandwidth product	$R_L = 2 k\Omega^{\dagger}$ , f = 100 kHz	C <sub>L</sub> = 100 pF,		5.8			5.8		MHz
Вом	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 2 V, A <sub>VD</sub> = 1	$R_L = 2 k\Omega^{\dagger}$ ,		660			660		kHz
φm	Phase margin	$R_L = 2 k\Omega^{\dagger}$ ,	C <sub>L</sub> = 100 pF		57°			57°		·

<sup>†</sup> R<sub>L</sub> terminates at 2.5 V

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### TLE2144M electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = $\pm 15$ V (unless otherwise noted)

	PARAMETER	TEST COND	NOITIONS	TA <sup>†</sup>		LE2144N		TL	E2144A	M	UNIT
	PANAMETER	TEST CONE	///ONS	'A'	MIN	TYP	MAX	MIN	TYP	MAX	OMI
VIO	Input offset voltage			25°C		0.6	2.4		0.5	1.5	mV
*IU	input onset voltage			Full range			4			3.2	
αVIO	Temperature coefficient of input offset voltage			Full range		1.7			1.7		μV/°C
1	l	V <sub>IC</sub> = 0,	$R_S = 50 \Omega$	25°C		7	100		7	100	nA
10	Input offset current			Full range			250			250	IIA
l	Input bias current			25°C		-0.7	-1.5		-0.7	-1.5	μА
lВ	input bias current			Full range			-1.8			-1.8	μΑ
	O			25°C	-15 to 13	-15.3 to 13.2		-15 to 13	-15.3 to 13.2		
VICR	Common-mode input voltage range	R <sub>S</sub> = 50 Ω		<u> </u>	-15	-15.3		-15	-15.3		٧
	Tonago rango			Full range	to	to		to	to		
					12.7	12.9		12.7	12.9		
		I <sub>O</sub> = -150 μA			13.8	14.1		13.8	14.1		
		$I_{O} = -1.5 \text{ mA}$		25°C	13.7	14		13.7	14		
V	Maximum positive peak	l <sub>O</sub> = -15 mA			13.1	13.7		13.1	13.7		v
VOM+	output voltage swing	l <sub>O</sub> = -100 μA			13.7			13.7			•
		I <sub>O</sub> = -1 mA		Full range	13.6			13.6			
		I <sub>O</sub> = -10 mA			13.1			13.1			
		I <sub>O</sub> = 150 μA			-14.7	14.9		-14.7	-14.9		v
		1 <sub>O</sub> = 1.5 mA		25°C	-14.5	-14.8		-14.5	-14.8		V
V	Maximum negative	I <sub>O</sub> = 15 mA			-13.4	-13.8		-13.4	-13.8		
VOM-	peak output voltage swing	I <sub>O</sub> = 100 μA			-14.6			-14.6			
	<b>-</b>	IO = 1 mA		Full range	-14.5			-14.5			
		I <sub>O</sub> = 10 mA	_	]	-13.4			-13.4			
	Large-signal differential	V- 140 V	D. 010	25°C	100	170		100	170		V/mV
AVD	voltage amplification	$V_0 = \pm 10 \text{ V},$	$R_L = 2 k\Omega$	Full range	20			20			V/IIIV
rį	Input resistance		· ·	25°C		65			65		ΜΩ
ci	Input capacitance			25°C		2.5			2.5		pF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz		25°C		30			30		Ω
CMRR	Common-mode	VV	De - 50.0	25°C	85	108		85	108		dB
CMIRK	rejection ratio	VIC = VICAmin,	ng = 50 M	Full range	80			80			ub.
ksvr	Supply-voltage rejection ratio	V <sub>CC±</sub> =±2.5 V to	± 15 V,	25°C	90	106		90	106		dB
	(ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	$R_S = 50 \Omega$		Full range	85			85			
la a	Short-circuit output	V 0	V <sub>ID</sub> = 1 V	25°C	-25	-50		-25	-50		mA
los	current	VO = 0	V <sub>ID</sub> = −1 V	25-0	20	31		20	31		
	Cumply assessed	V <sub>O</sub> = 0,	No load,	25°C		13.8	18		13.8	18	mA
ICC	Supply current	V <sub>IC</sub> = 2.5 V		Full range			18.8			18.8	I "'A

