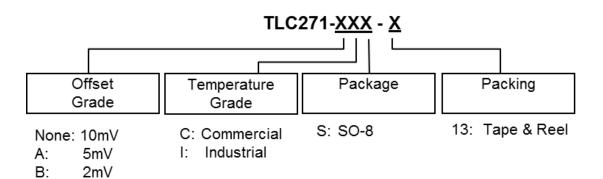


## **Ordering Information**



	Bookogo	Offset	Operating	Dookoging	13" Tape a	ind Reel
Device	Package Code	Voltage	Temperature Range	Packaging (Note 4)	Quantity	Part Number Suffix
TLC271CS-13	S	10mV	0 to 70°C	SO-8	2500/Tape & Reel	-13
TLC271ACS-13	S	5mV	0 to 70°C	SO-8	2500/Tape & Reel	-13
TLC271BCS-13	S	2mV	0 to 70°C	SO-8	2500/Tape & Reel	-13
TLC271IS-13	S	10mV	-40 to 85°C	SO-8	2500/Tape & Reel	-13
TLC271AIS-13	S	5mV	-40 to 85°C	SO-8	2500/Tape & Reel	-13
TLC271BIS-13	S	2mV	-40 to 85°C	SO-8	2500/Tape & Reel	-13

Note: 4. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.

# **Pin Descriptions**

Pin Name	Pin number	Description
OFFSET N1	1	Offset Control Inverting Input
IN-	2	Inverting Input
IN+	3	Non-Inverting Input
GND	4	Ground
OFFSET N2	5	Offset Control Non-Inverting Input
OUT	6	Output
$V_{DD}$	7	Supply
BIAS SELECT	8	Bias Mode Select



## Absolute Maximum Ratings (Notes 5, 6, 7, 8, 9)

Symbol	P	arameter	Rating	Unit	
$V_{DD}$	Supply Voltage (Note 6)		18	V	
V <sub>ID</sub>	Differential Input Voltage (Note 7)		±V <sub>DD</sub>	V	
V <sub>IN</sub>	Input Voltage Range (either input)	nput Voltage Range (either input)			
I <sub>IN</sub>	Input Current		±5	mA	
l.	Output Current		±30	mA	
	Output Short-Circuit to GND (Note	8)	Continuous	_	
P <sub>D</sub>	Power Dissipation (Note 9)		1065	mW	
<b>-</b>	On another Terror and the Design	C Grade	0 to +70	°C	
T <sub>A</sub>	Operating Temperature Range	I Grade	-40 to +85		
TJ	Operating Junction Temperature		150	°C	
T <sub>ST</sub>	Storage Temperature Range		-65 to +150	°C	
ESD HBM	Human Body Model ESD Protection	n (1.5kΩ in series with 100pF)	1.5	kV	

Notes:

- 5. Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only; 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.
- 6. All voltage values, except differential voltages, are with respect to ground.
- 7. Differential input voltages are at IN+ with respect to IN-.
- 8. 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.
- 9. For operating at high temperatures, the TLC271 must be derated 8.5mW/°C to zero based on a +150°C maximum junction temperature and a thermal resistance of +117 °C/W when the device is soldered to a printed circuit board, operating in a still air ambient.

## **Recommended Operating Conditions**

Cumbal	Doromoto	Parameter			l gr	Unit	
Symbol	Parameter	Min	Max	Min	Max		
$V_{DD}$	Supply Voltage	Supply Voltage			4	16	V
V <sub>IC</sub>	Common Mode Input Voltage	Common Mode Input Voltage V <sub>DD</sub> = 5V		3.5	-0.2	3.5	V
	$V_{DD} = 10V$		-0.2	8.5	-0.2	8.5	
T <sub>A</sub>	Operating Free Air Temperature	0	+70	-40	+85	°C	



					TL	C271C,	TLC27	71AC, 1	LC271	вс	
	Parameter		Conditions	TA		/ <sub>DD</sub> = 5\		1	<sub>DD</sub> = 10		Unit
					Min	Тур	Max	Min	Тур.	Max	
				+25°C	_	1.1	10	_	1.1	10	
		TLC271C	V∘ = 1.4V, V <sub>IC</sub> =	0 to +70°C	_	_	12	_	_	12	
.,	Lancet Office t Maltana	TI 007440	0V, R <sub>S</sub> =	+25 <sup>°</sup> C	_	0.9	5	_	0.9	5	
VI°	Input Offset Voltage	TLC271AC	$50\Omega$ , $R_L =$	0 to 70 °C	_	_	6.5	_	_	6.5	mV
		TI C074DC	10kΩ	25 <sup>°</sup> C	_	0.34	2	_	0.39	2	
		TLC271BC		0 to +70°C	_	_	3	_	_	3	
α <sub>VI°</sub>	Average Temperature Input Offset Voltage	Coefficient of		+25°C to 70°C		1.8			2		μV/°C
1	Input Offoot Current (A	loto 10\	$V_{\circ} = V_{DD}/2, \ V_{IC}$	+25 <sup>°</sup> C	_	0.1	60	_	0.1	60	nΛ
Ι <sub>Ι</sub> ۰	Input Offset Current (N	Note 10)	= V <sub>DD</sub> /2	+70°C	_	7	300	_	7	300	pА
l.=	Input Bias Current (No	to 10)	$V_{\circ} = V_{DD}/2, \ V_{IC}$	+25 <sup>°</sup> C	_	0.6	60	_	0.7	60	pА
I <sub>IB</sub>	input bias current (No	10)	= V <sub>DD</sub> /2	+70 <sup>°</sup> C	_	40	600	_	50	600	рΑ
.,	Common Mode Input Voltage (Note 11)			+25 <sup>°</sup> C	-0.2 to	-0.3 to 4.2	_	-0.2 to	-0.3 to 9.2	_	V
VICR			_	0 to +70°C	-0.2 to 3.5	_	_	-0.2 to 8.5	_	_	V
				+25 <sup>°</sup> C	3.2	3.8	_	8	8.5	_	
V∘H	High Level Output Volta	age	$V_{ID} = 100 \text{mV}, R_L$ = $10 \text{k}\Omega$	o°C	3	3.8	_	7.8	8.5	_	V
			= 10K22	+70°C	3	3.8	_	7.8	8.4	_	
			1001	+25 <sup>°</sup> C	_	0	50	_	0	50	
V∘L	Low Level Output Volta	age	$V_{ID} = -100 \text{mV},$ $I_{^{\circ}L} = 0$	o°C	_	0	50	_	0	50	mV
			1-2 = 0	+70°C	_	0	50	_	0	50	
	Lorgo Signal Difforentia	al Valtaga	$R_L = 10k\Omega$ (Note	+25 <sup>°</sup> C	5	23	_	10	36	_	
$A_{VD}$	Large Signal Differentia	ai voitage	12)	o°C	4	27	_	7.5	42	_	V/mV
	Cum		12)	+70°C	4	20	_	7.5	32	_	
				+25 °C	65	80	_	65	85		
CMRR	Common Mode Rejecti	on Ratio	$V_{IC} = V_{ICRmin}$	o°C	60	84	_	60	88	_	dB
				+70°C	60	85	_	60	88	_	
	Supply Voltage Rejecti	on Ratio	$V_{DD} = 5V \text{ to } 10V,$	+25°C	65	95		65	95	_	
k <sub>SVR</sub>	$(\Delta V_{DD}/\Delta V_{I^{\circ}})$	o., rado	$V_0 = 3V \text{ to 10V},$ $V_0 = 1.4V$	0-0	60	94		60	94	_	dB
				+70°C	60	96		60	96	_	
I <sub>I(SEL)</sub>	Input Current (BIAS SE	LECT)	$V_{I(SEL)} = 0$	+25°C		-1.4			-1.9		μΑ
			$V_{\circ} = V_{DD}/2, V_{IC}$	+25°C		675	1600		950	2000	)
$I_{DD}$	Supply Current		= V <sub>DD</sub> /2, No	0°C	_	775	1800	_	1125	2200	μΑ
	I	load	+70°C		575	1300		750	1700		

Notes:

<sup>10.</sup> The typical values of input bias current and input offset current below 5pA were calculated.

<sup>11.</sup> This range also applies to each input individually.

<sup>12.</sup> At  $V_{DD} = 5 \text{ V}$ ,  $V_{\circ} = 0.25 \text{ V}$  to 2 V; at  $V_{DD} = 10 \text{ V}$ ,  $V_{\circ} = 1 \text{ V}$  to 6 V.



High bia	as mode		1	T							
				_				71AI, T			
	Parameter		Conditions	TA		V <sub>DD</sub> = 5V			<sub>DD</sub> = 10		Unit
	1				Min	Тур	Max	Min	Тур.	Max	
		TLC271I		+25 <sup>°</sup> C		1.1	10	_	1.1	10	
		1202711	V∘ = 1.4V, V <sub>IC</sub> =	-40 to 85 °C		_	13	_	_	13	
Vı∘	Input Offset Voltage	TLC271AI	0V, R <sub>S</sub> =	+25 <sup>°</sup> C	_	0.9	5	_	0.9	5	mV
VI	Input Onset Voltage	TEOZITAI	$50Ω$ , $R_L =$	-40 to 85 °C	_	_	7	_	_	7	IIIV
		TLC271BI	10kΩ	+25 <sup>°</sup> C	_	0.34	2	_	0.39	2	
		TLO27 IDI		-40 to 85 °C	_		3.5	_		3.5	
α <sub>VI°</sub>	Average Temperature (Input Offset Voltage	Coefficient of	_	+25 to 85°C		1.8			2		μV/°C
	In must Offenst Comment (A	lata 40\	$V_{\circ} = V_{DD}/2, V_{IC}$	+25°C		0.1	60	_	0.1	60	- ^
I <sub>I°</sub>	Input Offset Current (N	iote 13)	= V <sub>DD</sub> /2	+85 <sup>°</sup> C		24	1000	_	26	1000	pA
	Innut Ding Company (No	t- 40\	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C		0.6	60	_	0.7	60	- ^
I <sub>IB</sub>	Input Bias Current (No	te 13)	= V <sub>DD</sub> /2	+85 <sup>°</sup> C	_	200	2000	_	220	2000	pA
				+25 <sup>°</sup> C	-0.2 to	-0.3 to	_	-0.2 to	-0.3 to		V
V <sub>ICR</sub>	Common Mode Input V	on Mode Input Voltage (Note		+25 C	4	4.2		9	9.2		V
VICR	14)		_	-40 to +85 <sup>°</sup> C	-0.2 to	_	_	-0.2 to 8.5	_	_	V
				+25 <sup>°</sup> C	3.2	3.8	_	8	8.5		
V∘H	High Level Output Volta	age	$V_{ID} = 100 \text{mV}, R_L$	-40 <sup>°</sup> C	3	3.8	_	7.8	8.5		V
			= 10kΩ	+85 <sup>°</sup> C	3	3.8	_	7.8	8.5		
				+25 <sup>°</sup> C		0	50	_	0	50	
V∘L	Low Level Output Volta	ige	$V_{ID} = -100 \text{mV},$	-40 <sup>°</sup> C		0	50	_	0	50	mV
			I∘L = 0	+85 <sup>°</sup> C	_	0	50	_	0	50	
				+25 <sup>°</sup> C	5	23	_	10	36		
$A_{VD}$	Large Signal Differentia	al Voltage	$R_L = 10k\Omega$ (Note	-40 <sup>°</sup> C	3.5	32	_	7	46		V/mV
	Gain		15)	+85 <sup>°</sup> C	3.5	19	_	7	31		
				+25 <sup>°</sup> C	65	80	_	65	85		
CMRR	Common Mode Rejecti	on Ratio	V <sub>IC</sub> = V <sub>ICRmin</sub>	-40 <sup>°</sup> C	60	81	_	60	87		dB
				+85 <sup>°</sup> C	60	86	_	60	88		
				+25 °C	65	95	_	65	95	_	
k <sub>SVR</sub>	Supply Voltage Rejection	on Ratio	$V_{DD} = 5V \text{ to } 10V,$	-40°C	60	92	_	60	92	_	dB
	$(\Delta V_{DD}/\Delta V_{I^{\circ}})$		V∘ = 1.4V	+85 <sup>°</sup> C	60	96		60	96		
I <sub>I(SEL)</sub>	Input Current (BIAS SE	LECT)	$V_{I(SEL)} = 0$	+25 °C	_	-1.4	_	_	-1.9	_	μA
,			$V_{\circ} = V_{DD}/2, V_{IC}$	+25 °C	_	675	1600	_	950	2000	0
I <sub>DD</sub>	Supply Current			-40°C	_	950	2200	_	1375	2500	
			load	+85 <sup>°</sup> C	_	525	1200	_	725	1600	

Notes:

<sup>13.</sup> The typical values of input bias current and input offset current below 5pA were calculated.

<sup>14.</sup> This range also applies to each input individually.

<sup>15.</sup> At  $V_{DD}$  = 5 V,  $V_{\circ}$  = 0.25 V to 2 V; at  $V_{DD}$  = 10 V,  $V_{\circ}$  = 1 V to 6 V.



