



TLC271, TLC271A, TLC271B

CMOS PROGRAMMABLE LOW POWER OPERATIONAL AMPLIFIERS

Description

The TLC271 operational amplifier combines a wide range of input offset voltage grades with low offset voltage drift and high input impedance. In addition, the TLC271 offers a bias-select mode that allows the user to select the best combination of power dissipation and AC performance for a particular application.

Using the bias-select option, these devices can be programmed to fit a wide range of applications. Three offset voltage grades are available, ranging from the low-cost TLC271 (10mV) to the TLC271B (2mV) low-offset version. The devices are offered in both commercial and industrial operating temperature ranges.

The extremely high input impedance and low bias currents, in conjunction with good common-mode and supply voltage rejection make these devices an excellent choice for high performance designs.

The devices also feature low-voltage single-supply operation with a common-mode input voltage range which includes the negative rail.

Features

 Wide range of supply voltages over specified temperature range:

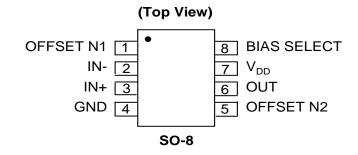
> 0°C to 70°C . . . 3 V to 16 V -40°C to 85°C . . . 4 V to 16 V

- Single-Supply Operation
- Common-Mode Input Voltage Range
- · Extends Below the Negative Rail
- Low Noise:

20 nV/√Hz Typical @ f = 1kHz (High-Bias Mode)

- Output Voltage Range Includes Negative Rail
- High Input Impedance
- ESD-Protection Circuitry
- Designed-In Latch-Up Immunity
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)

Pin Assignments



Applications

With the programmability options of the TLC271, a designer can choose a very low current option allowing for extended battery life or choose a higher current option for more performance. It is possible to switch performance modes as the application demands change.

The TLC271 is well suited for many consumer audio, industrial and other low power applications.

Audio

Microphone Preamplifier

Filtering - Equalizers

Signal Amplification

Industrial

Power Supply

Instrumentation

Metering

Medical

Portable Meters and Measurement

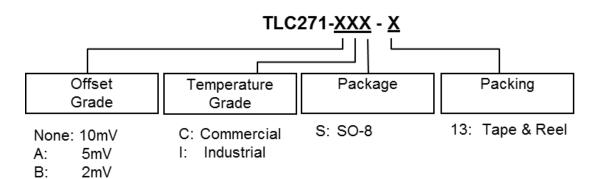
Instrumentation

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.

- 2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
- 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.



Ordering Information



	Bookogo	Offset	Operating	Dookoging	13" Tape and 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	Pa	arameter	Rating	Unit
V_{DD}	Supply Voltage (Note 6)		18	V
V_{ID}	Differential Input Voltage (Note 7)		$\pm V_{DD}$	V
V _{IN}	Input Voltage Range (either input)		-0.3 to V _{DD}	V
I _{IN}	Input Current		±5	mA
l _°	Output Current		±30	mA
	Output Short-Circuit to GND (Note 8	3)	Continuous	_
P _D	Power Dissipation (Note 9)		1065	mW
_	Operating Temperature Bange	C Grade	0 to +70	°C
T _A	Operating Temperature Range	I Grade	-40 to +85	
TJ	Operating Junction Temperature		150	°C
T _{ST}	Storage Temperature Range		-65 to +150	°C
ESD HBM	Human Body Model ESD Protection	Human Body Model ESD Protection (1.5kΩ in series with 100pF)		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		C gı	rade	l gr	Unit	
Symbol	Parameter	i arameter			Min	Max	
V_{DD}	Supply Voltage		3	16	4	16	V
V _{IC}	Common Mode Input Voltage	$V_{DD} = 5V$	-0.2	3.5	-0.2	3.5	V
		$V_{DD} = 10V$	-0.2	8.5	-0.2	8.5	
T _A	Operating Free Air Temperature		0	+70	-40	+85	°C



i -											
High Bia	as Mode		1	1	ı						
								71AC, T			
	Parameter		Conditions	T _A	\	$I_{DD} = 5$	/	V	_{DD} = 10	V	Unit
		1			Min	Тур	Max	Min	Тур.	Max	
		TLC271C		+25°C	_	1.1	10	_	1.1	10	
		1202710	V∘ = 1.4V, V _{IC} =	0 to +70°C	_	_	12	_	_	12	
Vı∘	Input Offset Voltage	TLC271AC	0V, R _S =	+25 °C	_	0.9	5	_	0.9	5	mV
VI	imput Onset voltage	TLOZITAO	$50Ω$, $R_L =$	0 to 70 °C	_	_	6.5	_	_	6.5	111 V
		TLC271BC	10kΩ	25 °C	_	0.34	2	_	0.39	2	
		TLO27 IDO		0 to +70°C	_	_	3	_	_	3	
α _{VI°}	Average Temperature (Input Offset Voltage	Coefficient of	_	+25°C to 70°C	1.8			2			
١.	Innuit Officet Current (A	loto 10)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 [°] C	_	0.1	60	_	0.1	60	~ Λ
II∘	Input Offset Current (N	iote 10)	= V _{DD} /2	+70°C	_	7	300	_	7	300	pA
	Innert Ding Comment (No	4- 40)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25°C	_	0.6	60	_	0.7	60	- A
I _{IB}	Input Bias Current (No	te 10)	= V _{DD} /2	+70°C	_	40	600	_	50	600	pA
				+25 [°] C	-0.2 to	-0.3 to	_	-0.2 to	-0.3 to		٧
V _{ICR}	Common Mode Input V	oltage (Note		+25 C	4	4.2		9	9.2		V
VICR	11)		_	0 to +70°C	-0.2 to 3.5			-0.2 to 8.5		_	٧
			\	+25°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		
			100 1	+25°C	_	0	50	_	0	50	
V∘L	Low Level Output Volta	ige	$V_{ID} = -100 \text{mV},$ $I_{^{\circ}L} = 0$	o°C	_	0	50	_	0	50	mV
			I°L = 0	+70°C	_	0	50	_	0	50	
	Lanca Cianal Differentia	11/1-11	D 401-0 (Note	+25°C	5	23		10	36		
A_{VD}	Large Signal Differentia	al Voltage	$R_L = 10k\Omega$ (Note 12)	o°C	4	27		7.5	42	_	V/mV
	Gairi		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	_	
	Cupply Voltage Deiget	on Doti-	V 5)/+- 40\/	+25°C	65	95	_	65	95	_	
k _{SVR}	Supply Voltage Rejection (ΔV _{DD} /ΔV _{I°})	on Katio	$V_{DD} = 5V \text{ to } 10V,$ $V_{\circ} = 1.4V$	0°C	60	94	_	60	94	_	dB
	(A A DOLA A I.)		V 1.4V	+70°C	60	96		60	96	_	
I _{I(SEL)}	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	
I_{DD}	Supply Current		= V _{DD} /2, No	0°C	_	775	1800	_	1125	2200	μΑ
			load	+70°C		575	1300	—	750	1700	

Notes:

^{10.} The typical values of input bias current and input offset current below 5pA were calculated.

^{11.} This range also applies to each input individually.

^{12.} 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.



					T	LC271I	, TLC2	71AI, T	LC2711	31	
	Parameter		Conditions	T _A	\	/ _{DD} = 5\	٧	٧	_{DD} = 10	٧	Unit
					Min	Тур	Max	Min	Тур.	Max	
		TI 00741		+25 °C	_	1.1	10	_	1.1	10	
		TLC271I	V∘ = 1.4V, V _{IC} =	-40 to 85 °C	_	_	13	_	_	13	
		TI 0074 A I	0V, R _S =	+25 [°] C	_	0.9	5	_	0.9	5	>/
Vı۰	Input Offset Voltage	TLC271AI	50Ω , $R_L =$	-40 to 85 °C	_		7	_		7	mV
		TI C074DI	10kΩ	+25 [°] C	_	0.34	2	_	0.39	2	
		TLC271BI		-40 to 85 °C	_	_	3.5	_	_	3.5	
αVI°	Average Temperature Input Offset Voltage	Coefficient of		+25 to 85 °C	1.8			2		μV/°C	
	Input Offeet Current (A	loto 12\	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 [°] C	_	0.1	60	_	0.1	60	~ ^
Ι _Ι ∘	Input Offset Current (N	Note 13)	= V _{DD} /2	+85 [°] C	_	24	1000	_	26	1000	pА
1	Input Bias Current (No	to 12\	$V_{\circ} = V_{DD}/2, \ V_{IC}$	+25 [°] C	_	0.6	60	_	0.7	60	pА
I _{IB}	Input Bias Current (No	=		+85 [°] C	_	200	2000	_	220	2000	PΑ
.,	Common Mode Input Voltage (Note			+25 [°] C	-0.2 to	-0.3 to	_	-0.2 to	-0.3 to 9.2	_	V
V_{ICR}	14)	σ ,	_	-40 to +85°C	-0.2 to			-0.2 to 8.5		_	V
				+25 [°] C	3.2	3.8	_	8	8.5	_	
V∘H	High Level Output Volt	age	$V_{ID} = 100 \text{mV}, R_L$	-40 [°] C	3	3.8	_	7.8	8.5		V
			= 10kΩ	+85 [°] C	3	3.8	_	7.8	8.5		
			1001	+25 [°] C		0	50	—	0	50	
۷°L	Low Level Output Volta	age	$V_{ID} = -100 \text{mV},$ $I_{\circ L} = 0$	-40 [°] C	_	0	50	_	0	50	mV
			1-2 = 0	+85 [°] C	_	0	50	_	0	50	
	Lorgo Signal Difforentia	al Valtaga	$R_L = 10k\Omega$ (Note	+25 [°] C	5	23		10	36	_	
A_{VD}	Large Signal Differentia	ai voitage	15)	-40°C	3.5	32		7	46		V/mV
	Cum		10)	+85 [°] C	3.5	19	_	7	31		
				+25 [°] C	65	80	_	65	85	_	
CMRR	Common Mode Rejecti	on Ratio	$V_{IC} = V_{ICRmin}$	-40°C	60	81	_	60	87	_	dB
				+85 [°] C	60	86	_	60	88	_	
	Supply Voltage Rejecti	on Patio	$V_{DD} = 5V \text{ to } 10V,$	+25 °C	65	95	_	65	95	_	
k_{SVR}	$(\Delta V_{DD}/\Delta V_{I^{\circ}})$	on Italio	$V_{DD} = 5V \text{ to 10V},$ $V_{\odot} = 1.4V$	-40°C	60	92	_	60	92	_	dB
				+85 [°] C	60	96	_	60	96	_	
I _{I(SEL)}	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 _{DD} /2, No	-40°C	_	950	2200	_	1375	2500	μΑ
				+85 [°] C	_	525	1200	—	725	1600	- '