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



■ 8961724 Olo7457 55T **■** \_

### TLE2144M operating characteristics, $V_{CC\pm} = \pm 15 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

				Т	LE2144N	A	TL	.E2144A	М	
	PARAMETER	TEST CON	IDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
SR+	Positive slew rate	$R_1 = 2 k\Omega$	Avp = -1,	27	45		27	45		14/ -
SR-	Negative slew rate	C <sub>L</sub> = 100 pF		27	42		27	42		V/μs
•	Settling time	A <sub>VD</sub> = -1,	To 0.1%		0.34			0.34		
ts	Settling time	10-V step	To 0.01%		.4			.4		μs
v	Envisalent insutanting college	$R_S = 20 \Omega$ ,	f = 10 Hz		15			15		
V <sub>n</sub>	Equivalent input noise voltage	$R_S = 20 \Omega$ ,	f=1 kHz		10.5			10.5		nV/√Hz
V	Peak-to-peak equivalent input	f = 0.1 Hz to 1 Hz			0.48			0.48		.,
VN(PP)	noise voltage	f = 0.1 Hz to 10 H	z		0.51			0.51		μV
	Equivalent input paige extremt	f = 10 Hz			1.89			1.89		A 1 / T
ıu	Equivalent input noise current	f = 10 kHz			0.47			0.47		pA/√Hz
THD + N	Total harmonic distortion plus noise	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10,	R <sub>L</sub> = 2 kΩ, f = 10 kHz		0.01%			0.01%		
B <sub>1</sub>	Unity-gain bandwidth	R <sub>L</sub> = 2 kΩ,	C <sub>L</sub> = 100 pF		6			6		MHz
	Gain-bandwidth product	R <sub>L</sub> = 2 kΩ, f = 100 kHz	C <sub>L</sub> = 100 pF,		5.9			5.9		MHz
ВОМ	Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 1,	R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 100 pF		668			668		kHz
φm	Phase margin at unity gain	$R_L = 2 k\Omega$ ,	C <sub>L</sub> = 100 pF		58°			58°		

### TLE2141Y electrical characteristics at specified free-air temperature, $V_{CC\pm}=\pm 15$ V, $T_A=25^{\circ}C$ (unless otherwise noted)

		7707.001	DITIONS	7	LE2141\	<i>'</i>	UNIT
	PARAMETER	TEST CON	DITIONS	MiN	TYP	MAX	UNII
VIO	Input offset voltage	I			200	1000	μV
lio	Input offset current	V <sub>IC</sub> = 0, V <sub>O</sub> = 0	$R_S = 50 \Omega$ ,		7	100	nA
lв	Input bias current	7'0-"			-0.7	-1.5	μА
VICR	Common-mode input voltage range	R <sub>S</sub> = 50 Ω		-15 to 13	-15.3 to 13.2		٧
		I <sub>O</sub> = -150 μA		13.8	14.1		
VOM+	Maximum positive peak output voltage swing	$I_0 = -1.5 \text{ mA}$		13.7	14		٧
		$I_0 = -15 \text{ mA}$		13.3	13.7		
		i <sub>O</sub> = 150 μA		-14.7	-14.9		
V <sub>OM</sub> -	Maximum negative peak output voltage swing	I <sub>O</sub> = 1.5 mA		-14.5	14.8		٧
		I <sub>O</sub> = 15 mA		-13.4	- 13.8		
Avd	Large-signal differential voltage amplification	$V_0 = \pm 10 \text{ V}$	R <sub>L</sub> = 2 kΩ	100	450		V/mV
rį	Input resistance				65		MΩ
Ci	Input capacitance				2.5		pF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz			30		Ω
CMRR	Common-mode rejection ratio	V <sub>IC</sub> = V <sub>ICR</sub> min,	R <sub>S</sub> = 50 Ω	80	108		dB
ksvr	Supply-voltage rejection ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	V <sub>CC±</sub> = ±2.5 V t R <sub>S</sub> = 50 Ω	o ± 15 V,	85	106		dB
		\u 0	V <sub>ID</sub> = 1 V	-25	-50		A
los	Short-circuit output current	VO = 0	V <sub>ID</sub> = -1 V	20	31		mA
Icc	Supply current	V <sub>O</sub> = 0,	No load		3.5	4.5	mA