	Parameter	Con	ditions	TA		71C, TLC TLC271B		Unit
					Min	Тур	Max	_
				+25 <sup>°</sup> C	_	3.6	_	
		$R_L = 10k\Omega$ ,	$V_{I(PP)} = 1V$	o°C	_	4	_	]
		$C_L = 20pF$		+70 <sup>°</sup> C	_	3	_	Ī ,,,
SR	Slew Rate at Unity Gain	0		+25 <sup>°</sup> C	_	2.9	_	V/µs
		See	$V_{I(PP)} = 2.5V$	o°C	_	3.1	_	
		Figure 92		+70°C	_	2.5	_	
Vn	Equivalent Input Noise Voltage	F = 1kHz, R <sub>S</sub> = See Figure 93	20Ω	+25 <sup>°</sup> C	_	25	_	nV/√Hz
		V∘ = V∘ <sub>H</sub> , C <sub>L</sub> = 2	20pF,	+25 °C	_	200	_	
В∘м	Maximum Output Swing	$R_L = 10k\Omega$		o°C	_	220	_	kHz
	Bandwidth	See Figure 92		+70 °C	_	140	_	1
		V 40 V 0 00 F		+25 °C	_	2.2	_	
B <sub>1</sub>	Unity Gain Bandwidth	$V_I = 10 \text{mV}, C_L$	= 20pF	o°C	_	2.5	_	MHz
		See Figure 94		+70°C	_	1.8	_	
		F = B <sub>1</sub> , V <sub>I</sub> = 10	mV.	+25 °C	_	49°	_	
φm	Phase Margin	C <sub>L</sub> = 20pF	,	o°C	_	50°	_	_
• • • •	See Figure 94		+70°C	_	46°	_		
gh b	ias mode: V <sub>DD</sub> = 10V	-		· ·		I		
	Parameter	Cond	litions	TA	TLC271C, TLC271AC, TLC271BC			Unit
				IA	Min	Тур	Max	_
				+25 °C	_	5.3	_	
			$V_{I(PP)} = 1V$	o°C	_	5.9	_	1
		$R_L = 10k\Omega$ ,		+70°C	_	4.3	_	1
SR	Slew Rate at Unity Gain	$C_L = 20pF$		+25 °C	_	4.6	_	V/µs
		See Figure 92	$V_{I(PP)} = 5.5V$	o°C	_	5.1	_	1
				+70 °C	_	3.8	_	1
Vn	Equivalent Input Noise Voltage	F = 1kHz, R <sub>S</sub> = See Figure 93	20Ω	+25 °C	_	25	_	nV/√Hz
		$V_{\circ} = V_{\circ H}, C_{L} = 2$	20pF,	+25 °C	_	200	_	
D	Maximum Output Swing	$R_L = 10k\Omega$	•	o°C	_	220	_	kHz
В∘м						140	_	1
В∘м	Maximum Output Swing Bandwidth	See Figure 92		+70°C				
В∘м		See Figure 92		+70 C +25 °C	<del> </del>	2.2	_	
В∘м ——		See Figure 92 V <sub>I</sub> = 10mV, C <sub>L</sub>	= 20pF	_			_ 	MHz
	Bandwidth	See Figure 92	= 20pF	+25 <sup>°</sup> C	_	2.2	— — —	MHz
B∘ <sub>M</sub>	Bandwidth	See Figure 92 V <sub>I</sub> = 10mV, C <sub>L</sub>		+25°C 0°C		2.2 2.5		MHz
	Bandwidth	See Figure 92  V <sub>I</sub> = 10mV, C <sub>L</sub> See Figure 94		+25°C 0°C +70°C	_ 	2.2 2.5 1.8	_	MHz —



	Parameter	Con	ditions	T <sub>A</sub>	TLC	271I, TLC TLC271E		Unit
					Min	Тур	Max	_
				+25 <sup>°</sup> C	_	3.6	_	
		$R_L = 10k\Omega$ ,	$V_{I(PP)} = 1V$	-40 °C	_	4.5	_	
0.0		C <sub>L</sub> = 20pF		+85 <sup>°</sup> C	_	2.8	_	, , , , , , , , , , , , , , , , , , ,
SR	Slew rate at unity gain	See		+25 <sup>°</sup> C	_	2.9	_	V/µs
		Figure 92	$V_{I(PP)} = 2.5V$	-40°C	_	3.5	_	
				+85 <sup>°</sup> C	_	2.3	_	
Vn	Equivalent input noise voltage	F = 1kHz, R <sub>S</sub> Figure 93	= 20Ω See	+25 <sup>°</sup> C	_	25	_	nV/√H
		$V_{\circ} = V_{\circ H}, C_{L} = 20 pF, R_{L} = 0$		+25 <sup>°</sup> C	_	320	_	
B∘ <sub>M</sub>	Maximum output swing	10kΩ	See Figure	-40 °C	_	380	_	kHz
	bandwidth	92		+85 <sup>°</sup> C	_	250	_	
				+25 <sup>°</sup> C	_	1.7	_	
B <sub>1</sub>	Unity gain bandwidth	$V_I = 10$ mV, $C_L = 20$ pF See Figure 94		-40°C	_	2.6	_	MHz
		Figure 94		+85 <sup>°</sup> C	_	1.2	_	
		F = B <sub>1</sub> , V <sub>I</sub> = 10	0mV. C <sub>1</sub> =	+25 <sup>°</sup> C	_	46°	_	
φm	Phase margin	20pF	See Figure		_	49°	_	Ī —
		94	-	+85 <sup>°</sup> C	_	43°	_	
gh b	ias mode: V <sub>DD</sub> = 10V				•			
	Parameter	Conditions		T <sub>A</sub>	TLC271I, TLC271AI, TLC271BI			Unit
				I A	Min	Тур	Max	
				+25 °C	<u> </u>	5.3	_	
		$R_L = 10k\Omega$ ,	$V_{I(PP)} = 1V$	-40 °C	_	6.8	_	
		$C_L = 20pF$		+85 °C	_	4	_	
SR	Slew rate at unity gain	See		+25 °C	_	4.6	_	V/µs
		Figure 92	$V_{I(PP)} = 5.5V$	-40°C	_	5.8	_	
				+85 <sup>°</sup> C	_	3.5	_	
V	Equivalent input noise voltage	F = 1kHz, R <sub>S</sub> Figure 93	= 20Ω See	+25 <sup>°</sup> C	_	25	_	nV/√H
$V_n$		Figure 93		+25 °C	_	200	_	
v <sub>n</sub>		V∘ = V∘ <sub>H</sub> , C₁ =	20pF, R <sub>L</sub> =	120 0		1	_	kHz
	Maximum output swing	$V_{\circ} = V_{\circ H}, C_{L} = 10k\Omega$	$20pF$ , $R_L =$ See Figure	-40 °C	_	260		- 10.12
					<u>-</u>	260 130		
	Maximum output swing	10kΩ 92	See Figure	-40 <sup>°</sup> C			+	
	Maximum output swing	10kΩ 92 $V_I = 10mV, C_I$		-40 °C +85 °C		130		MHz
B∘ <sub>M</sub>	Maximum output swing bandwidth	10kΩ 92	See Figure	-40 °C +85 °C +25 °C	_	130 2.2		MHz
B∘ <sub>M</sub>	Maximum output swing bandwidth	10kΩ 92 V <sub>I</sub> = 10mV, C <sub>I</sub> Figure 94	See Figure	-40 °C +85 °C +25 °C -40 °C +85 °C	_ 	130 2.2 3.1	_ _ _	MHz
B∘ <sub>M</sub>	Maximum output swing bandwidth	10kΩ 92 $V_I = 10mV, C_I$	See Figure	-40 °C +85 °C +25 °C -40 °C +85 °C +25 °C		130 2.2 3.1 1.7		MHz



					TLO	C271C,	TLC27	71AC, 1	LC271	вс	
	Parameter		Conditions	T <sub>A</sub>		/ <sub>DD</sub> = 5\			<sub>DD</sub> = 10		Unit
					Min	Тур	Max	Min	Тур.	Max	
				+25 <sup>°</sup> C	_	1.1	10	_	1.1	10	
		TLC271C	V° = 1.4V, V <sub>IC</sub> =	0 to +70°C	_	_	12	_	_	12	
V.	Input Offact Valtage	TI C074 A C	0V, R <sub>S</sub> =	+25 <sup>°</sup> C		0.9	5	_	0.9	5	\/
VI°	Input Offset Voltage	TLC271AC	$50Ω$ , $R_L =$	0 to +70 °C		_	6.5	_	_	6.5	mV
		TI C271DC	100kΩ	+25 <sup>°</sup> C		0.25	2	_	0.26	2	
		TLC271BC		0 to +70°C		_	3	_	_	3	
α∨ι∘	Average temperature input offset voltage	coefficient of		25 to +70°C		1.7			2.1		μV/°(
	Input offset surrent (A	loto 16)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C		0.1	60	_	0.1	60	n 1
Ι <sub>Ι°</sub>	Input offset current (N	iote 16)	= V <sub>DD</sub> /2	+70°C		7	300	_	7	300	рA
1	Input bias current (No	to 16\	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C		0.6	60	_	0.7	60	n^
I <sub>IB</sub>	input bias current (No	= V <sub>DD</sub> /2		+70°C		40	600	_	50	600	рA
W	Common mode input voltage (Note 17)			+25 <sup>°</sup> C	-0.2 to	-0.3 to 4.2		-0.2 to	-0.3 to 9.2		V
VICE				0 to +70°C	-0.2 to	_		-0.2 to 8.5	_		V
	High level output voltage			+25°C	3.2	3.9	_	8	8.7	_	٧
V∘H			$V_{ID} = 100 \text{mV}, R_L$ = $100 \text{k}\Omega$	o°C	3	3.9	_	7.8	8.7	_	
			= 100K22	+70°C	3	4	_	7.8	8.7		
				+25 <sup>°</sup> C		0	50	_	0	50	
V∘L	Low level output voltage	ge	$V_{ID} = -100 \text{mV},$ $I_{^{\circ}L} = 0$	o°C	_	0	50	_	0	50	mV
			1°∟ = 0	+70°C		0	50	_	0	50	
			D 4001-0	+25 <sup>°</sup> C	25	170		25	275		
$A_{VD}$	Large signal differentia	al voltage gain	$R_L = 100k\Omega$ (Note 18)	o°C	15	200	_	15	320	_	V/m
			(Note 10)	+70°C	15	140	_	15	230		
				+25 <sup>°</sup> C	65	91	_	65	94	_	
CMRR	Common mode rejecti	on ratio	$V_{IC} = V_{ICRmin}$	o°C	60	91	_	60	94	_	dB
				+70°C	60	92	_	60	94	_	
	Supply voltage rejection	on ratio	\/ = 5\/ to 10\/	+25 <sup>°</sup> C	70	93		70	93		
$k_{\text{SVR}}$	Supply voltage rejection $(\Delta V_{DD}/\Delta V_{I^{\circ}})$	חומווט	$V_{DD} = 5V \text{ to } 10V,$ $V_{0} = 1.4V$		60	92		60	92	_	dB
			•	+70°C	60	94		60	94	_	
I <sub>I(SEL)</sub>	Input current (BIAS SE	ELECT)	$V_{I(SEL)} = 0$	+25 <sup>°</sup> C		-130		—	-160	_	nA
			$V_{\circ} = V_{DD}/2, V_{IC}$	+25°C		105	280	_	143	300	0 0 μΑ
$I_{DD}$	Supply current		= $V_{DD}/2$ , No $0^{\circ}C$		1-	125	320	_	173	400	
				+70°C	—	85	220	—	110	280	

Notes:

<sup>16.</sup> The typical values of input bias current and input offset current below 5pA were calculated.

<sup>17.</sup> This range also applies to each input individually.

<sup>18.</sup> At  $V_{DD} = 5 \text{ V}$ ,  $V_{\circ} = 0.25 \text{ V}$  to 2 V; at  $V_{DD} = 10 \text{ V}$ ,  $V_{\circ} = 1 \text{ V}$  to 6 V.



					T	LC271I	, TLC2	71AI, T	LC271I	31	
	Parameter		Conditions	TA	\	/ <sub>DD</sub> = 5\	<b>/</b>	٧	<sub>DD</sub> = 10	٧	Unit
					Min	Тур	Max	Min	Тур.	Max	
		TI 00741		+25 <sup>°</sup> C	_	1.1	10	_	1.1	10	
		TLC271I	V∘ = 1.4V, V <sub>IC</sub> =	-40 to +85°C	_	_	13	_	_	13	
.,	land Office Voltage	TI 0074 A I	0V, R <sub>S</sub> =	+25 <sup>°</sup> C	_	0.9	5	_	0.9	5	\/
۷ <sub>I°</sub>	Input Offset Voltage	TLC271AI	$50Ω$ , $R_L =$	-40 to +85°C	_	_	7	_		7	mV
		TLC271BI	100kΩ	+25 <sup>°</sup> C	_	0.25	2	_	0.26	2	
		ILC2/ IBI		-40 to +85°C	_	_	3.5	_	_	3.5	
$\alpha_{VI^\circ}$	Average temperature of input offset voltage	coefficient of		+25 to +85°C	1.7			2.1		μV/°C	
L.	Input offset surrent (N	oto 10)	$V_{\circ} = V_{DD}/2, \ V_{IC}$	+25 <sup>°</sup> C	_	0.1	60	_	0.1	60	- Λ
Ι <sub>Ι</sub> ∘	Input offset current (No	ole 19)	= V <sub>DD</sub> /2	+85 <sup>°</sup> C	_	24	1000	_	26	1000	рA
l	Input bias current (Not	to 10)	$V_{\circ} = V_{DD}/2, \ V_{IC}$	+25 <sup>°</sup> C	_	0.6	60	_	0.7	60	рA
I <sub>IB</sub>	input bias current (Noi	.e 1 <i>9)</i>	= V <sub>DD</sub> /2	+85 <sup>°</sup> C		200	2000	_	220	2000	PΑ
V	Common mode input voltage (Note 20)			+25 <sup>°</sup> C	-0.2 to	-0.3 to 4.2	_	-0.2 to	-0.3 to 9.2	_	V
VICE				-40 to +85°C	-0.2 to	_	_	-0.2 to 8.5		_	V
				+25 <sup>°</sup> C	3.2	3.9	_	8	8.7		
V∘H	High level output voltage	ge	$V_{ID} = 100 \text{mV}, R$ = 100k $\Omega$	-40°C	3	3.9	_	7.8	8.7		_ ·
			= 100K22	+85 <sup>°</sup> C	3	4	_	7.8	8.7	_	
			1001	+25 <sup>°</sup> C	_	0	50	_	0	50	
۷°L	Low level output voltag	je	$V_{ID} = -100 \text{mV},$ $I_{^{\circ}L} = 0$	-40°C	_	0	50		0	50	mV
			I*L = 0	+85 <sup>°</sup> C	_	0	50	_	0	50	
			D. = 100k0	+25 <sup>°</sup> C	25	170	_	25	275		
$A_{VD}$	Large signal differentia	l voltage gain	$R_L = 100k\Omega$ (Note 21)	-40°C	15	270		15	390		V/mV
			(1000 21)	+85 <sup>°</sup> C	15	130	_	15	220	_	
				+25 °C	65	91		65	94		
CMRR	Common mode rejection	on ratio	$V_{IC} = V_{ICRmin}$	-40°C	60	90		60	93		dB
				+85 <sup>°</sup> C	60	90		60	94	_	
	Supply voltage rejectio	n ratio	$V_{DD} = 5V \text{ to } 10V,$	+25°C	70	93	_	70	93	_	
$k_{\text{SVR}}$	$(\Delta V_{DD}/\Delta V_{I^{\circ}})$	ii ialio	$V_{DD} = 3V \text{ to 10V},$ $V_{\circ} = 1.4V$	-40 C	60	91		60	91	_	dB
	(— · UU· — · i /			+85 <sup>°</sup> C	60	94		60	94		
I <sub>I(SEL)</sub>	Input current (BIAS SE	LECT)	$V_{I(SEL)} = 0$	+25 <sup>°</sup> C	_	-130		_	-160	_	nA
			$V_{\circ} = V_{DD}/2,  V_{IC}$	+25 <sup>°</sup> C	_	105	280	_	143	300	
$I_{DD}$	Supply current		= V <sub>DD</sub> /2, No	-40°C	_	158	400	_	225	450	μΑ
			+85 <sup>°</sup> C	-	80	200		103	260	μ,,	

Notes:

<sup>19.</sup> The typical values of input bias current and input offset current below 5pA were calculated.