Notes:

^{13.} The typical values of input bias current and input offset current below 5pA were calculated.

^{14.} This range also applies to each input individually.

^{15.} 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.



	Parameter	Con	ditions	TA		71C, TLC TLC271B		Unit
					Min	Тур	Max	_
				+25 [°] C	_	3.6	_	
		$R_L = 10k\Omega$,	$V_{I(PP)} = 1V$	o°C	_	4	_]
		$C_L = 20pF$		+70 [°] C	_	3	_	Ī ,,,
SR	Slew Rate at Unity Gain	C		+25 [°] 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 _S = See Figure 93	20Ω	+25 [°] C	_	25	_	nV/√Hz
		V∘ = V∘ _H , C _L = 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
		-		+25 °C	_	2.2	_	
B ₁	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 ₁ , V _I = 10	mV.	+25 °C	_	49°	_	
φm	Phase Margin $C_L = 20pF$,	o°C	_	50°	_	_
• • • • • • • • • • • • • • • • • • • •		See Figure 94		+70°C	_	46°	_	
gh b	ias mode: V _{DD} = 10V	-		·		I		
	Parameter	Cond	litions	TA		71C, TLC TLC271B		Unit
				I A	Min	Тур	Max	_
				+25 °C	_	5.3	_	
			$V_{I(PP)} = 1V$	o°C	_	5.9	_	
		$R_L = 10k\Omega$,		+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 _S = See Figure 93	20Ω	+25 °C	_	25	_	nV/√Hz
		$V_{\circ} = V_{\circ H}, C_{L} = 2$	20pF,	+25 °C	_	200	_	
	Maximum Output Swing		•	o°C	_	220	_	kHz
В∘м	Maximum Output Swing	$R_L = 10k\Omega$				140	_	1
В∘м	Maximum Output Swing Bandwidth	See Figure 92		+70°C				
В∘м		See Figure 92		+70 C +25 °C	 	2.2	_	
В∘м ——		See Figure 92 V _I = 10mV, C _L	= 20pF	_			_ 	MHz
	Bandwidth	See Figure 92	= 20pF	+25 [°] C	_	2.2	— — —	MHz
B∘ _M	Bandwidth	See Figure 92 V _I = 10mV, C _L		+25°C 0°C		2.2 2.5		MHz
	Bandwidth	See Figure 92 V _I = 10mV, C _L See Figure 94		+25°C 0°C +70°C	_ 	2.2 2.5 1.8	_	MHz —



	Parameter	Con	ditions	T _A	TLC	271I, TLC TLC271E		Unit
					Min	Тур	Max	_
				+25 [°] C	_	3.6	_	
		$R_L = 10k\Omega$,	$V_{I(PP)} = 1V$	-40 °C	_	4.5	_	
0.0		C _L = 20pF		+85 [°] C	_	2.8	_	, , , , , , , , , , , , , , , , , , ,
SR	Slew rate at unity gain	See		+25 [°] C	_	2.9	_	V/µs
		Figure 92	$V_{I(PP)} = 2.5V$	-40°C	_	3.5	_	
				+85 [°] C	_	2.3	_	
Vn	Equivalent input noise voltage	F = 1kHz, R _S Figure 93	= 20Ω See	+25 [°] C	_	25	_	nV/√H
		V∘ = V∘ _H , C _L =	20pF, R _L =	+25 [°] C	_	320	_	
B∘ _M	Maximum output swing	10kΩ	See Figure	-40 °C	_	380	_	kHz
	bandwidth	92		+85 [°] C	_	250	_	
				+25 [°] C	_	1.7	_	
B ₁	Unity gain bandwidth		_ = 20pF See	-40°C	_	2.6	_	MHz
		Figure 94		+85 [°] C	_	1.2	_	
			0mV. C ₁ =	+25 [°] C	_	46°	_	
φm			See Figure		_	49°	_	Ī —
		94	-	+85 [°] C	_	43°	_	
gh b	ias mode: V _{DD} = 10V				•	•		
	Parameter	Conditions		T _A	TLC271I, TLC271AI, TLC271BI			Unit
				-	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 [°] C	_	3.5	_	
V	Equivalent input noise voltage	F = 1kHz, R _S Figure 93	= 20Ω See	+25 [°] C	_	25	_	nV/√H
V_n		Figure 93		+25 °C	_	200	_	
v _n		V∘ = V∘ _H , C₁ =	20pF, R _L =	120 0		1	_	kHz
	Maximum output swing	$V_{\circ} = V_{\circ H}, C_{L} = 10k\Omega$	$20pF$, $R_L =$ See Figure	-40 °C	_	260		
					<u>-</u>	260 130		
	Maximum output swing	10kΩ 92	See Figure	-40 [°] C			+	
	Maximum output swing	10kΩ 92 $V_I = 10mV, C_I$		-40 °C +85 °C		130		MHz
B∘ _M	Maximum output swing bandwidth	10kΩ 92	See Figure	-40 °C +85 °C +25 °C	_	130 2.2		MHz
B∘ _M	Maximum output swing bandwidth	10kΩ 92 V _I = 10mV, C _I Figure 94	See Figure	-40 °C +85 °C +25 °C -40 °C +85 °C	_ 	130 2.2 3.1	_ _ _	MHz
B∘ _M	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 _A		/ _{DD} = 5\			_{DD} = 10		Unit
					Min	Тур	Max	Min	Тур.	Max	
				+25 [°] C	_	1.1	10	_	1.1	10	
		TLC271C	V° = 1.4V, V _{IC} =	0 to +70°C	_	_	12	_	_	12	
V.	Input Offact Valtage	TI C074 A C	0V, R _S =	+25 [°] 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 [°] 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 [°] C		0.1	60	_	0.1	60	n 1
Ι _{Ι°}	Input offset current (N	iote 16)	= V _{DD} /2	+70°C		7	300	_	7	300	рA
1	Input bias current (No	to 16\	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 [°] C		0.6	60	_	0.7	60	n^
I _{IB}	input bias current (No	= V _{DD} /2		+70°C		40	600	_	50	600	рA
W	Common mode input v	Common mode input voltage (Note		+25 [°] C	-0.2 to	-0.3 to 4.2		-0.2 to	-0.3 to 9.2		V
V _{ICR}	17)			0 to +70°C	-0.2 to	_		-0.2 to 8.5	_		V
				+25 [°] C	3.2	3.9	_	8	8.7	_	
V∘H	High level output volta	ge	$V_{ID} = 100 \text{mV}, R_L$ = $100 \text{k}\Omega$	o°C	3	3.9	_	7.8	8.7	_	V
			= 100K22	+70°C	3	4	_	7.8	8.7		
			1001/	+25 [°] 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 [°] 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 [°] 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 [°] C	70	93		70	93		
k_{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 _{I(SEL)}	Input current (BIAS SE	ELECT)	$V_{I(SEL)} = 0$	+25 [°] C		-130		—	-160	_	nA
			$V_{\circ} = V_{DD}/2, V_{IC}$	+25°C		105	280	_	143	300	
I_{DD}	Supply current		= V _{DD} /2, No	o°C	1-	125	320	_	173	400	μΑ
			load	+70°C	—	85	220	—	110	280	

Notes:

^{16.} The typical values of input bias current and input offset current below 5pA were calculated.