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### TLE2142Y electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = $\pm 15$ V, $T_A$ = 25°C

	PARAMETER	TEST COM	IDITIONS	1	LE2142\	1	
	FARAMEIER	1EST COP	ADITIONS	MIN	TYP	MAX	UNIT
VIO	Input offset voltage				150	875	μV
110	Input offset current	V <sub>IC</sub> = 0, V <sub>O</sub> = 0	$R_S = 50 \Omega$ ,		7	100	nA
Iв	Input bias current	]*0-°			-0.7	-1.5	μА
ViCR	Common-mode input voltage range	R <sub>S</sub> = 50 Ω		-15 to 13	-15.3 to 13.2		٧
l		$I_O = -150 \mu\text{A}$		13.8	14.1		
∨ом+	Maximum positive peak output voltage swing	$I_0 = -1.5 \text{ mA}$		13.7	14		٧
		$I_0 = -15 \text{ mA}$		13.3	13.7		
		I <sub>O</sub> = 150 μA		-14.7	-14.9		
VOM-	Maximum negative peak output voltage swing	I <sub>O</sub> = 1.5 mA		-14.5	-14.8		٧
		I <sub>O</sub> = 15 mA		-13.4	-13.8		
AVD	Large-signal differential voltage amplification	$V_0 = \pm 10 \text{ V},$	R <sub>L</sub> = 2 kΩ	100	450		V/mV
η	Input resistance				65		MΩ
cį	Input capacitance				2.5		pF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz			30		Ω
CMRR	Common-mode rejection ratio	V <sub>IC</sub> = V <sub>ICR</sub> min,	$R_S = 50 \Omega$	80	108	Ī	dB
ksvr	Supply-voltage rejection ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	V <sub>CC±</sub> = ±2.5 V to R <sub>S</sub> = 50 Ω	o ± 15 V,	85	106		dB
los	Short-circuit output current	Va = 0	V <sub>ID</sub> = 1 V	-25	-50		
los	Onon-circuit output current	VO = 0	V <sub>ID</sub> = -1 V	20	31		mA
Icc	Supply current	V <sub>O</sub> = 0,	No load		6.9	9	mA

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### TLE2144Y electrical characteristics at $V_{CC\pm}$ = ±15 V, $T_A$ = 25°C (unless otherwise noted)