<sup>20.</sup> This range also applies to each input individually.

<sup>21.</sup> At  $V_{DD}$  = 5 V,  $V_{\circ}$  = 0.25 V to 2 V; at  $V_{DD}$  = 10 V,  $V_{\circ}$  = 1 V to 6 V.



ealun	n bias mode: V <sub>DD</sub> = 5V							
	Parameter	Con	ditions	T <sub>A</sub>		71C, TLC TLC271B		Unit
					Min	Тур	Max	_
				+25 °C		0.43	_	
		$R_L = 100k\Omega$ ,	$V_{I(PP)} = 1V$	0°C		0.46	_	
		C <sub>L</sub> = 20pF		+70 °C	_	0.36	_	Ī ,,,
SR	Slew rate at unity gain	See		+25 °C	_	0.4	_	V/µs
		Figure 92	$V_{I(PP)} = 2.5V$	0°C	_	0.43	_	
				+70°C	_	0.34	_	
Vn	Equivalent input noise voltage	F = 1kHz, Rs = Figure 93	= 20Ω See	25 <sup>°</sup> C	_	32	_	nV/√Hz
		V∘ = V∘ <sub>H</sub> , C <sub>L</sub> =	20pF, R <sub>L</sub> =	+25 °C	_	55	_	
В∘м	Maximum output swing	100kΩ	See	0°C		60	_	kHz
	bandwidth Figure			+70 °C		50	_	
		$V_I = 10$ mV, $C_L = 20$ pF See Figure 94		+25 <sup>°</sup> C		525	_	
B <sub>1</sub>	Unity gain bandwidth			o <sup>°</sup> C		600	_	MHz
				+70°C		400	_	
		F = B <sub>1</sub> , V <sub>I</sub> = 10	$OmV$ , $C_L =$	+25 <sup>°</sup> C		40°	_	
φm	Phase margin	20pF	See Figure	o°C		41°		_
		94		+70 °C		39°	_	
/lediun	n bias mode: V <sub>DD</sub> = 10V							
	Parameter Conditions			T <sub>A</sub>		71C, TLC TLC271B		Unit
					Min	Тур	Max	_
				+25 <sup>°</sup> C	_	0.62	_	_
		$R_L = 100k\Omega$ ,	$V_{I(PP)} = 1V$	o°C	_	0.67	_	
SR	Slew Rate at Unity Gain	$C_L = 20pF$	,,	+70°C	_	0.51	_	V/µs
SK	Siew Nate at Utility Gaill	See		+25 <sup>°</sup> C	_	0.56	_	v/µs
		Figure 02		°°				

	Parameter	Con	ditions	T <sub>A</sub>		71C, TLC: TLC271B		Unit
					Min	Тур	Max	_
				+25 °C	_	0.62	_	
		$R_L = 100k\Omega$	$V_{I(PP)} = 1V$	o°C	_	0.67	_	
CD	Class Data at Haits Cain	$C_L = 20pF$		+70°C	_	0.51	_	\//
SR	Slew Rate at Unity Gain	See		+25 °C	_	0.56	_	V/µs
		Figure 92		o°C	_	0.61	_	
				+70°C	_	0.46	_	
Vn	Equivalent Input Noise Voltage	F = 1kHz, R <sub>S</sub> : See Figure 93	$F = 1$ kHz, $R_S = 20Ω$ See Figure 93		_	32	_	nV/√Hz
		V∘ = V∘H, C <sub>L</sub> = 20pF,		+25 °C	_	35	_	
B∘ <sub>M</sub>	Maximum Output Swing Bandwidth	$R_L = 100k\Omega$		o°C		40	_	kHz
	Danuwium	See Figure 92	2	+70°C	_	30	_	
		\/ 40m\/ C	20	+25 <sup>°</sup> C		635	_	
B <sub>1</sub>	Unity Gain Bandwidth	$V_I = 10 \text{mV}, C_L$	•	o°C	_	710	_	MHz
		See Figure 94		+70°C	_	510	_	
		E D V 40	)\ O	+25 °C	_	43°	_	
φm	Phase Margin	$F = B_1, V_1 = 10 \text{mV}, C_L = 20 \text{pF}$		o°C	_	44°	_	<b>7</b> —
		See Figure 94		+70°C		42°	_	



	Parameter	Conditions		TA	TLC	Unit			
					Min	Тур	Max		
				+25 <sup>°</sup> C	_	0.43	<u> </u>		
		$R_L = 100k\Omega$ ,	$V_{I(PP)} = 1V$	-40 °C	_	0.51			
		C <sub>L</sub> = 20pF		+85 <sup>°</sup> C	_	0.35	_	l	
SR	Slew rate at unity gain	See		+25 <sup>°</sup> C	_	0.4	_	V/µs	
		Figure 92	$V_{I(PP)} = 2.5V$	-40°C	_	0.48	_		
				+85 <sup>°</sup> C	_	0.32	_		
Vn	Equivalent input noise voltage	F = 1kHz Po = 200 See		+25 <sup>°</sup> C	_	32	_	nV/√Hz	
		V∘ = V∘ <sub>H</sub> , C <sub>L</sub> =	20pF, R <sub>L</sub> =	+25 <sup>°</sup> C	_	55	_		
В∘м	Maximum output swing	100kΩ	See	-40 °C	_	75	_	kHz	
	bandwidth	Figure 92		+85 <sup>°</sup> C	_	45	_		
				+25°C	_	525	_		
B <sub>1</sub>	Unity gain bandwidth	$V_I = 10 \text{mV}, C_L$	= 20pF See	-40 °C	_	770	_	MHz	
	, ,	Figure 94		+85 <sup>°</sup> C	_	370	_		
фт		F = B <sub>1</sub> , V <sub>I</sub> = 10	mV, C <sub>L</sub> =		_	40°	_		
	Phase margin	20pF See Figure 94			_	43°	_	_	
,	3			+85 <sup>°</sup> C	_	38°			
ediu	m bias mode: V <sub>DD</sub> = 10V			I					
	Parameter	Conditions		TA	TLC271I, TLC271AI, TLC271BI			Unit	
					Min Typ		Max	_	
				+25 <sup>°</sup> C	_	0.62	_		
		R <sub>L</sub> = 100kΩ,	$V_{I(PP)} = 1V$	-40°C	_	0.77			
		$C_L = 20pF$		+85 <sup>°</sup> C	_	0.47	_		
SR	Slew Rate at Unity Gain	See			_	0.56	_		V/µs
SK				I+25 C	h	_			
ъĸ		Figure 92	$V_{I(PP)} = 5.5V$	+25 °C -40 °C	_	0.7			
ъĸ			$V_{I(PP)} = 5.5V$	-40°C	_		<del> </del>	-	
V <sub>n</sub>	Equivalent Input Noise Voltage	Figure 92  F = 1kHz, R <sub>S</sub> =	, ,		+	0.7 0.44 32		nV/√Hz	
		Figure 92  F = 1kHz, R <sub>S</sub> = See Figure 93	= 20Ω	-40°C +85°C	+	0.44	_	nV/√Hz	
Vn	Maximum Output Swing	Figure 92  F = 1kHz, R <sub>S</sub> =	= 20Ω	-40°C +85°C +25°C		0.44		nV/√Hz kHz	
Vn		Figure 92 $F = 1kHz, R_S = See Figure 93$ $V_0 = V_{0H}, C_L = See Figure 93$	= 20Ω 20pF,	-40 °C +85 °C +25 °C +25 °C		0.44 32 35			
Vn	Maximum Output Swing	Figure 92 $F = 1 \text{kHz}, R_S = \text{See Figure 93}$ $V^{\circ} = V^{\circ}_{\text{H}}, C_L = \text{R}_L = 100 \text{k}\Omega$ See Figure 92	= 20Ω 20pF,	-40°C +85°C +25°C +25°C -40°C		0.44 32 35 45			
Vn	Maximum Output Swing	Figure 92 $F = 1kHz, R_S = See Figure 93$ $V^\circ = V^\circ_{H}, C_L = R_L = 100k\Omega$ $See Figure 92$ $V_I = 10mV, C_L$	= 20Ω 20pF, = 20pF	-40 °C +85 °C +25 °C +25 °C -40 °C +85 °C		0.44 32 35 45 25			
V <sub>n</sub> B∘ <sub>M</sub>	Maximum Output Swing Bandwidth	Figure 92 $F = 1 \text{kHz}, R_S = \text{See Figure 93}$ $V^{\circ} = V^{\circ}_{\text{H}}, C_L = \text{R}_L = 100 \text{k}\Omega$ See Figure 92	= 20Ω 20pF, = 20pF	-40 °C +85 °C +25 °C +25 °C -40 °C +85 °C +25 °C		0.44 32 35 45 25 635		kHz	
V <sub>n</sub> B∘ <sub>M</sub>	Maximum Output Swing Bandwidth	Figure 92 $F = 1 \text{kHz}, R_S = \text{See Figure 93}$ $V^\circ = V^\circ_H, C_L = \text{R}_L = 100 \text{k}\Omega$ See Figure 92 $V_I = 10 \text{mV}, C_L$ See Figure 94	= 20Ω 20pF, = 20pF	-40 °C +85 °C +25 °C +25 °C -40 °C +85 °C +25 °C -400 °C		0.44 32 35 45 25 635 880		kHz	
V <sub>n</sub> B∘ <sub>M</sub>	Maximum Output Swing Bandwidth	Figure 92 $F = 1 \text{kHz}, R_S = \text{See Figure 93}$ $V^\circ = V^\circ_H, C_L = \text{R}_L = 100 \text{k}\Omega$ See Figure 92 $V_I = 10 \text{mV}, C_L$ See Figure 94	= 20Ω 20pF, = 20pF mV, C <sub>L</sub> = 20pF	-40 °C +85 °C +25 °C +25 °C -40 °C +85 °C +25 °C -400 °C +85 °C		0.44 32 35 45 25 635 880 480		kHz	



Low bia	ıs mode											
					TL	C271C,	TLC27	71AC, T	LC271	вс		
	Parameter		Conditions	TA	1	/ <sub>DD</sub> = 5\	<b>/</b>	V	$V_{DD} = 10V$			
					Min	Тур	Max	Min	Тур.	Max		
				+25 °C	_	1.1	10	_	1.1	10		
		TLC271C	V∘ = 1.4V, V <sub>IC</sub> =	0 to +70°C	_	_	12	_	_	12		
.,		TI 007440	0V, R <sub>S</sub> =	+25 <sup>°</sup> C	_	0.9	5	_	0.9	5		
Vı°	Input Offset Voltage	TLC271AC	$50Ω$ , $R_L =$	0 to +70°C			6.5	_		6.5	mV	
		TI C274DC	1ΜΩ	+25 °C	_	0.24	2	_	0.26	2		
		TLC271BC		0 to +70°C	_	_	3	_		3		
α∨ı∘	Average Temperature Input Offset Voltage	Coefficient of	_	+25 to +70 °C		1.1			1		μV/°C	
Iı∘	Input Offset Current (N	vloto 22)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C	_	0.1	60	_	0.1	60	- 0	
II	Input Offset Current (Note 22)		= V <sub>DD</sub> /2	+70°C	_	7	300	_	8	300	рА	
I <sub>IB</sub>	Input Rias Current (No	nto 22)	$V^{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C	_	0.6	60	_	0.7	60	pA	
IIB	Input Bias Current (Note 22)		= V <sub>DD</sub> /2	+70 <sup>°</sup> C	_	40	600	_	50	600	РΑ	
	Common Mode Input \	/oltage (Note		+25 <sup>°</sup> C	-0.2 to	-0.3 to 4.2	_	-0.2 to	-0.3 to 9.2	_	V	
Vicr	23)	3 (	_	0 to +70°C	-0.2 to		_	-0.2 to 8.5	_	_	V	
				+25 °C	3.2	4.1	_	8	8.9	_		
V∘H	High Level Output Volt	age	$V_{ID} = 100 \text{mV}, R_L$ = $1 \text{M}\Omega$	o°C	3	4.1	_	7.8	8.9	_	V	
		. •		+70 <sup>°</sup> C	3	4.2	_	7.8	8.9	_		
			100 11	+25 <sup>°</sup> C		0	50		0	50	mV	
V∘L	Low Level Output Volta	age	$V_{ID} = -100 \text{mV},$ $I_{^{\circ}L} = 0$	o <sup>°</sup> C	_	0	50	_	0	50		
			1ºL = 0	+70 <sup>°</sup> C	_	0	50	_	0	50		
	Lorgo Cignal Difforenti	al Valtaga	D. = 1MO (Note	+25 <sup>°</sup> C	50	520	_	50	870	_		
$A_{VD}$	Large Signal Differentia	ai voitage	$R_L = 1M\Omega$ (Note 24)	0°C	50	700	_	50	1030		V/mV	
	Can		2-1)	+70 <sup>°</sup> C	50	380	_	50	660			
				+25 <sup>°</sup> C	65	94	_	65	97	_		
CMRR	Common Mode Reject	ion Ratio	$V_{IC} = V_{ICRmin}$	o°C	60	95	_	60	97	_	dB	
				+70 <sup>°</sup> C	60	95	_	60	97	_		
	Supply Voltage Rejecti	ion Ratio	$V_{DD} = 5V \text{ to } 10V,$	+25 °C	70	97		70	97	_		
ksvr	$(\Delta V_{DD}/\Delta V_{I^o})$	IOH INAUU	$V_0 = 3V \text{ to } 10V,$ $V_0 = 1.4V$		60	97		60	97	_	dB	
				+70°C	60	98	_	60	98	_		
I <sub>I(SEL)</sub>	Input Current (BIAS SE	ELECT)	V <sub>I(SEL)</sub> = 0	+25 °C	_	65	_	_	95	_	nA	
			$V_{\circ} = V_{DD}/2, V_{IC}$	+25 °C	_	10	17		14	23		
$I_{DD}$	Supply Current		= V <sub>DD</sub> /2, No	o°C		12	21	_	18	33	μΑ	
			load	+70°C		8	14		11	20		