^{17.} This range also applies to each input individually.

^{18.} 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	\	/ _{DD} = 5\	/	٧	_{DD} = 10	٧	Unit
					Min	Тур	Max	Min	Тур.	Max	
		TI 00741		+25 [°] C	_	1.1	10	_	1.1	10	
		TLC271I	V∘ = 1.4V, V _{IC} =	-40 to +85°C	_	_	13	_	_	13	
.,	land Office Voltage	TI 0074 A I	0V, R _S =	+25 [°] C	_	0.9	5	_	0.9	5	\/
۷ _{I°}	Input Offset Voltage	TLC271AI	$50Ω$, $R_L =$	-40 to +85°C	_	_	7	_		7	mV
		TLC271BI	100kΩ	+25 [°] C	_	0.25	2	_	0.26	2	
		ILC2/ IBI		-40 to +85°C	_	_	3.5	_	_	3.5	
α_{VI°	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 [°] C	_	0.1	60	_	0.1	60	- Λ
Ι _Ι ∘	Input offset current (No	ole 19)	= V _{DD} /2	+85 [°] C	_	24	1000	_	26	1000	рA
l	Input bias current (Not	to 10)	$V_{\circ} = V_{DD}/2, \ V_{IC}$	+25 [°] C	_	0.6	60	_	0.7	60	pА
I _{IB}	input bias current (Noi	.e 1 <i>9)</i>	= V _{DD} /2	+85 [°] C		200	2000	_	220	2000	PΑ
V	Common mode input v	Common mode input voltage (Note		+25 [°] C	-0.2 to	-0.3 to 4.2	_	-0.2 to	-0.3 to 9.2	_	V
V _{ICR}	20)			-40 to +85°C	-0.2 to	_	_	-0.2 to 8.5		_	V
				+25 [°] C	3.2	3.9	_	8	8.7		
V∘H	ligh level output voltage		$V_{ID} = 100 \text{mV}, R_L$	-40°C	3	3.9	_	7.8	8.7		V
			= 100kΩ	+85 [°] C	3	4	_	7.8	8.7	_	
			1001	+25 [°] 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 [°] C	_	0	50	_	0	50	
			P. = 100k0	+25 [°] 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 [°] 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 [°] C	60	90		60	94	_	
	Supply voltage rejectio	n ratio	$V_{DD} = 5V \text{ to } 10V,$	+25 °C	70	93	_	70	93	_	
k_{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 [°] C	60	94		60	94		
I _{I(SEL)}	Input current (BIAS SE	LECT)	$V_{I(SEL)} = 0$	+25 [°] C	_	-130		_	-160	_	nA
			$V_{\circ} = V_{DD}/2, V_{IC}$	+25 [°] C	_	105	280	_	143	300	
I_{DD}	Supply current		= V _{DD} /2, No	-40°C	_	158	400	_	225	450	μΑ
			load	+85 [°] C	-	80	200		103	260	

Notes:

^{19.} The typical values of input bias current and input offset current below 5pA were calculated.

^{20.} This range also applies to each input individually.

^{21.} 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.



	n bias mode: V _{DD} = 5V	Т		т				
	Parameter	Cond	ditions	T _A		71C, TLC TLC271B		Unit
	J				Min	Тур	Max	_
			T	+25 [°] C		0.43	<u> </u>	+
	1	$R_L = 100k\Omega$,	$V_{I(PP)} = 1V$	0°C	<u> </u>	0.46	<u> </u>	1
		C _L = 20pF		+70 °C		0.36	<u> </u>]
SR	Slew rate at unity gain	See		+25 [°] C	<u> </u>	0.4	<u> </u>	V/µs
	1	Figure 92	$V_{I(PP)} = 2.5V$	0°C	<u> </u>	0.43	<u> </u>	1
				+70°C	<u> </u>	0.34	<u> </u>	1
Vn	leguivalent input noise voltage	F = 1kHz, R _S = Figure 93	= 20Ω See	25 [°] C		32		nV/√Hz
		V∘ = V∘ _H , C _L =	20pF, R _L =	+25 [°] C	<u> </u>	55	<u> </u>	
В∘м	Maximum output swing	100kΩ	See	0°C	<u> </u>	60	<u> </u>	kHz
	bandwidth	Figure 92		+70°C	<u> </u>	50	<u> </u>	1
				+25 [°] C	<u> </u>	525	<u> </u>	
B ₁	Unity gain bandwidth	$V_I = 10 \text{mV}, C_L$	= 20pF See	0 °C	_	600	_	MHz
		Figure 94		+70 [°] C	_	400	_	1
		F = B ₁ , V _I = 10)mV. C _L =	+25 [°] C	_	40°	_	1
φm		20pF	See Figure	0°C		41°	_	_
	!	94		+70°C	_	39°		1
diun	n bias mode: V _{DD} = 10V			.I		.1	,_ L	<u>-</u>
	Parameter	Conc	ditions	T _A		71C, TLC TLC271B		Unit
	!				Min	Тур	Max	_
				+25 [°] C	<u> </u>	0.62	1 —	
		$R_L = 100k\Omega$,	$V_{I(PP)} = 1V$	0°C	<u> </u>	0.67	T	1
~ D		C _L = 20pF		+70°C	<u> </u>	0.51	T <u> </u>	1
SR	Slew Rate at Unity Gain	See		+25 [°] C	<u> </u>	0.56	T <u> </u>	V/µs
		Figure 92	$V_{I(PP)} = 5.5V$	0°C	<u> </u>	0.61	_	1
				+70°C	_	0.46	_	Ī <u></u>
	Equivalent Input Noise Voltage	F = 1kHz, R _S =		+25 °C	_	32	_	nV/√H:
Vn	Equivalent input Noise voltage	See Figure 93				1		1
Vn	-	See Figure 93 V° = V°H, CL =		+25 °C	+_	35	_	