		TEAT COMPLETE	2112	T	LE2144\	,	
	PARAMETER	TEST CONDITIO	ONS	MIN	TYP	MAX	UNIT
Vio	Input offset voltage				0.3	1.8	mV
lio	Input offset current	$V_{IC} = 0$ , $V_{O} = 0$	$R_S = 50 \Omega$ ,		7	100	nA
IВ	Input bias current	7			-0.7	-1.5	μA
V <sub>ICR</sub>	Common-mode input voltage range	R <sub>S</sub> = 50 Ω		-15 to 13	-15.3 to 13.2		٧
		l <sub>O</sub> = -150 μA		13.8	14.1		
V <sub>OM+</sub>	Maximum positive peak output voltage swing	l <sub>O</sub> = −1.5 mA		13.7	14		v
		I <sub>O</sub> = -15 mA		13.3	13.7		
		l <sub>O</sub> = 150 μA		-14.7	14.9		
VOM-	Maximum negative peak output voltage swing	I <sub>O</sub> = 1.5 mA		-14.5	-14.8		v
		I <sub>O</sub> = 15 mA		-13.4	-13.8		
AVD	Large-signal differential voltage amplification	$V_0 = \pm 10 \text{ V},$	$R_L = 2 k\Omega$	100	450		V/mV
rį	Input resistance				65		МΩ
cį	Input capacitance				2.5		pF
z <sub>o</sub>	Open-loop output impedance	f = 1 MHz			30	,	Ω
CMRR	Common-mode rejection ratio	V <sub>IC</sub> = V <sub>ICR</sub> min,	$R_S = 50 \Omega$	80	108		dB
ksvr	Supply-voltage rejection ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> )	$V_{CC\pm} = \pm 2.5 \text{ V to } \pm 15 \text{ V},$	$R_S = 50 \Omega$	85	106		dB
1	Chart sire it autout aurora	V 0	V <sub>ID</sub> = 1 V	-25	-50		mA
los	Short-circuit output current	V <sub>O</sub> = 0	V <sub>ID</sub> = -1 V	20	31		IIIA
Icc	Supply current	V <sub>O</sub> = 0,	No load		13.8	18	mA

### TLE214x, TLE214xA, TLE214xY EXCALIBUR LOW-NOISE HIGH-SPEED PRECISION OPERATIONAL AMPLIFIERS SLOS183 - FEBRUARY 1997

### **TYPICAL CHARACTERISTICS**

### **Table of Graphs**

				FIGURE
V <sub>IO</sub>	Input offset voltage		Distribution	1, 2, 3
lio	Input offset current		vs Free-air temperature	4
IB	Input bias current	-	vs Common-mode input voltage vs Free-air temperature	5 6
V <sub>OM+</sub>	Maximum positive p	eak output voltage	vs Supply voltage vs Free-air temperature vs Output current vs Settling time	7 8 9 †1
V <sub>OM</sub>	Maximum negative p	peak output voltage	vs Supply voltage vs Free-air temperature vs Output current vs Settling time	7 8 10 11
V <sub>O(PP)</sub>	Maximum peak-to-p	eak output voltage	vs Frequency	12
Vон	High-level output vol	tage	vs Output current	13
VOL	Low-level output voll	age	vs Output current	14
AVD	Large-signal differen	tial voltage amplification	vs Frequency vs Free-air temperature	15 16
z <sub>o</sub>	Closed loop output in	npedance	vs Frequency	17
los	Short-circuit output of	eurrent	vs Free-air temperature	18
CMRR	Common-mode rejec	ction ratio	vs Frequency vs Free-air temperature	19 20
ksvr	Supply-voltage rejec	tion ratio	vs Frequency vs Free-air temperature	21 22
lcc	Supply current		vs Supply voltage vs Free-air temperature	23 24
V <sub>n</sub>	Equivalent input nois	e voltage	vs Frequency	25
v <sub>n</sub>	Input noise voltage		Over a 10-second period	26
l <sub>n</sub>	Noise current		vs Frequency	27
THD + N	Total harmonic distor	tion plus noise	vs Frequency	28
SR	Slew rate		vs Free-air temperature vs Load capacitance	29 30
		Noninverting large signal	vs Time	31
	Pulse response	Inverting large signal	vs Time	32
	•	Small signal	vs Time	33
B <sub>1</sub>	Unity-gain bandwidth	<u> </u>	vs Load capacitance	34
	Gain margin		vs Load capacitance	35
фm	Phase margin		vs Load capacitance	36
	Phase shift		vs Frequency	15