Notes:

- $22. \ The \ typical \ values \ of \ input \ bias \ current \ and \ input \ offset \ current \ below \ 5pA \ were \ calculated.$
- 23. This range also applies to each input individually.
- 24. At  $V_{DD} = 5 \text{ V}$ ,  $V_{\circ} = 0.25 \text{ V}$  to 2 V; at  $V_{DD} = 10 \text{ V}$ ,  $V_{\circ} = 1 \text{ V}$  to 6 V.



			TLC271I, TLC271AI, TLC271							ВІ		
	Parameter		Conditions	TA	\	/ <sub>DD</sub> = 5\	<b>/</b>	V <sub>DD</sub> = 10V			Unit	
					Min	Тур	Max	Min	Тур.	Max		
		TI 00T4		+25 <sup>°</sup> C	_	1.1	10	_	1.1	10		
		TLC271I	V∘ = 1.4V, V <sub>IC</sub> =	-40 to +85°C	_	_	13	_	_	13		
\ /	land Office Voltage	TI 0074 A I	0V, R <sub>S</sub> =	+25 <sup>°</sup> C		0.9	5	_	0.9	5	\/	
۷ı۰	Input Offset Voltage	TLC271AI	$50Ω$ , $R_L =$	-40 to +85°C	_	_	7	_	_	7	mV	
		TLC271BI	1ΜΩ	+25 <sup>°</sup> C	_	0.24	2	_	0.26	2		
		ILC2/ IBI		-40 to +85°C	_	_	3.5	_	_	3.5		
$\alpha_{VI^\circ}$	Average Temperature Coefficient of Input Offset Voltage			+25 to +85 °C		1.1			1		μV/°C	
l	Input Offcot Current (N	loto 25)	$V_{\circ} = V_{DD}/2, \ V_{IC}$	+25 <sup>°</sup> C	_	0.1	60	_	0.1	60	^	
Ι <sub>Ι</sub> ∘	input Onset Current (i	nput Offset Current (Note 25)		+85 <sup>°</sup> C	_	24	1000	_	26	1000	рA	
lıs	Input Rias Current (No	ato 25)	$V_{\circ} = V_{DD}/2, \ V_{IC}$	+25 <sup>°</sup> C		0.6	60	_	0.7	60	pA	
I <sub>IB</sub>	Input Bias Current (Note 25)		= V <sub>DD</sub> /2	+85 <sup>°</sup> C		200	2000	_	220	2000	pΑ	
	Common Mode Input \	/oltage		+25 <sup>°</sup> C	-0.2 to	-0.3 to	_	-0.2 to	-0.3 to 9.2	_	V	
$V_{ICR}$	(Note 26)	S	_	-40 to +85 °C	-0.2 to		_	-0.2 to 8.5	_	_	V	
			V <sub>ID</sub> = 100mV, R <sub>L</sub>	+25 <sup>°</sup> C	3	4.1 — 8		8	8.9	_	V	
V∘H	High Level Output Volt	igh Level Output Voltage		-40 <sup>°</sup> C	3	4.1	_	7.8	8.9	_		
	. <del>.</del>		= 1ΜΩ	+85 <sup>°</sup> C	3	4.2	_	7.8	8.9	_		
	Low Level Output Voltage		1/ 4001/	+25°C	_	0	50	_	0	50		
V∘L			$V_{ID} = -100 \text{mV},$ $I_{^{\circ}L} = 0$	-40°C		0	50	_	0	50	mV	
			I°L = U	+85 <sup>°</sup> C	_	0	50	_	0	50	<u></u>	
	Lorge Cianal Differenti	al Maltaga	D = 1MO (Note	+25 <sup>°</sup> C	50	520	_	50	870	_	V/mV	
$A_{VD}$	Large Signal Differentia	ai voitage	$R_L = 1M\Omega$ (Note 27)	-40°C	50	900	_	50	1550	_		
	Cum		21)	+85 <sup>°</sup> C	50	330	_	50	585	_		
				+25 <sup>°</sup> C	65	94	_	65	97	_		
CMRR	Common Mode Rejecti	ion Ratio	$V_{IC} = V_{ICRmin}$	-40°C	60	<del>                                     </del>		60	97	_	dB	
				+85 <sup>°</sup> C	60	95		60	98	_		
	Supply Voltage Rejecti	on Patio	$V_{DD} = 5V \text{ to } 10V,$	+25 <sup>°</sup> C	70	97	_	70	97	_	dB	
$k_{\text{SVR}}$	$(\Delta V_{DD}/\Delta V_{I^{\circ}})$	on Railo	V <sub>0</sub> D = 3V to 10V, V∘ = 1.4V	-40 C	60	97	_	60	97	_		
				+85 <sup>°</sup> C	60	98	_	60	98	_		
I <sub>I(SEL)</sub>	Input Current (BIAS SE	LECT)	$V_{I(SEL)} = 0$	+25 <sup>°</sup> C		65			95		nA	
			$V_{\circ} = V_{DD}/2, V_{IC}$	+25 °C		10	17	_	14	23		
$I_{DD}$	Supply Current		= V <sub>DD</sub> /2, No	-40 °C		16	27		25	43	μΑ	
			load	+85 <sup>°</sup> C	—	17	13	_	10	18		

Notes:

- 25. The typical values of input bias current and input offset current below 5pA were calculated.
- 26. This range also applies to each input individually. 27. At  $V_{DD}$  = 5 V,  $V_{\circ}$  = 0.25 V to 2 V; at  $V_{DD}$  = 10 V,  $V_{\circ}$  = 1 V to 6 V.



	as mode: V <sub>DD</sub> = 5V				TLC2	Unit			
	Parameter	Con	ditions	T <sub>A</sub>		TLC271BC		J.III.	
					Min	Тур	Max	_	
				+25 °C	_	0.03	_		
		$R_L = 1M\Omega$ ,	$V_{I(PP)} = 1V$	o°C	_	0.04			
SR	Claus Data at Unity Cain	$C_L = 20pF$		+70°C	_	0.03		1////	
SK	Slew Rate at Unity Gain	See		+25 <sup>°</sup> C	_	0.03		V/µs	
		Figure 92 $V_{I(PP)} = 2.5V$ 0°C — 0.03 —							
				+70°C	_	0.02			
Vn	Equivalent Input Noise Voltage	$F = 1kHz, R_S = 20\Omega$ See Figure 93		+25 <sup>°</sup> C	_	68	_	nV/√Hz	
				+25 °C	_	5	_		
B∘ <sub>M</sub>	Maximum Output Swing		= 20pF, R <sub>L</sub> = 1MΩ	o°C	<u> </u>	6	_	kHz	
	Bandwidth	See Figure 92		+70°C	_	4.5	_		
				+25 °C	_	85	_		
B <sub>1</sub>	Unity Gain Bandwidth	$V_I = 10 \text{mV}, C_I$		o°C	_	100	_	MHz	
		See Figure 94	1	+70°C	_	65	_		
				+25 <sup>°</sup> C	_	34°	_		
φm	Phase Margin		$0mV, C_L = 20pF$	o°C	_	36°	_	<u> </u>	
• • • •		See Figure 94	1	+70°C	_	30°	_		
_ow bi	ias mode: V <sub>DD</sub> = 10V	<u> </u>		l		I.		· L	
				_		71C, TLC		Unit	
	Parameter	Con	ditions	T <sub>A</sub>	TLC271BC				
				• _	Min	Тур	Max	_	
				+25 <sup>°</sup> C	_	0.05			
		$R_L = 1M\Omega$ ,	$V_{I(PP)} = 1V$	0°C		0.05	_		
SR	Slew Rate at Unity Gain	$C_L = 20pF$		+70 C	_	0.04		V/µs	
	,	See		+25 C		0.04	_	_	
		Figure 92	$V_{I(PP)} = 5.5V$	0°C	_	0.05		1	
				+70 °C		0.04	_		
Vn	Equivalent Input Noise Voltage	F = 1kHz, R <sub>S</sub> See Figure 93		+25 <sup>°</sup> C	_	68	_	nV/√Hz	
	Maximum Output Code	Vo = V C-	. 20nE D 1MO	+25 <sup>°</sup> C	_	1	_		
$B_{^{\circ}M}$	Maximum Output Swing Bandwidth		= 20pF, R <sub>L</sub> = 1MΩ	0 <sup>°</sup> C	_	1.3		kHz	
	Dariuwiutii	See Figure 92	<u>-</u>	+70°C	_	0.9	_		
		\/ 10m\/_0		+25 <sup>°</sup> C	_	110	_		
B <sub>1</sub>	Unity Gain Bandwidth	$V_I = 10 \text{mV}, C_I$		o°C	_	125	_	MHz	
		See Figure 94	<u> </u>	+70°C		90	_		
		- D \/ 1	0>/ 0 00 5	+25 <sup>°</sup> C	_	38°	_		
	Phase Margin $F = B_1, V_1 = B_2$		$UmV$ , $U_1 = 20pF$	•				] —	
$\varphi_{\text{m}}$	Phase Margin	See Figure 94		o°C	_	40°	_		



Low bi	as mode: V <sub>DD</sub> = 5V								
	Parameter	Conditions		TA	TLC	Unit			
					Min	Тур	Max	<del>      _   _   _   _   _   _   _</del>	
				+25 <sup>°</sup> C	<u> </u>	0.03	_		
		$R_L = 1M\Omega$ ,	$V_{I(PP)} = 1V$	-40°C	_	0.04	_	:	
0.0	0. 5	$C_L = 20pF$		+85 <sup>°</sup> C	_	0.03	_	.,,	
SR	Slew Rate at Unity Gain	See		+25 <sup>°</sup> C	_	0.03	_	V/µs	
		Figure 92	$V_{I(PP)} = 2.5V$	-40°C	_	0.04	_		
				+85 <sup>°</sup> C	_	0.02	_		
Vn	Equivalent Input Noise Voltage	See Figure 93		+25 <sup>°</sup> C	_	68		nV/√Hz	
				+25 <sup>°</sup> C	_	5	_		
В∘м	Maximum Output Swing		20pF, $R_L$ = 1MΩ	-40 <sup>°</sup> C	_	7	_	kHz	
	Bandwidth	See Figure 92		+85 <sup>°</sup> C	_	4	_	1	
				+25 °C	_	85	_		
B <sub>1</sub>	Unity Gain Bandwidth	$V_I = 10 \text{mV}, C_L$	•	-40 <sup>°</sup> C	<u> </u>	130	_	MHz	
		See Figure 94		+85 <sup>°</sup> C	<u> </u>	55	_		
				+25 <sup>°</sup> C	<u> </u>	34°	_		
φm	Phase Margin		$OmV, C_L = 20pF$	-40 °C	<u> </u>	38°	_	<b>1</b> —	
		See Figure 94		+85 <sup>°</sup> C	<u> </u>	28°	_		
ow bi	as mode: V <sub>DD</sub> = 10V					•	•	•	
	Parameter	Conditions		T <sub>A</sub>	TLC271I, TLC271AI, TLC271BI			Unit	
	r aramotor	00		• •	Min	Тур	Max	_	
				+25 °C		0.05			
		$R_L = 1M\Omega$ ,	$V_{I(PP)} = 1V$	-40 °C	_	0.06	_		
		$C_L = 20pF$		+85 °C	_	0.03	_	Unit  — V/µs	
SR	Slew Rate at Unity Gain	See		+25 °C	_	0.04	_	V/µs	
		Figure 92	$V_{I(PP)} = 5.5V$	-40 °C	_	0.05	_		
				+85 °C	_	0.03	_	†	
Vn	Equivalent Input Noise Voltage	F = 1kHz, R <sub>S</sub> : See Figure 93		+25 <sup>°</sup> C	_	68	_	nV/√Hz	
				+25 <sup>°</sup> C	_	1	_		
В∘м	Maximum Output Swing		20pF, $R_L$ = 1MΩ	-40 °C	<u> </u>	1.4	_	kHz	
	Bandwidth	See Figure 92	2	+85 °C	_	0.8	_	1	
				+25 °C	_	110	_		
B <sub>1</sub>	Unity Gain Bandwidth	$V_I = 10 \text{mV}, C_L$		-400°C	_	155	_	MHz	
		See Figure 94	ŀ	+85 <sup>°</sup> C	_	80	_	1	
				+25 <sup>°</sup> C	_	38°	_		
Φm		$F = B_1, V_1 = 10$	$OmV$ , $C_L = 20pF$		1	400		1 _	
фm	Phase Margin	See Figure 94		-40 °C		42°			