o°C

+70°C

+25°C

40

30

635

kHz



	Parameter	Cond	ditions	TA	TLC	271I, TLC TLC271E		Unit
					Min	Тур	Max	_
				+25 [°] C	<u> </u>	0.43	_	
		$R_L = 100k\Omega$,	$V_{I(PP)} = 1V$	-40°C	_	0.51	_	
		$C_L = 20pF$		+85 [°] C	_	0.35	_	.,,
SR	Slew rate at unity gain	See		+25°C	_	0.4	_	V/µs
		Figure 92	$V_{I(PP)} = 2.5V$	-40°C	_	0.48	_	
				+85 [°] C	_	0.32	_	
Vn	Equivalent input noise voltage	F = 1kHz, R _S = Figure 93	= 20Ω See	+25 [°] C	_	32	_	nV/√Hz
		V∘ = V∘ _H , C _L =	20pF, R _L =	+25 °C	_	55	_	
В∘м	Maximum output swing	100kΩ	See	-40°C	_	75	_	kHz
	bandwidth	Figure 92		+85 °C	_	45	_	
				+25 °C	_	525	_	
B ₁	Unity gain bandwidth	$V_I = 10 \text{mV}, C_L$	= 20pF See	-40°C	_	770	_	MHz
		Figure 94		+85 °C	_	370	_	
		F = B ₁ , V ₁ = 10	mV, C _L =	+25 °C	_	40°	_	
фm			See Figure		_	43°	_	
		94	9	+85 °C	_	38°	_	
ediu	m bias mode: V _{DD} = 10V			•				I.
	Parameter	Conditions		T _A	TLC271I, TLC271AI, TLC271BI			Unit
					Min	Тур	Max	_
				+25 °C	_	0.62	_	
		$R_L = 100k\Omega$,	$V_{I(PP)} = 1V$	-40°C	_	0.77	_	
		$C_L = 20pF$		+85 [°] C	_	0.47	_	
SR	Slew Rate at Unity Gain	See		+25 [°] C	_	0.56	_	V/µs
٥ı						0.7	_	
υi		Figure 92	$V_{I(PP)} = 5.5V$	-40°C		0.7		
υi		Figure 92	$V_{I(PP)} = 5.5V$	-40°C +85°C	<u> </u>	0.44	_	
Vn	Equivalent Input Noise Voltage	F = 1kHz, R _S =	, ,		+			nV/√Hz
		F = 1kHz, R _S = See Figure 93	= 20Ω	+85 [°] C	+	0.44	+	nV/√Hz
Vn	Maximum Output Swing	F = 1kHz, R _S =	= 20Ω	+85°C +25°C		0.44	_	nV/√Hz kHz
Vn		F = 1kHz, R _S = See Figure 93 $V_{\circ} = V_{\circ H}$, C _L =	= 20Ω 20pF,	+85 °C +25 °C +25 °C		0.44 32 35	_	
Vn	Maximum Output Swing	F = 1kHz, R _S = See Figure 93 V \circ = V \circ H, C _L = R _L = 100k Ω See Figure 92	= 20Ω 20pF,	+85 °C +25 °C +25 °C -40 °C		0.44 32 35 45	_	
Vn	Maximum Output Swing	$F = 1 \text{kHz}, R_S = \\ \text{See Figure 93} \\ V_{\circ} = V_{\circ H}, C_L = \\ R_L = 100 \text{k}\Omega \\ \text{See Figure 92} \\ V_I = 10 \text{mV}, C_L$	= 20Ω 20pF, = 20pF	+85 °C +25 °C +25 °C -40 °C +85 °C		0.44 32 35 45 25		
V _n B∘ _M	Maximum Output Swing Bandwidth	F = 1kHz, R _S = See Figure 93 V \circ = V \circ H, C _L = R _L = 100k Ω See Figure 92	= 20Ω 20pF, = 20pF	+85 °C +25 °C +25 °C -40 °C +85 °C +25 °C		0.44 32 35 45 25 635		kHz
V _n B∘м	Maximum Output Swing Bandwidth	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 See Figure 94	= 20Ω 20pF, = 20pF	+85 °C +25 °C +25 °C -40 °C +85 °C +25 °C -400 °C		0.44 32 35 45 25 635 880		kHz
V _n B∘ _M	Maximum Output Swing Bandwidth	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 See Figure 94	= 20Ω 20pF, = 20pF mV, C _L = 20pF	+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 bias mode											
2011 3.0	<u> </u>				TL	C271C.	TLC2	71AC, 1	ΓLC271	ВС	
Parameter			Conditions	TA	$V_{DD} = 5V$			V _{DD} = 10V			Unit
					Min	Тур	Max	Min	Тур.	Max	
		TI 00710				1.1	10	_	1.1	10	
		TLC271C	V∘ = 1.4V, V _{IC} =	0 to +70°C	_	_	12	_	_	12	
	land to Office to Violence	TI 0074 A 0	0V, R _S =	+25 °C		0.9	5	_	0.9	5	\/
VI°	Input Offset Voltage	TLC271AC	$50Ω$, $R_L =$	0 to +70°C	_		6.5	_		6.5	mV
		TLC271BC	1ΜΩ	+25 [°] C	_	0.24	2	_	0.26	2	
		ILC2/ IBC		0 to +70 °C	_	_	3	_		3	
αVI°	Average Temperature Coefficient of Input Offset Voltage		_	+25 to +70°C		1.1			1		μV/°C
۱ _{I°}	Input Offset Current (Note 22)		$V_{\circ} = V_{DD}/2, V_{IC}$	+25 °C	_	0.1	60	—	0.1	60	рА
ılı,			= V _{DD} /2	+70°C	_	7	300	_	8	300	
I _{IB}	Input Bias Current (Note 22)		$V_{\circ} = V_{DD}/2, V_{IC}$	+25 °C	_	0.6	60	_	0.7	60	рА
ПВ			= V _{DD} /2	+70°C	_	40	600	_	50	600	
.,	Common Mode Input Voltage (Note 23)			+25 [°] C	-0.2 to	-0.3 to 4.2	_	-0.2 to	-0.3 to 9.2	_	V
V _{ICR}			_	0 to +70°C	-0.2 to			-0.2 to 8.5	_	_	V
	High Level Output Voltage		$V_{ID} = 100 \text{mV}, R_L$ = $1 \text{M}\Omega$	+25 °C	3.2	4.1	_	8	8.9	_	V
V∘H				o°C	3	4.1	_	7.8	8.9		
				+70°C	3	4.2		7.8	8.9		
	Low Level Output Voltage		V _{ID} = -100mV, I _° L = 0	+25 [°] C	_	0	50	_	0	50	mV
V∘L				o°C	_	0	50	_	0	50	
				+70°C		0	50	_	0	50	
	Large Signal Differential Voltage Gain		$R_L = 1M\Omega$ (Note	+25 [°] C	50	520	_	50	870	_	V/mV
A_{VD}			24)	o°C	50	700	_	50	1030	_	
				+70 C	50	380		50	660	_	
				+25 °C	65	94		65	97	_	_
CMRR	Common Mode Rejecti	on Ratio	$V_{IC} = V_{ICRmin}$	o°C	60	95		60	97		dB
				+70 [°] C	60	95		60	97		
	Supply Voltage Rejecti	on Ratio	$V_{DD} = 5V \text{ to } 10V,$	+25 C	70	97		70	97		_
ksvr	Supply voltage Rejection Ratio $(\Delta V_{DD}/\Delta V_{I^{\circ}})$		$V_0 = 3V \text{ to } 10V,$ $V_0 = 1.4V$		60	97	_	60	97		dB
				+70°C	60	98		60	98		_
I _{I(SEL)}	Input Current (BIAS SE	LECT)	$V_{I(SEL)} = 0$	+25 °C	_	65			95		nA
			$V_{\circ} = V_{DD}/2, V_{IC}$	+25 °C	_	10	17		14	23	┨ .
I _{DD}	Supply Current		= V _{DD} /2, No	0°C	_	12	21		18	33	μA
			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.



					T	LC271I	, TLC2	71AI, T	LC2711	ВІ	
Parameter			Conditions	TA	\	/ _{DD} = 5\	/	V _{DD} = 10V			Unit
					Min	Тур	Max	Min	Тур.	Max	
		TI 00T4		+25 [°] C	_	1.1	10	_	1.1	10	
		TLC271I	V∘ = 1.4V, V _{IC} =	-40 to +85°C	_	_	13	_	_	13	
\ /	land Office Voltage	TI 0074 A I	0V, R _S =	+25 [°] C		0.9	5	_	0.9	5	\/
۷ _{I°}	Input Offset Voltage	TLC271AI	$50Ω$, $R_L =$	-40 to +85°C	_	_	7	_	_	7	mV
		TLC271BI	1ΜΩ	+25 [°] C	_	0.24	2	_	0.26	2	
		ILC2/ IBI		-40 to +85°C	_	_	3.5	_	_	3.5	
α_{VI°	Average Temperature Coefficient of Input Offset Voltage			+25 to +85 °C		1.1			1		μV/°C
l	Input Offset Current (Note 25)		$V_{\circ} = V_{DD}/2, \ V_{IC}$	+25 [°] C	_	0.1	60	_	0.1	60	pА
Ι _Ι ∘			= V _{DD} /2	+85 [°] C	_	24	1000	_	26	1000	
lıs	Input Bias Current (Note 25)		$V_{\circ} = V_{DD}/2, V_{IC}$ = $V_{DD}/2$	+25 [°] C		0.6	60	_	0.7	60	pА
I _{IB}				+85 [°] C		200	2000	_	220	2000	
	Common Mode Input Voltage (Note 26)			+25 [°] C	-0.2 to	-0.3 to	_	-0.2 to	-0.3 to 9.2	_	V
V_{ICR}			_	-40 to +85 °C	-0.2 to		_	-0.2 to 8.5	_	_	V
	High Level Output Voltage		$V_{ID} = 100 \text{mV}, R_L$ = $1 \text{M}\Omega$	+25 [°] C	3	4.1	_	8	8.9	_	V
V∘H				-40 [°] C	3	4.1	_	7.8	8.9	_	
				+85 [°] C	3	4.2	_	7.8	8.9	_	
	Low Level Output Voltage		V _{ID} = -100mV, I _° L = 0	+25°C	_	0	50	_	0	50	mV
V∘L				-40°C		0	50	_	0	50	
				+85 [°] C	_	0	50	_	0	50	
	Large Signal Differential Voltage Gain		$R_L = 1M\Omega$ (Note 27)	+25 [°] C	50	520	_	50	870	_	V/mV
A_{VD}				-40°C	50	900	_	50	1550	_	
				+85 [°] C	50	330	_	50	585	_	
				+25 [°] C	65	94	_	65	97	_	
CMRR	Common Mode Rejecti	ion Ratio	$V_{IC} = V_{ICRmin}$	-40°C	60	95	_	60	97	_	dB
				+85 [°] C	60	95		60	98	_	
	Supply Voltage Rejecti	on Patio	\/ E\/ to 40\/	+25 [°] C	70	97	_	70	97	_	
k_{SVR}	Supply Voltage Rejection Ratio $(\Delta V_{DD}/\Delta V_{I^o})$		$V_{DD} = 5V \text{ to } 10V,$ $V_{\odot} = 1.4V$	-40 C	60	97	_	60	97	_	dB
				+85 [°] C	60	98	_	60	98	_	
I _{I(SEL)}	Input Current (BIAS SE	LECT)	$V_{I(SEL)} = 0$	+25 [°] C		65			95		nA
			$V_{\circ} = V_{DD}/2, V_{IC}$	+25 [°] C		10	17	_	14	23	
I_{DD}	Supply Current		= V _{DD} /2, No	-40 °C		16	27		25	43	μA
			load	+85 [°] 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 _{DD} = 5V				TLC2	Unit		
	Parameter	Con	ditions	T _A		TLC271B	С	O.IIIC
					Min	Тур	Max	_
		$R_L = 1M\Omega,$ $V_{I(PP)} = 1V$ $C_L = 20pF$ See	+25 °C	_	0.03	_		
			$V_{I(PP)} = 1V$	o°C	_	0.04		
SR	Claus Data at Unity Cain			+70°C	_	0.03		1////
SK	Slew Rate at Unity Gain			+25 [°] C	_	0.03		V/µs
		Figure 92	$V_{I(PP)} = 2.5V$	o°C	_	0.03		
				+70°C	_	0.02		
Vn	Equivalent Input Noise Voltage	$F = 1kHz$, $R_S = 20\Omega$ See Figure 93		+25 [°] C	_	68	_	nV/√Hz
				+25 °C	_	5	_	
B∘ _M	Maximum Output Swing	$V_{\circ} = V_{\circ H}, C_{L} = 20pF, R_{L} = 1M\Omega$		o°C	<u> </u>	6	_	kHz
	Bandwidth	See Figure 92	2	+70°C	_	4.5	_	1
	Unity Gain Bandwidth	$V_1 = 10$ mV, $C_L = 20$ pF See Figure 94		+25 [°] C	_	85	_	MHz
B ₁				o°C	_	100	_	
				+70°C	_	65	_	
Фm	Phase Margin	$F = B_1$, $V_I = 10$ mV, $C_L = 20$ pF See Figure 94		+25 [°] C	_	34°	_	_
				o°C	_	36°	_	
• • • •				+70°C	_	30°	_	
_ow bi	ias mode: V _{DD} = 10V	<u> </u>				I.		· L
				_	TLC271C, TLC271AC,			Unit
	Parameter	Con	ditions	T _A	TLC271BC			
				• _	Min	Тур	Max	
		$R_L = 1M\Omega$, $C_L = 20pF$ See Figure 92		+25 [°] C	_	0.05		
			V _{I(PP)} = 1V	0°C		0.05	_	
SR	Slew Rate at Unity Gain			+70 C	_	0.04		V/µs
	,			+25 C		0.04	_	_
			$V_{I(PP)} = 5.5V$	0°C	_	0.05		
				+70 °C		0.04	_	<u> </u>
Vn	Equivalent Input Noise Voltage	F = 1kHz, R _S See Figure 93		+25 [°] C	_	68	_	nV/√Hz
	Maximum Output Swing Bandwidth	$V_{\circ} = V_{\circ H}, C_{L} = 20 \text{pF}, R_{L} = 1 \text{M}\Omega$ See Figure 92		+25 [°] C	_	1	_	kHz
$B_{^{\circ}M}$				0°C	_	1.3		
				+70°C	_	0.9	_	
		\/. = 10m\/_0		+25 [°] C	_	110	_	
B ₁	Unity Gain Bandwidth	V _I = 10mV, C _L = 20pF See Figure 94		o°C	_	125	_	MHz
				+70°C		90	_	
		$F = B_1$, $V_I = 10$ mV, $C_L = 20$ pF See Figure 94		+25 [°] C	_	38°	_	
ϕ_{m}	Phase Margin			•				
φ_{m}	Phase Margin			o°C	_	40°	_	