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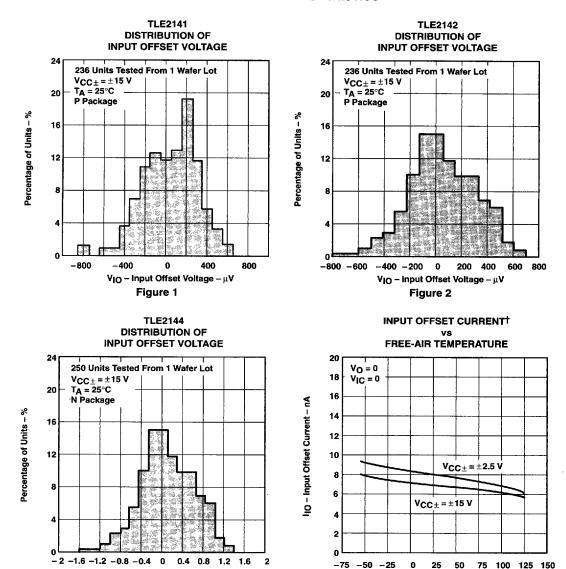


TA - Free-Air Temperature - °C

Figure 4

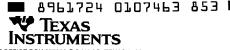
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#### **TYPICAL CHARACTERISTICS**



VIO - Input Offset Voltage - mV

Figure 3



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

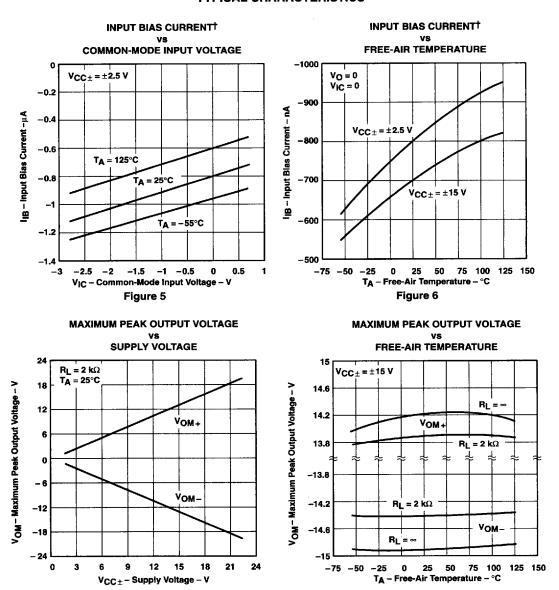


Figure 7

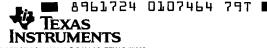
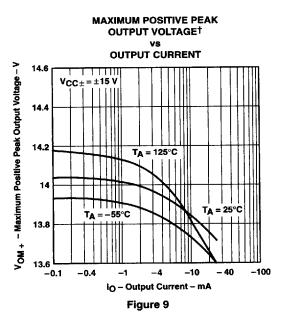


Figure 8

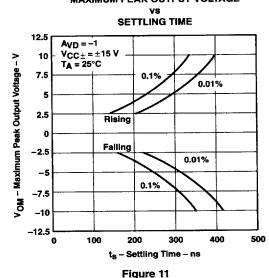
<sup>†</sup> Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

### TYPICAL CHARACTERISTICS



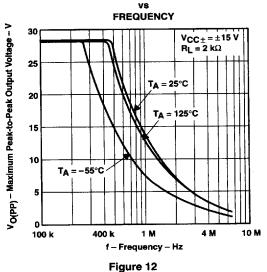
**MAXIMUM NEGATIVE PEAK OUTPUT VOLTAGE† OUTPUT CURRENT** -13.4V<sub>CC±</sub> = ±15 V - Maximum Negative Peak Output Voltage -13.6 -13.8T<sub>A</sub> = 125°C -14 -14.2-55°C TA = -14.4TA = 25°C -14.6 -14.8. So No 10 40 100 0.1 0.4 IO - Output Current - mA