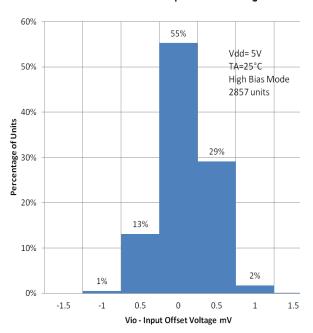


# Typical Performance Characteristics Table Index of Graphs

			High Bias Mode	Medium Bias Mode	Low Bias Mode
Vı°	Input Offset Voltage	Distribution	1,2	31,32	61,62
		vs. High Level Output Current	3,4	33,34	63,64
V∘H	High Level Output Voltage	vs. Supply Voltage	5	35	65
		vs. Free Air Temperature	6	36	66
		vs. Common Mode Input Voltage	7,8	37,38	67,68
<b>N</b> /	Lavel and Ordand Vales	vs. Differential Input Voltage	9	39	69
V∘L	Low Level Output Voltage	vs. Free Air Temperature	10	40	70
		vs. Low Level Output Current	11,12	41,42	71,72
^	Large Signal Differential Voltage Gain	vs. Supply Voltage	13	43	73
A <sub>VD</sub>		vs. Free Air Temperature	14	44	74
I <sub>IB</sub>	Input Bias Current	vs. Free Air Temperature	15	45	75
I <sub>I°</sub>	Input Offset Current	vs. Free Air Temperature	15	45	75
V <sub>IC</sub>	Common Mode Input Voltage	vs. Supply Voltage	16	46	76
	0	vs. Supply Voltage	17	47	77
I <sub>DD</sub>	Supply Current	vs. Free Air Temperature	18	48	78
SR	Slew Rate	vs. Supply Voltage	19	49	79
SK	Siew Rate	vs. Free Air Temperature	20	50	80
I <sub>sel</sub>	Bias Select Current	vs. Supply Voltage	21	51	81
V°(°PP)	Maximum Peak to Peak Output Voltage	vs. Frequency	22	52	82
Б	Linity Coin Dondwidth	vs. Free Air Temperature	23	53	83
B <sub>1</sub>	Unity Gain Bandwidth	vs. Supply Voltage	24	54	84
A <sub>VD</sub>	Large Signal Differential Voltage Gain	vs. Frequency	29,30	59,60	89,90
		vs. Supply Voltage	25	55	85
$\varphi_{\text{m}}$	Phase Margin	vs. Free Air Temperature	26	56	86
		vs. Capacitive Load	27	57	87
V <sub>n</sub>	Equivalent Input Noise Voltage	vs. Frequency	28	58	88
Фshift	Phase Shift	vs. Frequency	29,30	59,60	89,90



#### Distribution of TLC271 Input Offset Voltage



## Figure 1

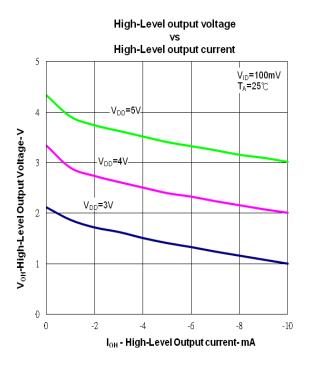


Figure 3

#### Distribution of TLC271 Input Offset Voltage

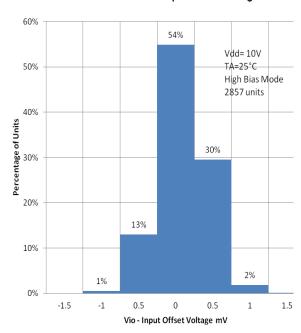


Figure 2

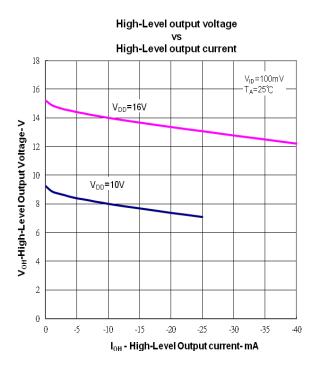


Figure 4



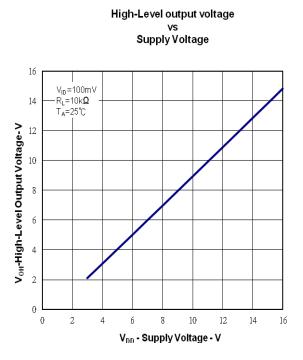
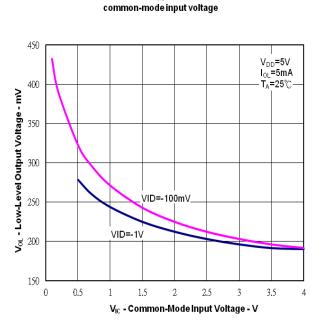


Figure 5

Low-level output voltage





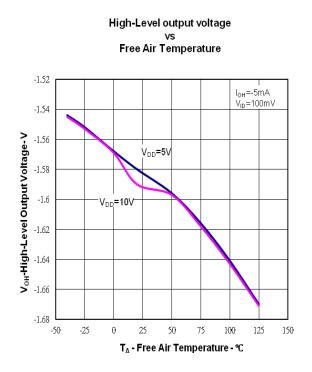


Figure 6

Low-level output voltage

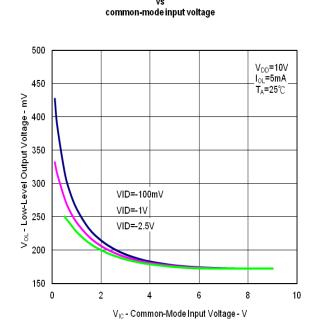


Figure 8



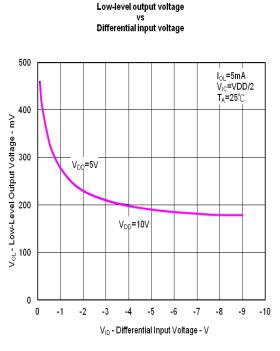
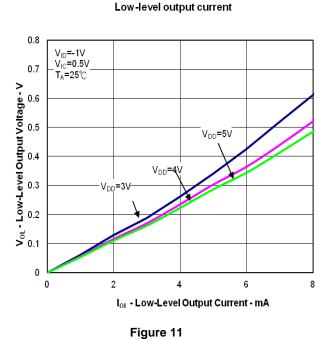


Figure 9

Low-level output voltage



Low-level output voltage vs Free-Air temperature

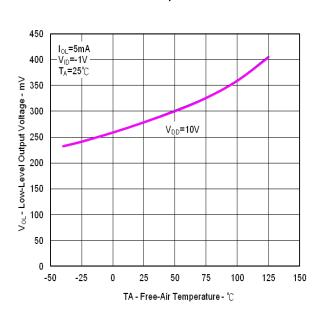


Figure 10

Low-level output voltage vs Low-level output current

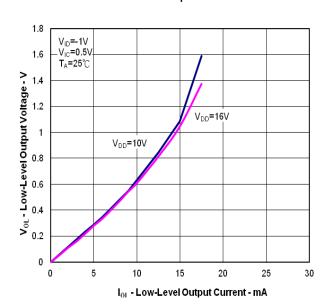


Figure 12



Large-Signal Differential Voltage Amplification

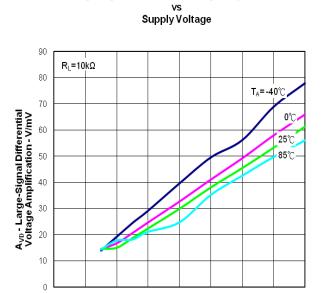


Figure 13

V<sub>DD</sub> - Supply Voltage - V

Input Bias Current and Input Offset Current

Free-Air Temperature

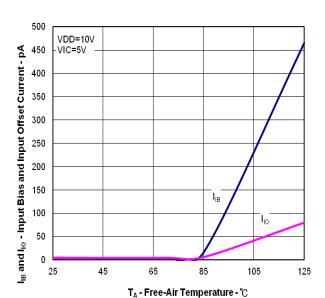


Figure 15

# Large-Signal Differential Voltage Amplification vs Free-Air Temperature

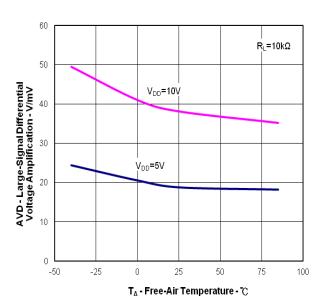


Figure 14

Common-mode input voltage (positive limit) vs Supply Voltage

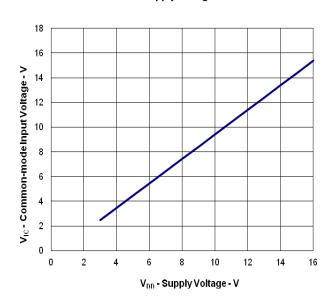


Figure 16



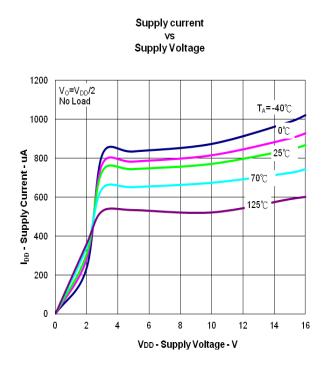


Figure 17

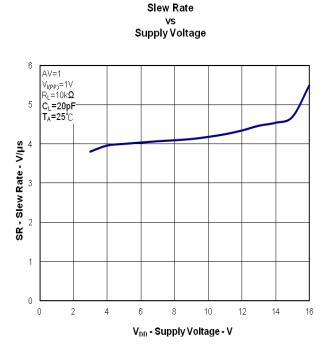


Figure 19

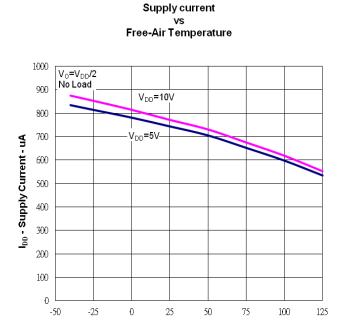


Figure 18

 $T_{\Delta}$  - Free-Air Temperature -  $^{\circ}$ 

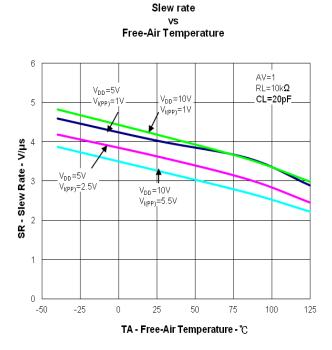


Figure 20



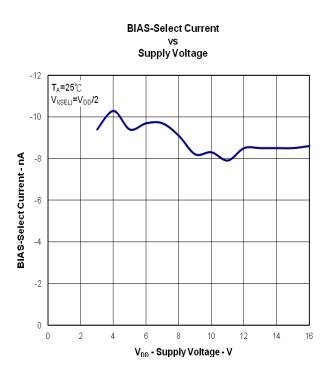


Figure 21

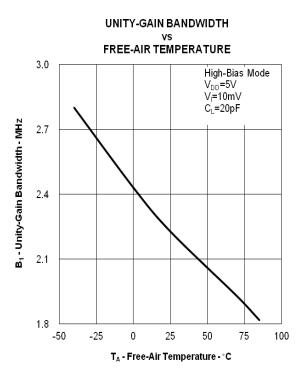


Figure 23

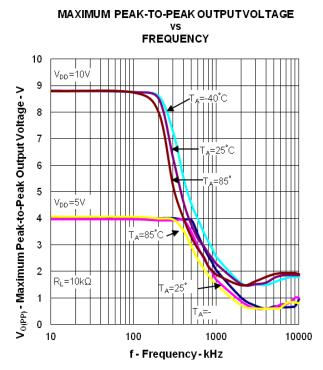


Figure 22

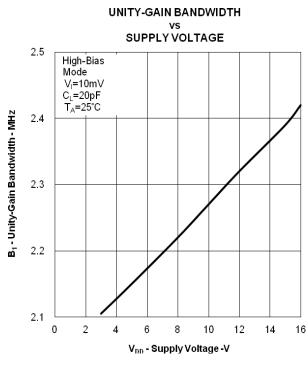


Figure 24



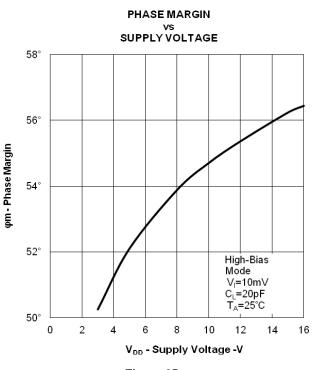


Figure 25

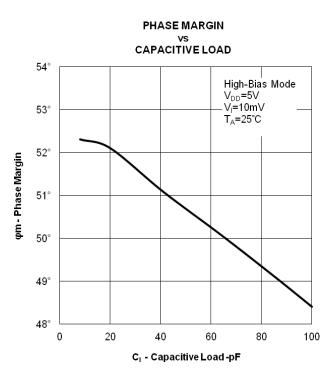


Figure 27

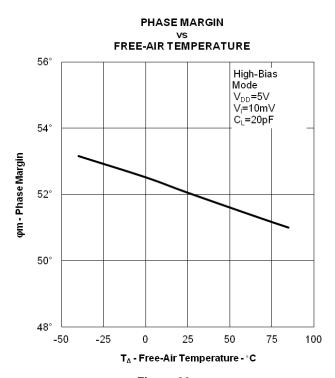


Figure 26

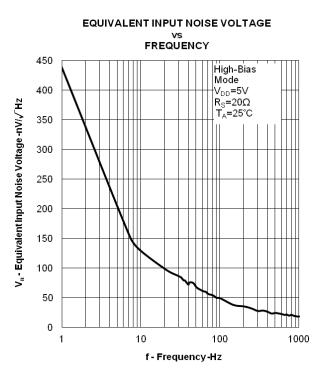
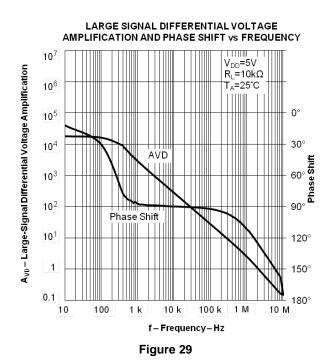
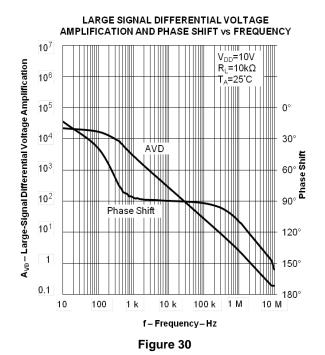