l avv bi	iss made: V = EV							
LOW DI	as mode: V _{DD} = 5V Parameter	Conditions		TA	TLC271I, TLC271AI, TLC271BI			Unit
					Min	Тур	Max	_
	Slew Rate at Unity Gain	$R_L = 1M\Omega$, $V_{I(PP)} = 1V$ $-40^{\circ}C$ $+85^{\circ}C$	+25 °C	_	0.03	_		
			$V_{I(PP)} = 1V$		_	0.04	_	V/µs
			V _{I(PP)} = 2.5V	+85 °C	_	0.03	_	
SR				+25 [°] C	_	0.03	_	
		Figure 92		-40°C	_	0.04	_	
			, ,	+85 [°] C	_	0.02	_	
Vn	Equivalent Input Noise Voltage	E - 1kHz Ro = 200		+25 [°] C	_	68	_	nV/√Hz
				+25 [°] C	_	5	_	
В∘м	Maximum Output Swing		20pF, R_L = 1MΩ	-40°C	_	7	_	kHz
	Bandwidth	See Figure 92		+85 [°] C	_	4	_	
	Unity Gain Bandwidth	$V_I = 10$ mV, $C_L = 20$ pF See Figure 94		+25 °C	_	85	_	MHz
B ₁				-40°C	_	130	_	
				+85 °C	_	55	_	
	Phase Margin	$F = B_1$, $V_I = 10$ mV, $C_L = 20$ pF See Figure 94		+25 [°] C	_	34°	_	_
фm				-40 °C	_	38°	_	
•				+85 °C	_	28°	_	
Low bi	as mode: V _{DD} = 10V	Į.		l .			. N	l .
	Parameter	Conditions		TA	TLC271I, TLC271AI, TLC271BI			Unit
					Min	Тур	Max	_
		$R_L = 1M\Omega$, $C_L = 20pF$		+25 °C	_	0.05	_	
			$V_{I(PP)} = 1V$	-40°C	_	0.06	_	-
				+85 °C	_	0.03	_	
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 _S : See Figure 93		+25 [°] C	_	68	_	nV/√Hz
		., ., .		+25 °C	_	1	_	
В∘м	Maximum Output Swing	$V_{\circ} = V_{\circ H}, C_L = 20pF, R_L = 1M\Omega$ See Figure 92		-40 °C	_	1.4	_	kHz
	Bandwidth			+85 [°] C	_	0.8	_	
		V 46 V 5	00.5	+25 °C	_	110	_	
B ₁	Unity Gain Bandwidth	V _I = 10mV, C _L = 20pF See Figure 94		-400°C	_	155	_	MHz
				+85 [°] C	_	80	_	
		$F = B_1$, $V_I = 10$ mV, $C_L = 20$ pF See Figure 94		+25 [°] C	_	38°	_	
4	Phase Margin			-40 °C	_	42°	_] —
φm	i naoo margiii			 0 0				



Typical Performance Characteristics Table Index of Graphs

			Figure			
			High Bias Mode	Medium Bias Mode	Low Bias Mode	
VI°	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	
.,	Lavel and Ordand Valence	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_{VD}		vs. Free Air Temperature	14	44	74	
I _{IB}	Input Bias Current	vs. Free Air Temperature	15	45	75	
I _{I°}	Input Offset Current	vs. Free Air Temperature	15	45	75	
V _{IC}	Common Mode Input Voltage	vs. Supply Voltage	16	46	76	
	Supply Current	vs. Supply Voltage	17	47	77	
I _{DD}		vs. Free Air Temperature	18	48	78	
CD	Slew Rate	vs. Supply Voltage	19	49	79	
SR		vs. Free Air Temperature	20	50	80	
I _{sel}	Bias Select Current	vs. Supply Voltage	21	51	81	
V°(°PP)	Maximum Peak to Peak Output Voltage	vs. Frequency	22	52	82	
_	Haite Caia Dan desidah	vs. Free Air Temperature	23	53	83	
B ₁	Unity Gain Bandwidth	vs. Supply Voltage	24	54	84	
A _{VD}	Large Signal Differential Voltage Gain	vs. Frequency	29,30	59,60	89,90	
		vs. Supply Voltage	25	55	85	
φ_{m}	Phase Margin	vs. Free Air Temperature	26	56	86	
		vs. Capacitive Load	27	57	87	
V _n	Equivalent Input Noise Voltage	vs. Frequency	28	58	88	
Фshift	Phase Shift	vs. Frequency	29,30	59,60	89,90	
	I .	į			1	