MAXIMUM PEAK OUTPUT VOLTAGE

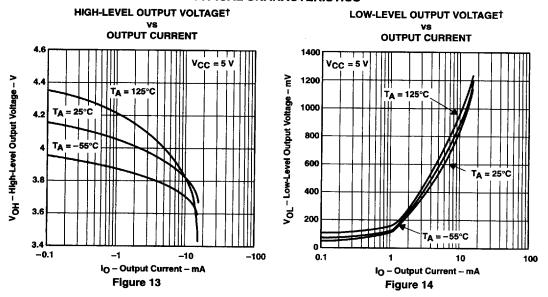


### MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE†

Figure 10



† 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 AND PHASE SHIFT**

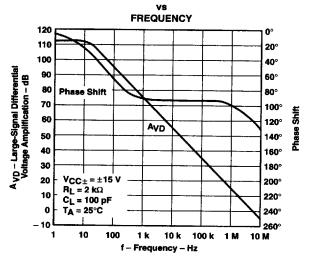
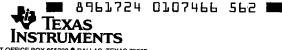


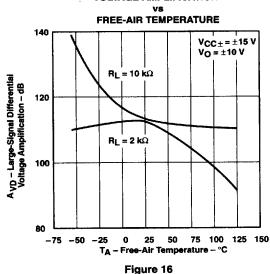
Figure 15

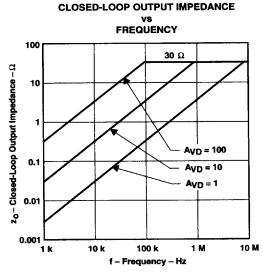
<sup>†</sup> Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.



#### TYPICAL CHARACTERISTICS

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





#### Figure 17

### SHORT-CIRCUIT OUTPUT CURRENT

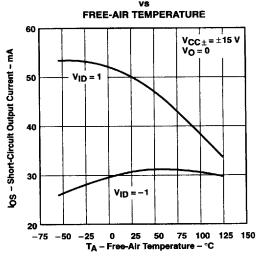


Figure 18

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



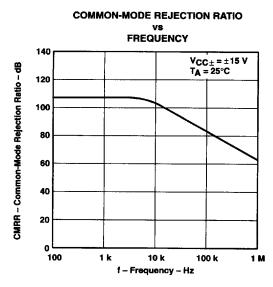


Figure 19

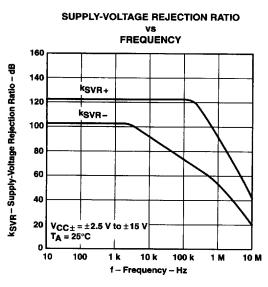


Figure 21

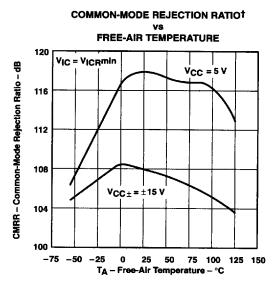


Figure 20

SUPPLY-VOLTAGE REJECTION RATIO<sup>†</sup>

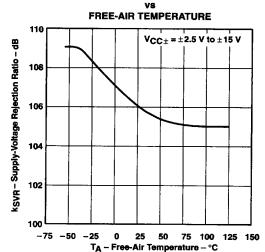
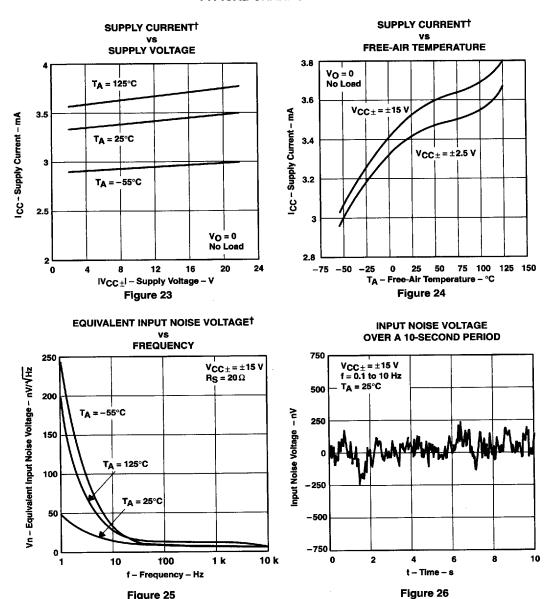