Figure 28







## Typical Performance Characteristics Medium Bias Mode

# Distribution of TLC271 Input Offset Voltage

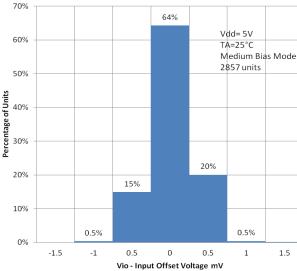


Figure 31

## Distribution of TLC271 Input Offset Voltage

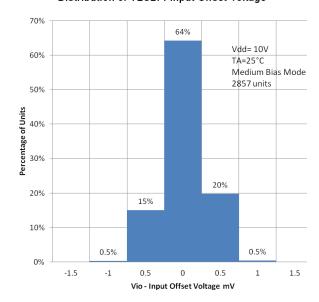


Figure 32



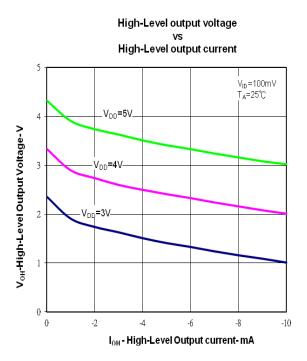
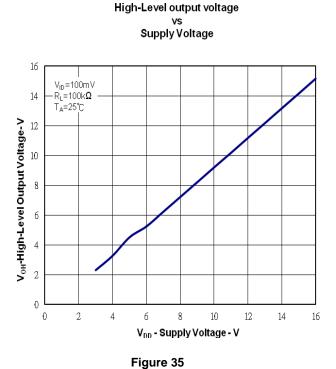


Figure 33



High-Level output voltage vs High-Level output current

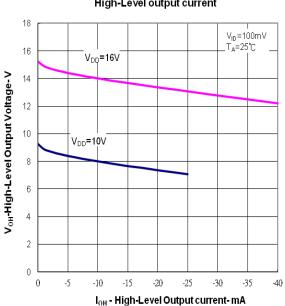


Figure 34



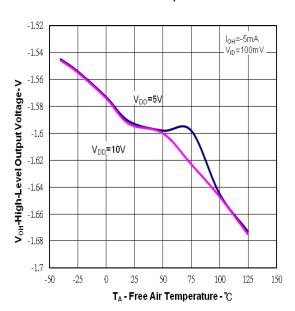


Figure 36



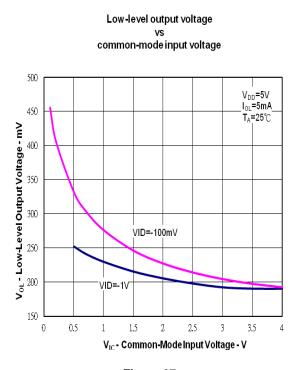
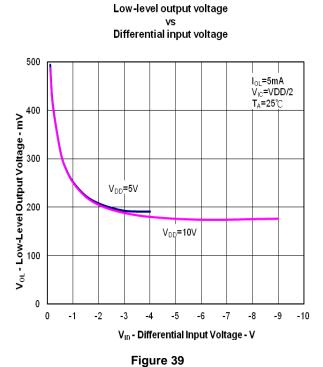


Figure 37



Low-level output voltage vs common-mode input voltage

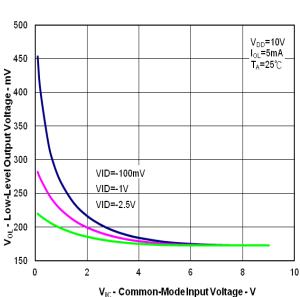
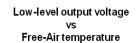


Figure 38



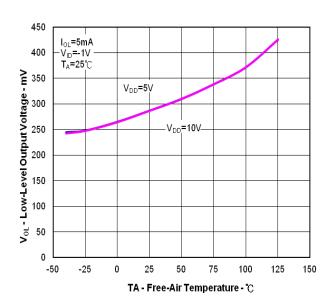


Figure 40



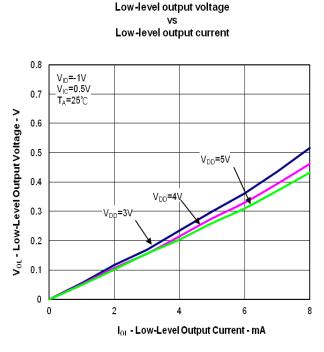


Figure 41

Large-Signal Differential Voltage Amplification

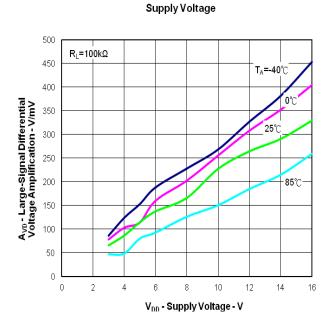
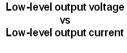


Figure 43



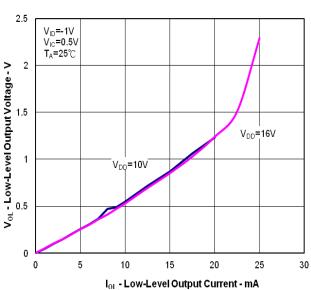


Figure 42

Large-Signal Differential Voltage Amplification
vs
Free-Air Temperature

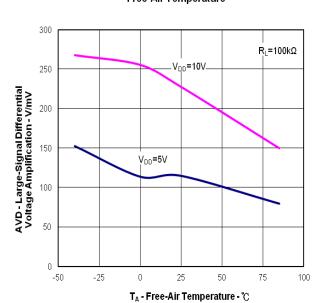


Figure 44



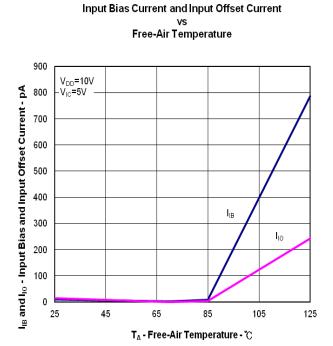


Figure 45

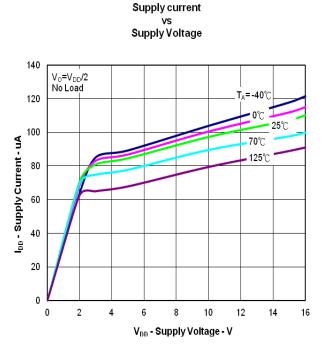
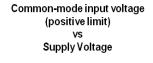


Figure 47



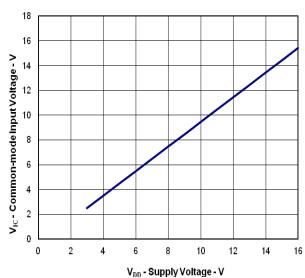


Figure 46



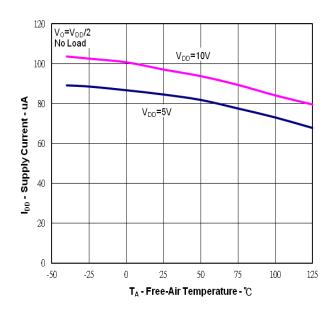
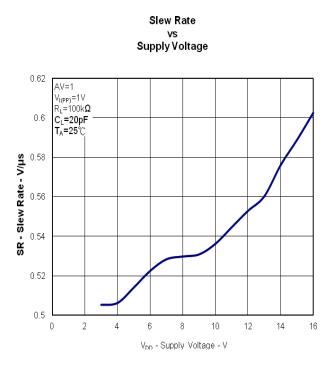


Figure 48



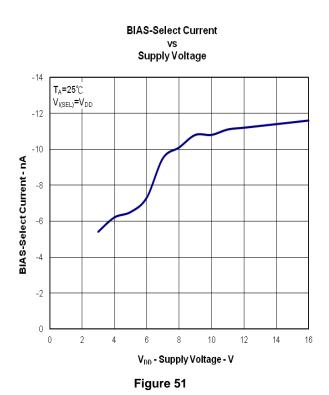


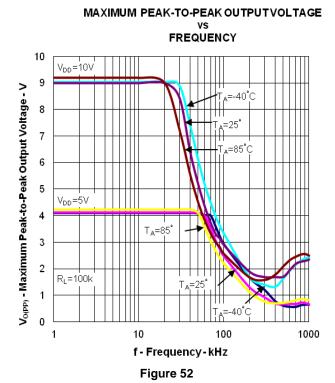
Free-Air Temperature 8.0 AV=1 \_RL=100k**Ω**  $V_{DD}=5V$ 0.7  $V_{DD}=10V$ CL=20pF  $V_{I(PP)}=1V$ V<sub>I(PP)</sub>=1V 0.6 SR - Slew Rate - V/µs 0.5 0.4 V<sub>DD</sub>=5V V<sub>DD</sub>=10V 0.3 V<sub>I(PP)</sub>=5.5V V<sub>I(PP)</sub>=2,5V 0.2 0.1 0 -50 -25 100 125 TA - Free-Air Temperature - °C

Slew rate

Figure 49







TLC271, TLC271A, TLC271B Document number: DS35395 Rev. 2 - 2



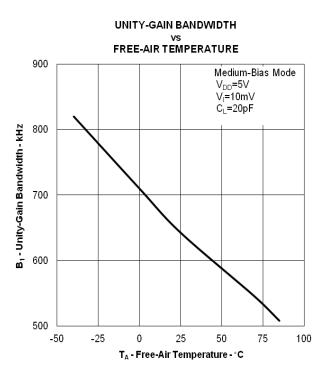


Figure 53

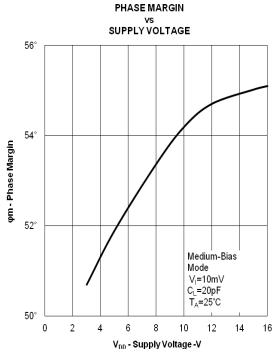


Figure 55

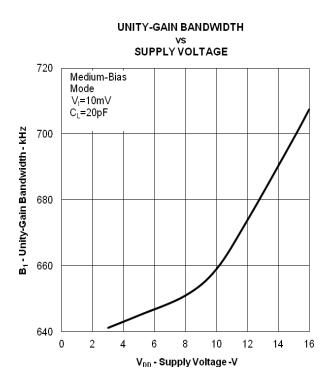


Figure 54

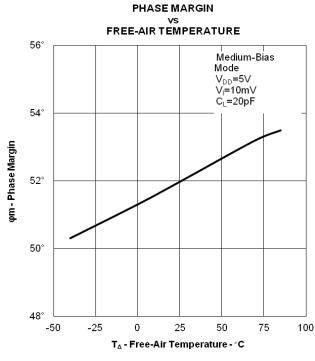


Figure 56



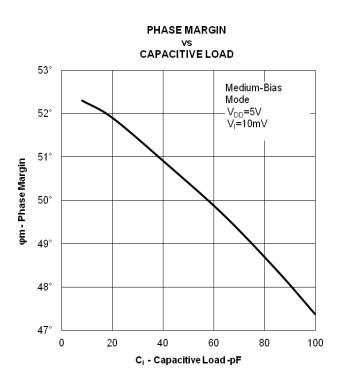


Figure 57

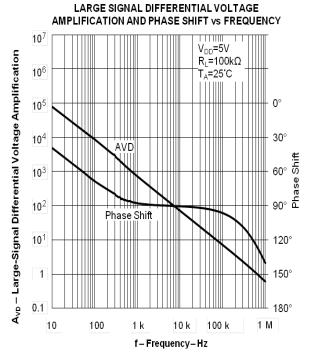


Figure 59

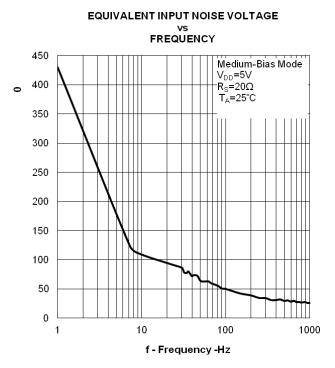


Figure 58

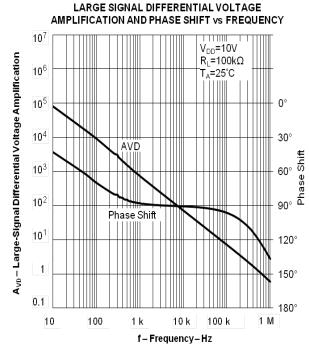
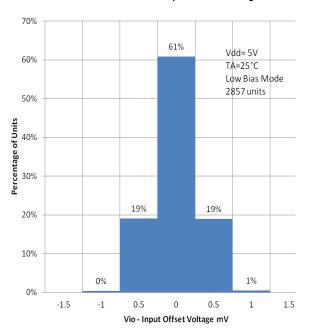