Distribution of TLC271 Input Offset Voltage

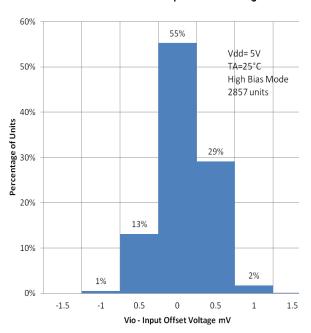


Figure 1

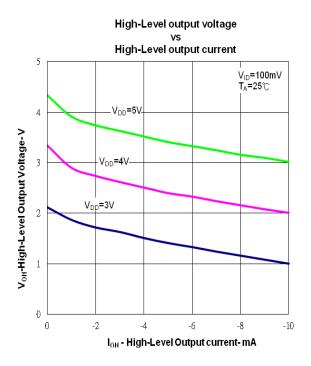


Figure 3

Distribution of TLC271 Input Offset Voltage

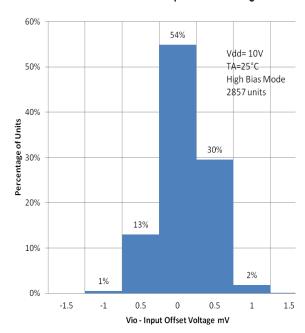


Figure 2

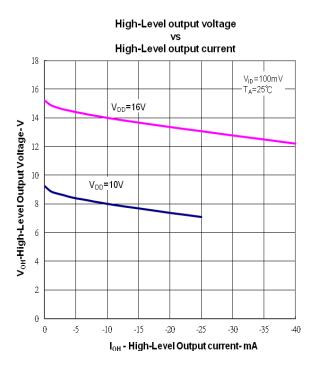


Figure 4



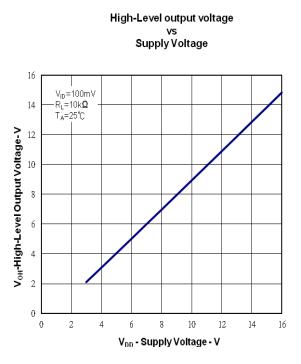


Figure 5

Low-level output voltage

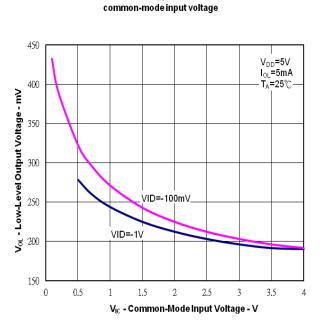


Figure 7

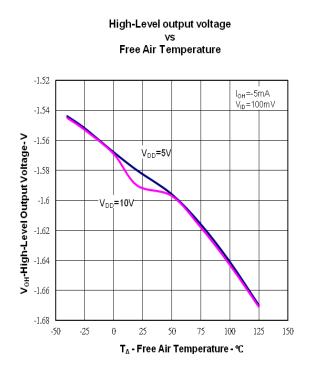
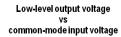