Figure 22

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

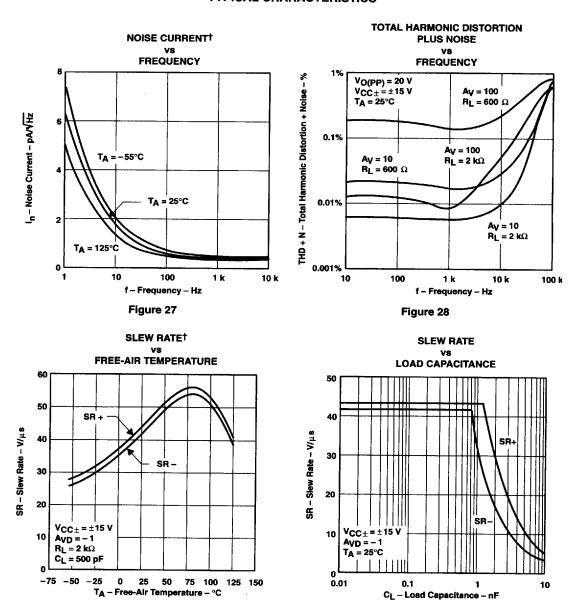


#### TYPICAL CHARACTERISTICS



<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.

Figure 29

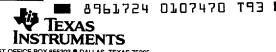


Figure 30

#### TYPICAL CHARACTERISTICS

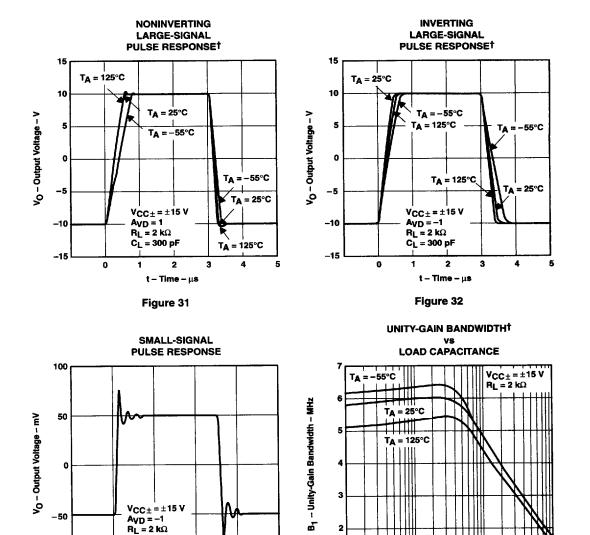


Figure 33

t - Time - ns

800

C<sub>L</sub> = 300 pF T<sub>A</sub> = 25°C

400

0

-100

Figure 34

C<sub>L</sub> - Load Capacitance - pF

1600

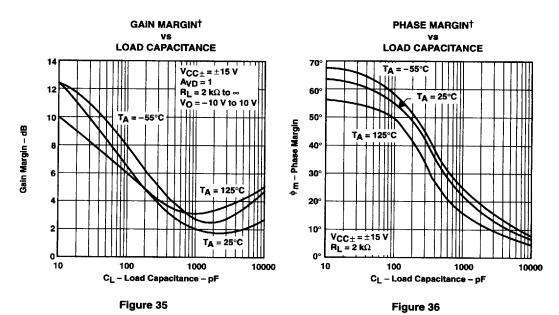
1200



10

10000

<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.

#### **APPLICATION INFORMATION**

### input offset voltage nulling

The TLE2141 series offers external null pins that can be used to further reduce the input offset voltage. If this feature is desired, connect the circuit of Figure 37 as shown. If external nulling is not needed, the null pins may be left unconnected.

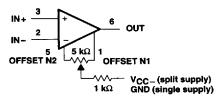


Figure 37. Input Offset Voltage Null Circuit