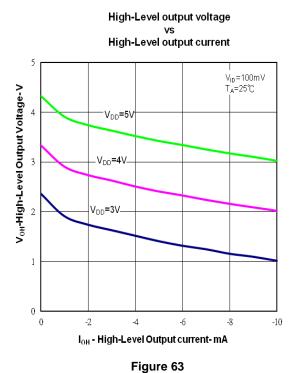
Figure 60



## Distribution of TLC271 Input Offset Voltage



## Figure 61



#### Distribution of TLC271 Input Offset Voltage

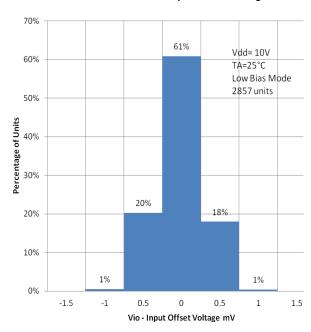


Figure 62

#### High-Level output voltage vs High-Level output current

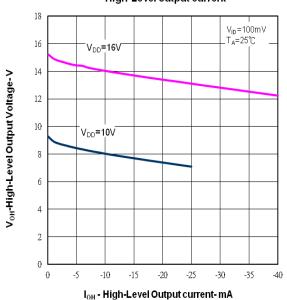


Figure 64



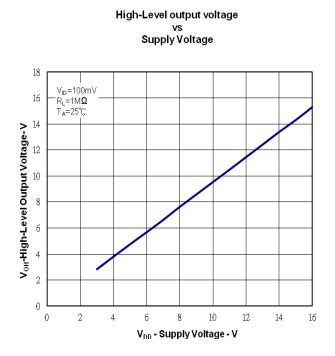
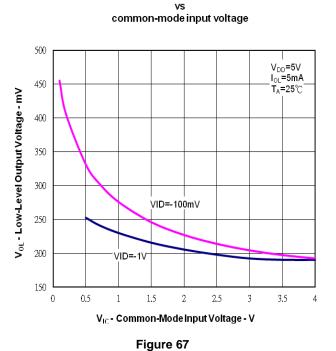


Figure 65

Low-level output voltage



High-Level output voltage vs Free Air Temperature

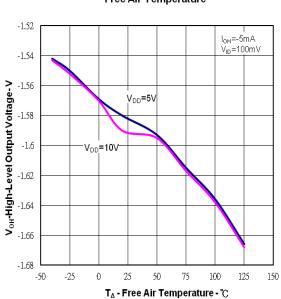
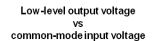


Figure 66



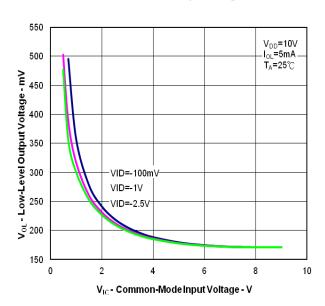
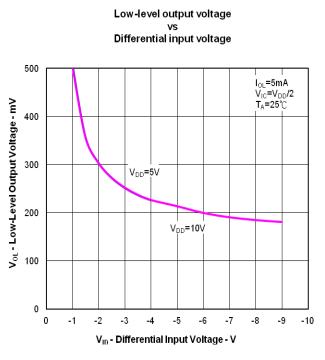


Figure 68





Differential input voltage

I<sub>OL</sub>=5mA
V<sub>IC</sub>=VDD/2
T<sub>A</sub>=25°C

V<sub>DD</sub>=5V

Low-level output voltage

500

400

300

200

100

0

0

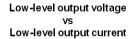
-1

Vol. - Low-Level Output Voltage - mV

Figure 69

Figure 70

-4



V<sub>DD</sub>=5V

V<sub>DD</sub>=4V

V<sub>DD</sub>=3V



Low-level output voltage vs Low-level output current

-5

 $V_{\text{ID}}$  - Differential Input Voltage - V

-7

-8 -9 -10

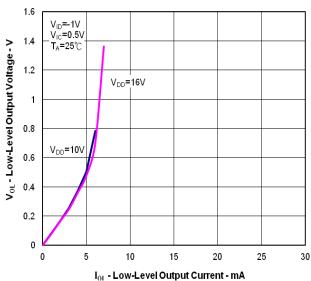


Figure 71

Ioı - Low-Level Output Current - mA

Figure 72

0.8

0.7

Vol - Low-Level Output Voltage - V

0.3

0

0

V<sub>ID</sub>=-1V V<sub>IC</sub>=0.5V T<sub>A</sub>=25°C



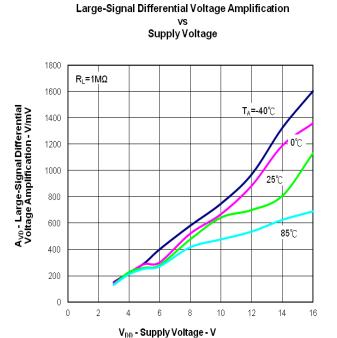


Figure 73

Input Bias Current and Input Offset Current

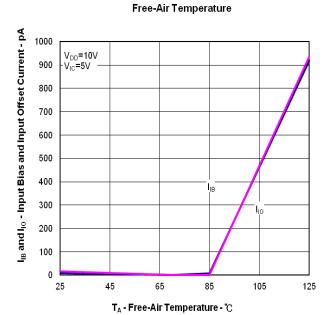


Figure 75



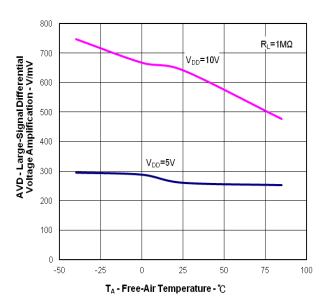


Figure 74

#### Common-mode input voltage (positive limit) vs Supply Voltage

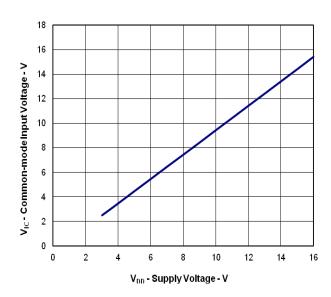
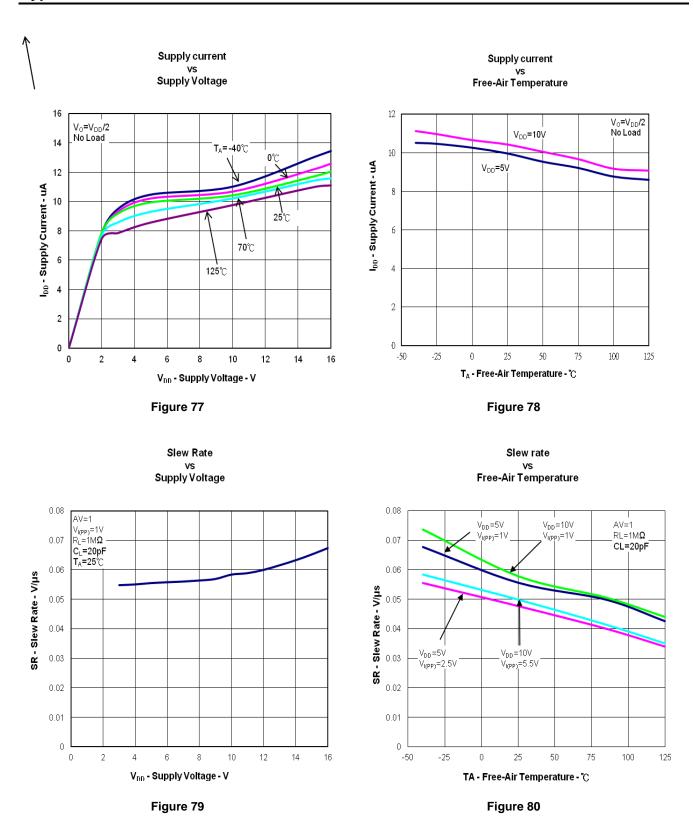


Figure 76







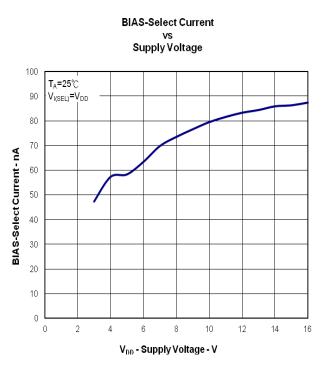
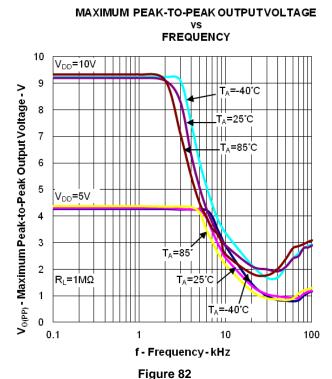
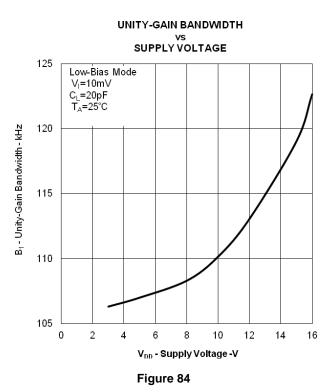


Figure 81

# UNITY-GAIN BANDWIDTH vs FREE-AIR TEMPERATURE 170 Low-Bias Mode $V_{DD}$ =5VV<sub>i</sub>=10mV B<sub>1</sub> - Unity-Gain Bandwidth - kHz 140 110 80 50 -50 -25 25 75 100 $T_{\Delta}$ - Free-Air Temperature - $^{\circ}$ C

Figure 83







### **Typical Performance Characteristics Low Bias Mode**

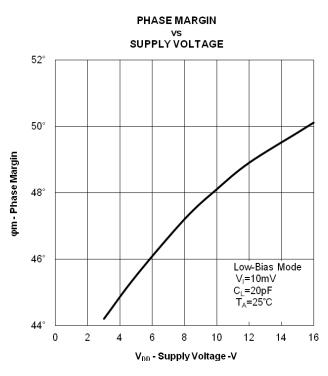
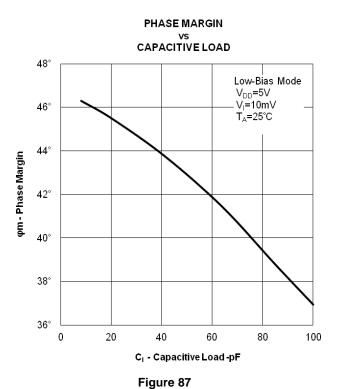


Figure 85



PHASE MARGIN
vs
FREE-AIR TEMPERATURE

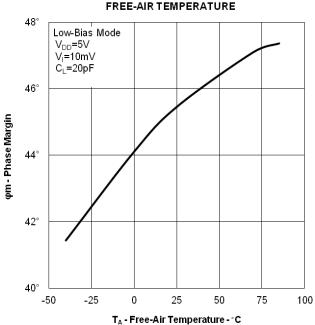


Figure 86

### **EQUIVALENT INPUT NOISE VOLTAGE**

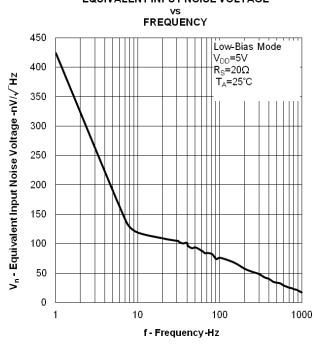
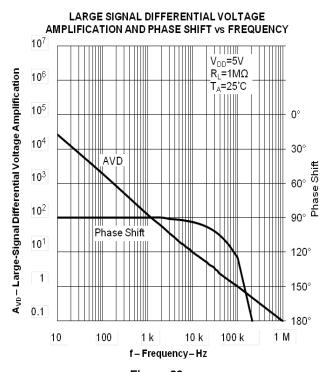


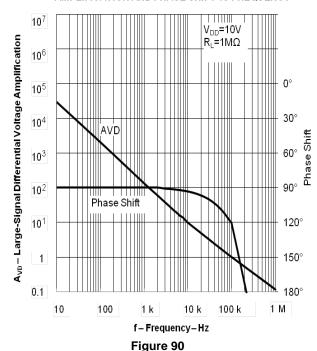
Figure 88



## **Typical Performance Characteristics Low Bias Mode**



LARGE SIGNAL DIFFERENTIAL VOLTAGE
AMPLIFICATION AND PHASE SHIFT VS FREQUENCY





### **Application Information**

#### Bias select feature

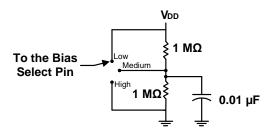
The TLC271 offers a bias-select feature that allows the user to select any one of three bias levels depending on the level of performance desired. The trade-off between bias levels relates to ac performance and power dissipation as below.

Typical values T <sub>A</sub> = +25°C, V <sub>DD</sub> = 5V			Mode		
		High bias	Medium bias	Low bias	Units
		$R_L = 10k\Omega$	$R_L = 100k\Omega$	$R_L = 1M\Omega$	
PD	Power Dissipation	3.4	0.5	0.05	mW
SR	Slew Rate	3.6	0.4	0.03	V/µs
Vn	Equivalent Input Noise Voltage at f=1kHz	20	25	28	nV√Hz
B <sub>1</sub>	Unity Gain Bandwidth	1.7	0.5	0.09	MHz
φ <sub>m</sub>	Phase Margin	46°	40°	34°	_
A <sub>VD</sub>	Large Signal Differential Voltage Amplification	23	170	480	V/mV

#### **Bias selection**

Bias selection is achieved by connecting the bias select pin to one of three voltage levels (see below). For medium-bias applications, it is recommended that the bias select pin be connected to the midpoint between the supply rails. This procedure is simple in split-supply applications, since this point is ground.

In single-supply applications, the medium-bias mode necessitates using a voltage divider as indicated below. The use of large-value resistors in the voltage divider reduces the current drain of the divider from the supply line. However, large-value resistors used in conjunction with a large-value capacitor require significant time to charge the supply to the midpoint after the supply is switched on. A voltage other than the midpoint can be used if it is within the voltages specified table.