Figure 6



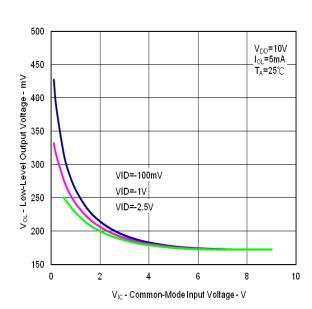


Figure 8



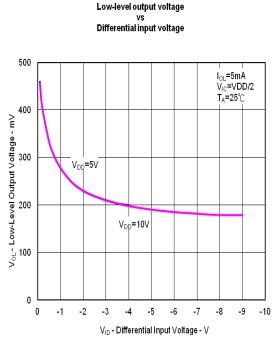


Figure 9

Low-level output voltage

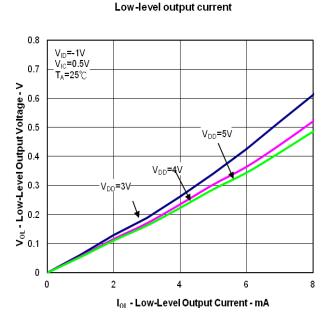


Figure 11

Low-level output voltage vs Free-Air temperature

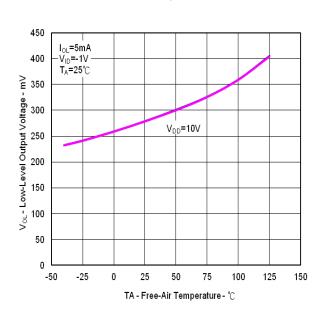


Figure 10

Low-level output voltage vs Low-level output current

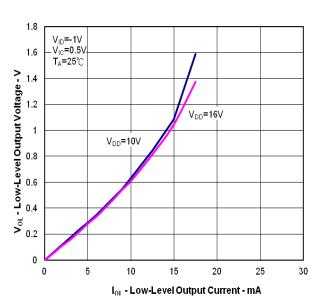


Figure 12



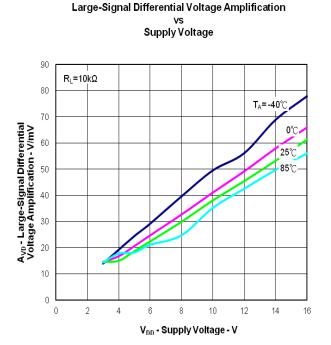


Figure 13

Input Bias Current and Input Offset Current

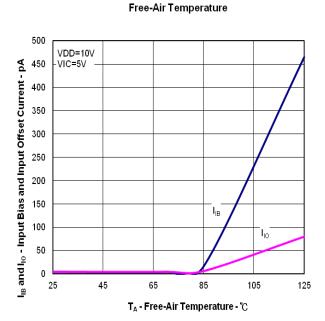


Figure 15

Large-Signal Differential Voltage Amplification
vs
Free-Air Temperature

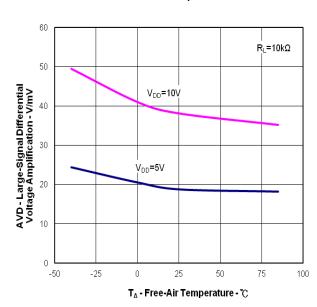


Figure 14

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

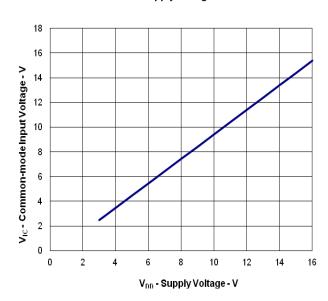


Figure 16



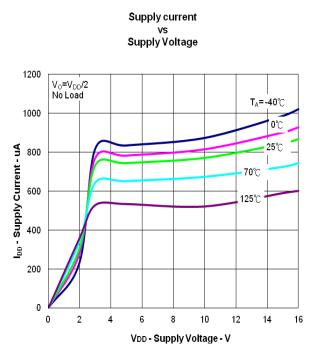


Figure 17

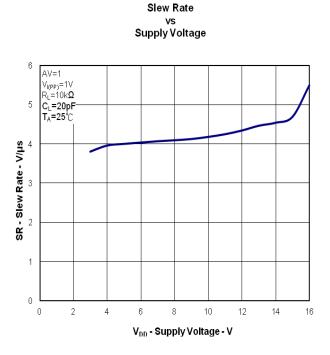


Figure 19

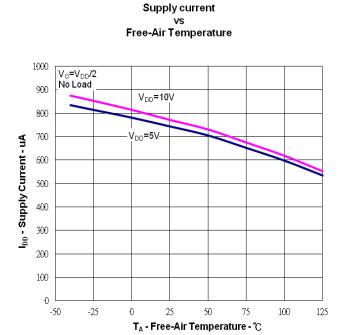


Figure 18

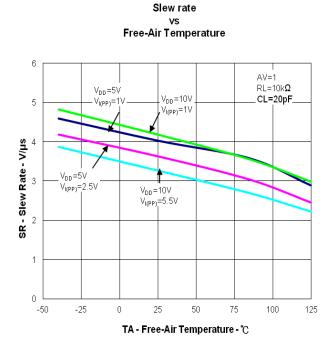


Figure 20



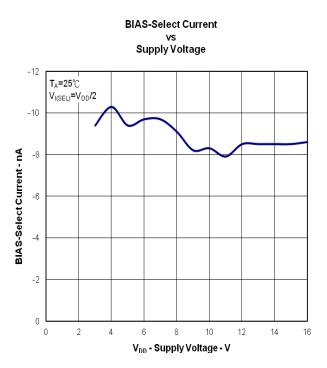


Figure 21

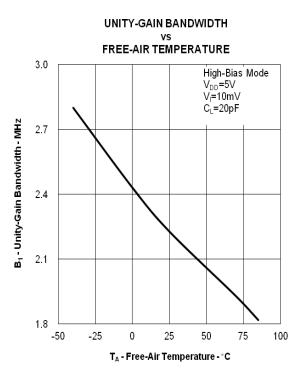


Figure 23

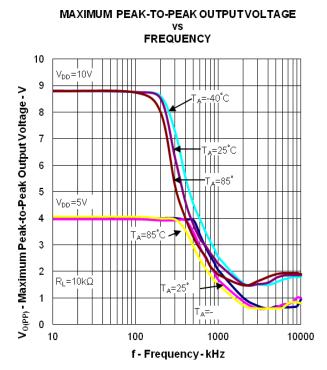


Figure 22

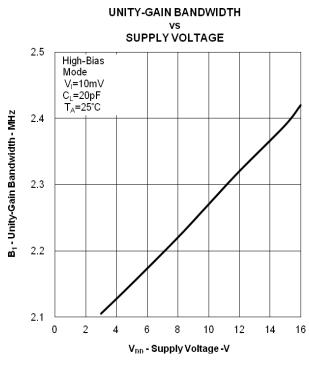


Figure 24



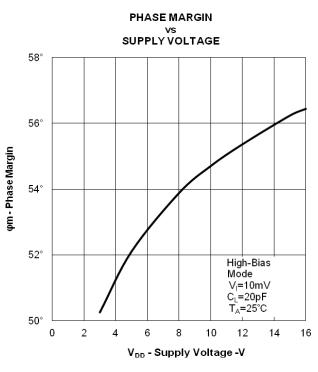


Figure 25

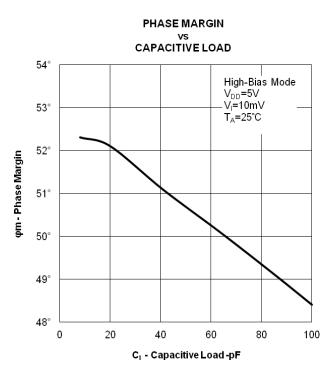


Figure 27

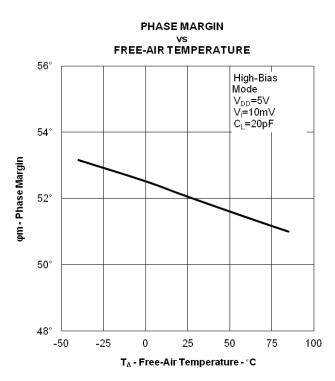


Figure 26

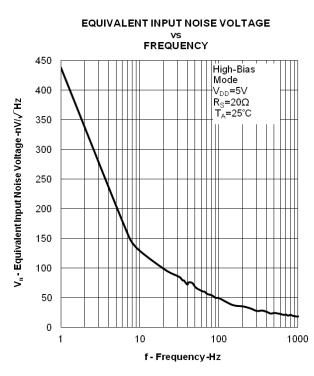
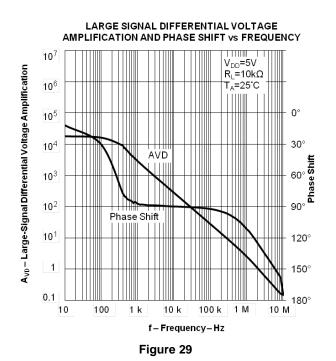
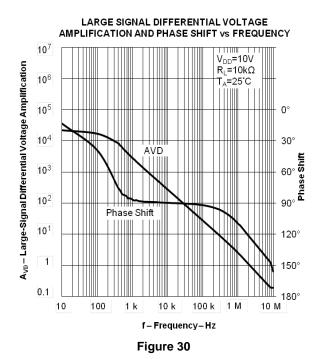


Figure 28







Typical Performance Characteristics Medium Bias Mode

Distribution of TLC271 Input Offset Voltage

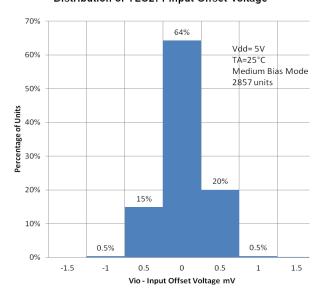


Figure 31

Distribution of TLC271 Input Offset Voltage

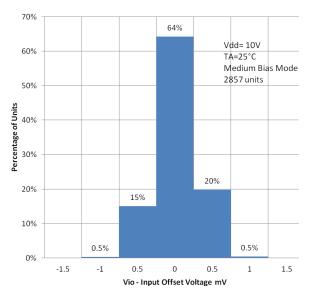


Figure 32



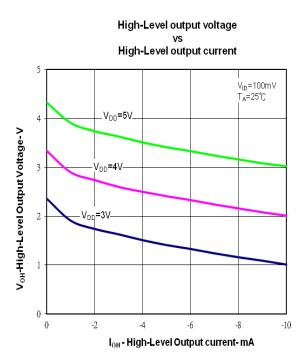


Figure 33

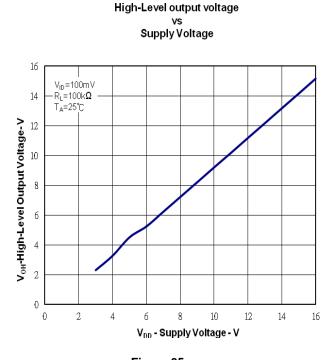


Figure 35

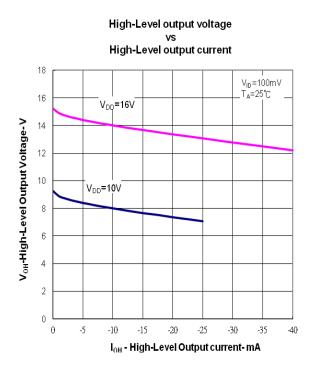


Figure 34

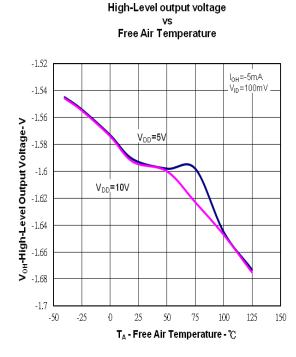


Figure 36



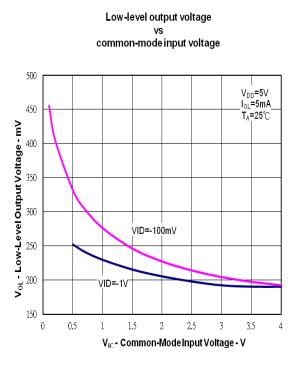
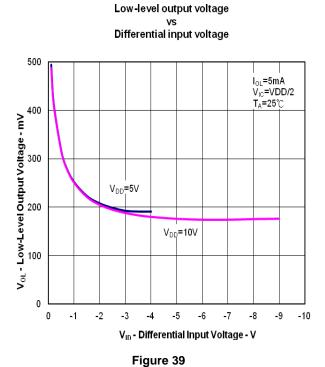
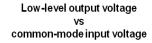


Figure 37





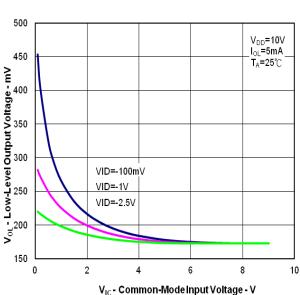


Figure 38

Low-level output voltage vs Free-Air temperature

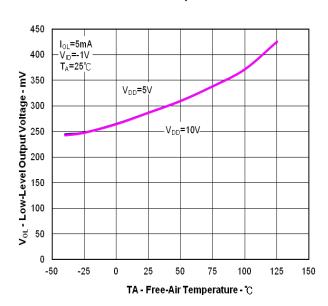


Figure 40



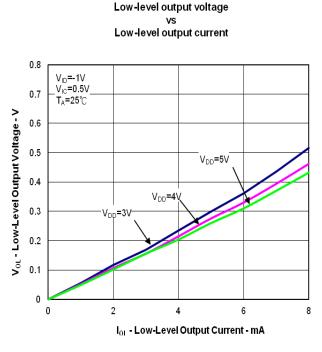


Figure 41

Large-Signal Differential Voltage Amplification

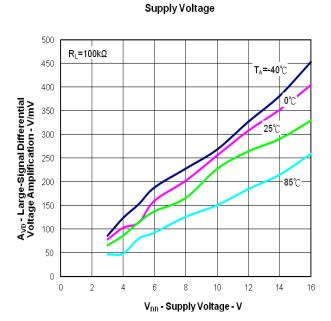
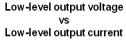


Figure 43



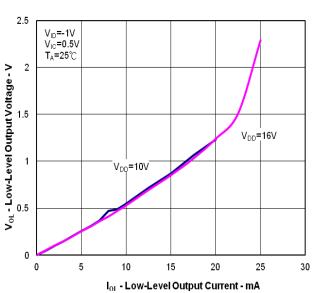


Figure 42

Large-Signal Differential Voltage Amplification vs Free-Air Temperature

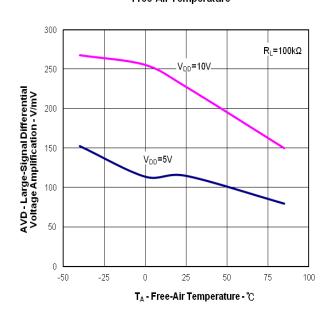


Figure 44



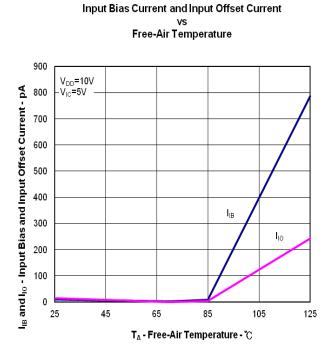


Figure 45

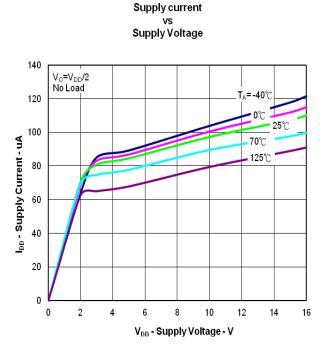
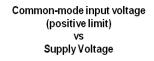


Figure 47



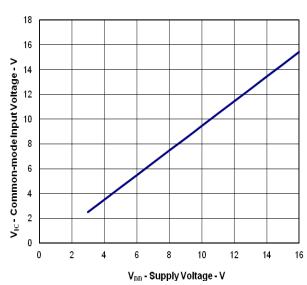


Figure 46

Supply current vs Free-Air Temperature

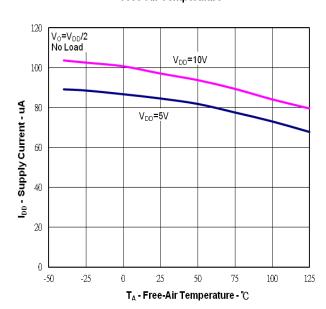
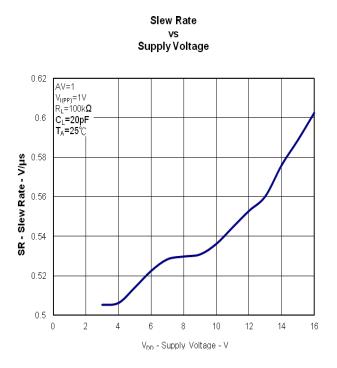