Bias Mode	Bias Select Voltage (Single Supply)	
Low	$V_{DD}$	
Medium	1 V to V <sub>DD</sub> -1 V	
High	GND	

Figure 91

### **High-Bias Mode**

In high-bias mode, the TLC271 series features low offset voltage drift, high input impedance and low noise. Speed in this mode approaches that of BiFET devices but at only a fraction of the power dissipation. Unity-gain bandwidth is typically greater than 1 MHz.

#### **Medium-Bias Mode**

The TLC271 in medium-bias mode features low offset voltage drift, high input impedance and low noise. Speed in this mode is similar to general-purpose bipolar devices, but power dissipation is only a fraction of that consumed by bipolar devices.

#### **Low-Bias Mode**

In low-bias mode, the TLC271 features low offset voltage drift, high input impedance, extremely low power consumption and high differential voltage gain.



### **Application Information (cont.)**

### Parameter measurement circuits

Because the TLC271 is optimized for single-supply operation, circuit configurations used for the various tests can present some difficulties since the input signal must be offset from ground. This issue can be avoided by testing the device with split supplies and the output load tied to the negative rail. Example circuits are shown below.

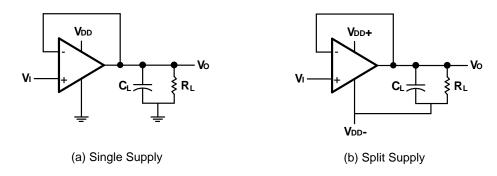


Figure 92 Measurement circuit with either single or split supply

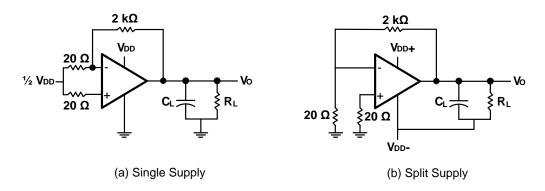


Fig 93 Noise measurement with single or split supply

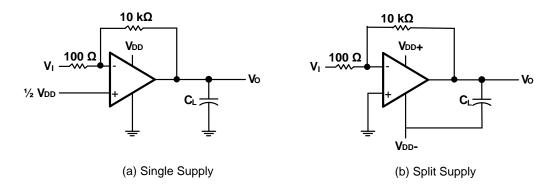


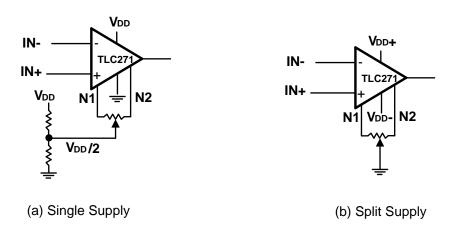
Figure 94 Gain of 100 with single or split supply



### **Application Notes**

#### Offset Voltage Nulling Circuit

The TLC271 offers external input offset null control. Nulling of the input off set voltage may be achieved by adjusting a  $100-k\Omega$  potentiometer connected between the offset null terminals with the wiper connected as shown in Figure 95. The amount of nulling range varies with the bias selection. In the high-bias mode, the nulling range allows the maximum offset voltage specified to be trimmed to zero. In low-bias and medium-bias modes, total nulling may not be possible.



**Figure 95 Offset Nulling Circuits** 

#### Input Bias Current - Error Protection

The TLC271 has an extremely high input impedance. To use the inputs as a high impedance node, for example, greater than 100K, or to accurately measure bias current, it will be necessary to place a guard ring around the input pins and drive this ring to a potential equivalent to the common mode input voltage. In many cases this common mode potential may exist as a part of the feedback circuit and can be obtained from one of the appropriate nodes. In the case for the SO8 package, pin 4 is connected to ground or Vdd-. Input pins 2 and 3 are normally well above the voltage on pin 4 so a large potential voltage on the order of several volts is likely between pins 3 and 4. To prevent interference with a 1 pA bias current the board resistance would need to be in the order of gigaohms to have a minimum impact. The goal is to have the common mode potential on the guard ring, therefore reducing the stray voltage near the input pins to millivolts in normal applications. Any solder flux residue, excess moisture, humidity or board contamination will be detrimental to using the device in a high impedance input mode.

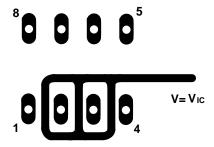


Figure 96 Bias Current Guarding for High Input Impedance Applications



## **Typical Application Circuits**

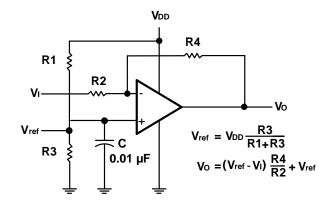


Figure 97 Inverting Amplifier With Voltage Reference

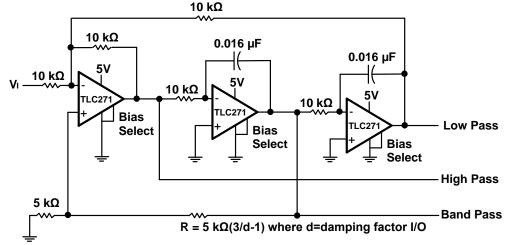
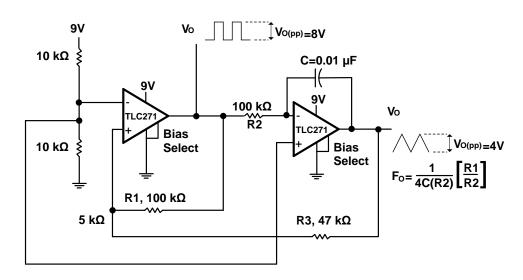


Figure 98 State Variable Filter



**Figure 99 Single Supply Function Generator** 



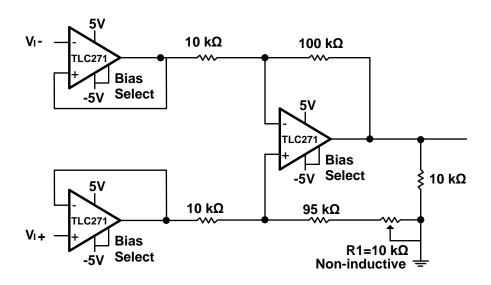


Figure 100 Low Power Instrumentation Amplifier

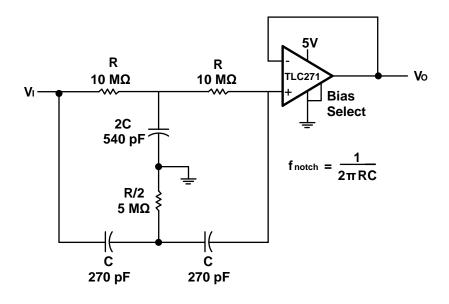


Figure 101 Single Supply Twin-T Notch Filter



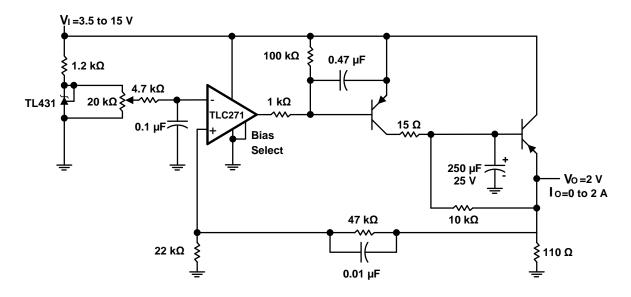


Figure 102 Power Supply

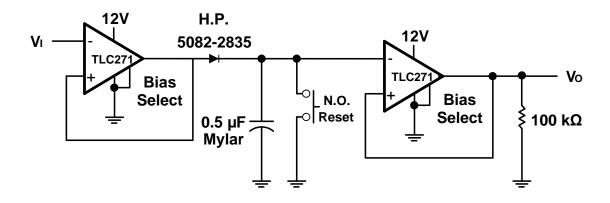


Figure 103 Positive Peak Detector



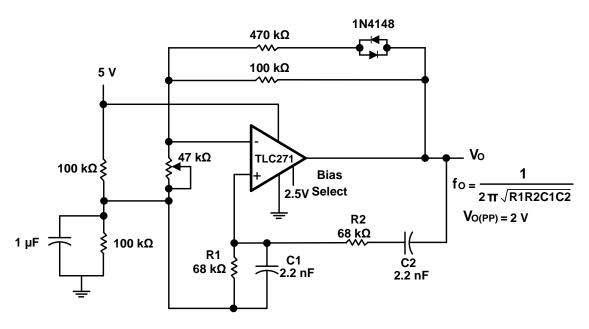


Figure 104 Wein Oscillator

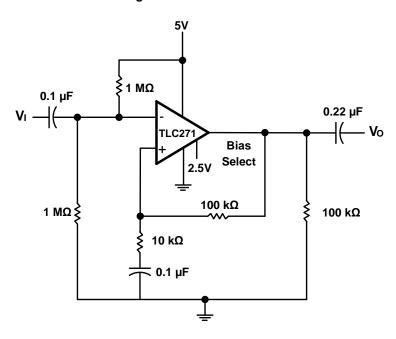


Figure 105 Single-Supply AC Amplifier



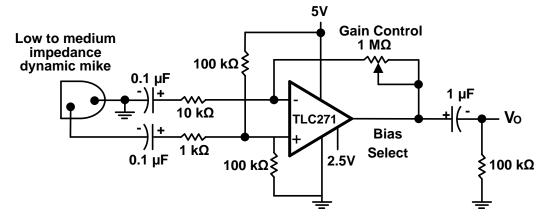


Figure 106 Microphone Preamplifier

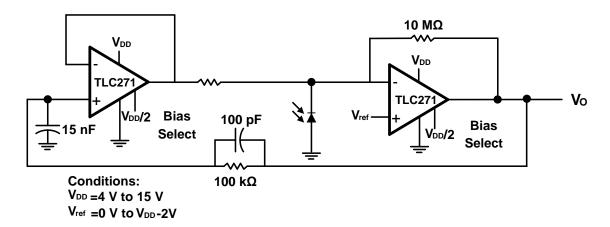
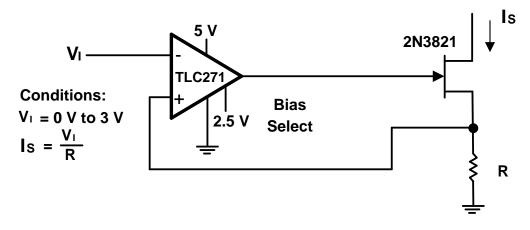
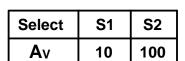


Figure 107 Photo-Diode Amplifier With Ambient Light Rejection



**Figure 108 Precision Low-Current Sink** 





 $V_{DD} = 5 V \text{ to } 12 V$ 

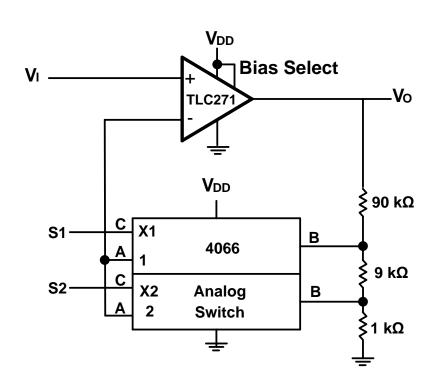


Figure 109 Amplifier With Digital Gain Selection

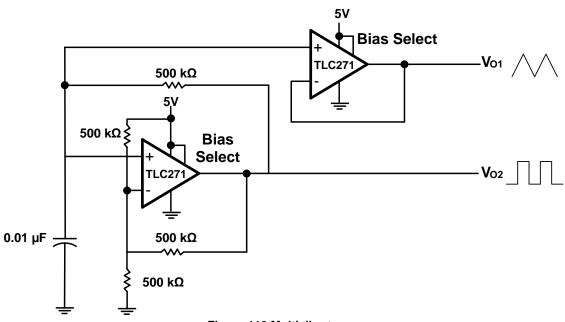


Figure 110 Multivibrator



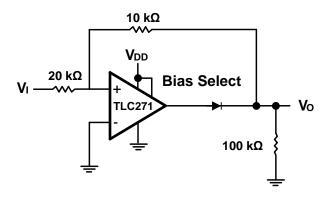
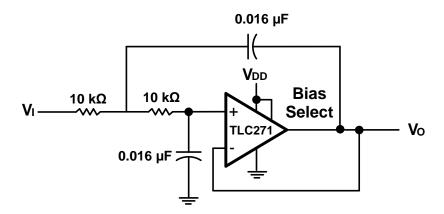


Figure 111 Full Wave Rectifier



Nomalized to Fc= 1 kHz and R  $_{L}$  = 10 k $\Omega$ 

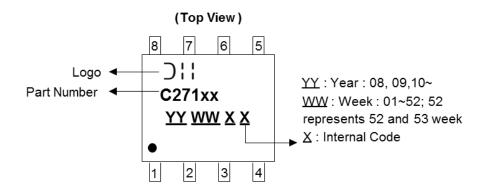
Figure 112 Two-Pole Low-Pass Butterworth Filter



## **Marking Information**

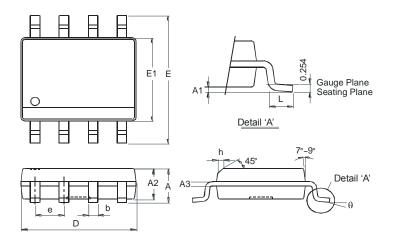
**SO-8** 

Part mark	Part number
C271C	TLC271CS
C271AC	TLC271ACS
C271BC	TLC271BCS
C271I	TLC271IS
C271AI	TLC271AIS
C271BI	TLC271BIS



### **Package Outline Dimensions**

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.



SO-8						
Dim	Min	Max				
Α	-	1.75				
A1	0.10	0.20				
A2	1.30	1.50				
A3	0.15	0.25				
b	0.3	0.5				
D	4.85	4.95				
Е	5.90	6.10				
E1	3.85	3.95				
е	1.27 Typ					
h	-	0.35				
L	0.62	0.82				
θ	0°	8°				
All Dimensions in mm						



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