Figure 48



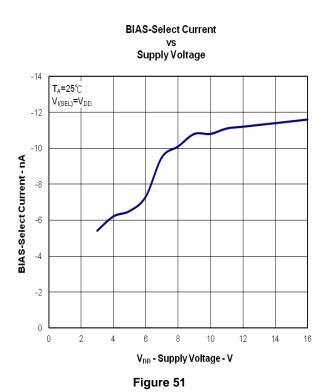


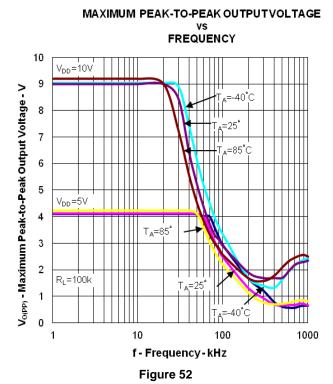
Free-Air Temperature 8.0 AV=1 _RL=100k**Ω** $V_{DD}=5V$ 0.7 $V_{DD}=10V$ CL=20pF $V_{I(PP)}=1V$ V_{I(PP)}=1V 0.6 SR - Slew Rate - V/µs 0.5 0.4 V_{DD}=5V V_{DD}=10V 0.3 V_{I(PP)}=5.5V V_{I(PP)}=2,5V 0.2 0.1 0 -50 -25 100 125 TA - Free-Air Temperature - °C

Slew rate

Figure 49









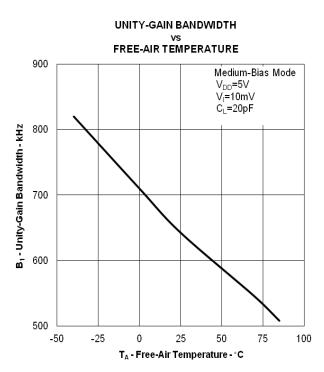


Figure 53

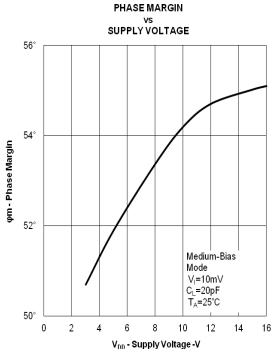


Figure 55

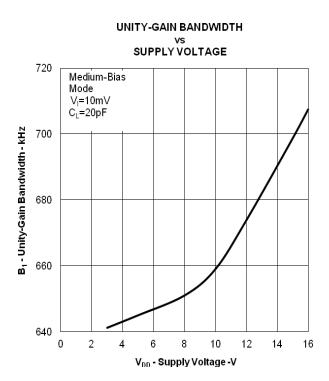


Figure 54

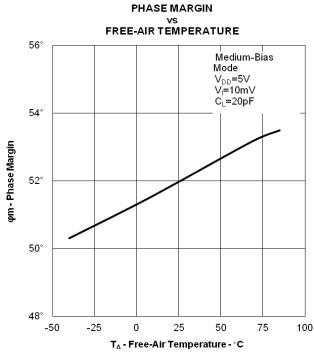


Figure 56



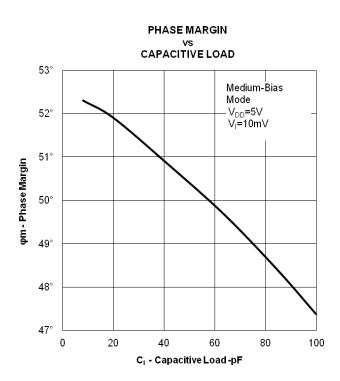
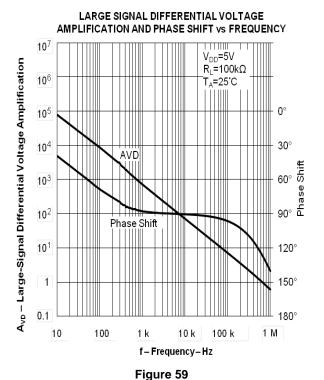


Figure 57



EQUIVALENT INPUT NOISE VOLTAGE
vs
FREQUENCY

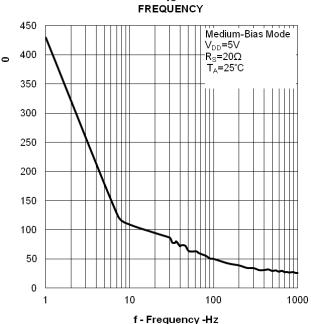


Figure 58

LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT VS FREQUENCY

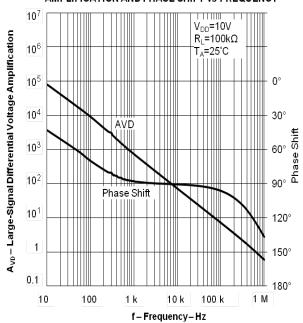


Figure 60



Distribution of TLC271 Input Offset Voltage

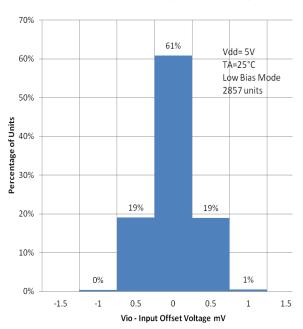


Figure 61

High-Level output voltage vs High-Level output current

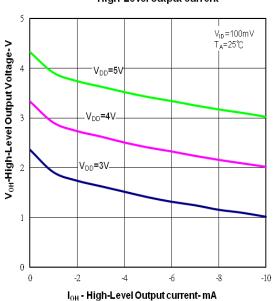


Figure 63

Distribution of TLC271 Input Offset Voltage

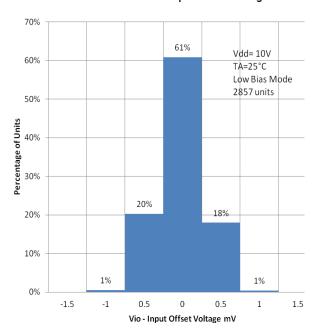


Figure 62

High-Level output voltage vs High-Level output current

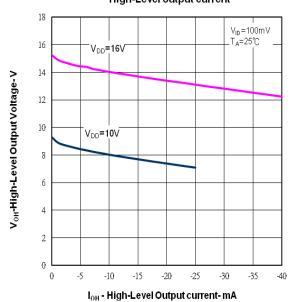


Figure 64



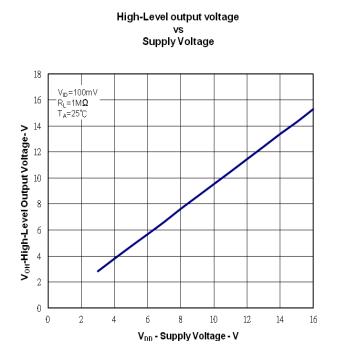


Figure 65

Low-level output voltage

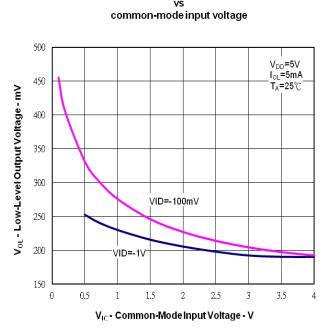


Figure 67

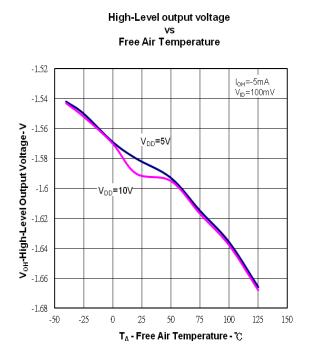


Figure 66

Low-level output voltage

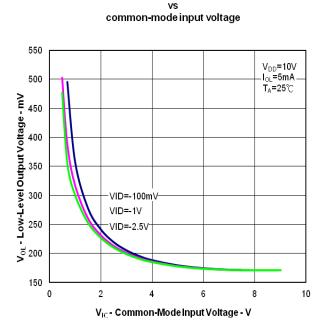
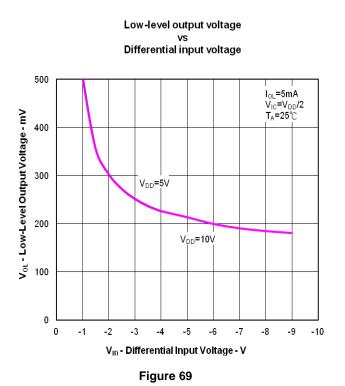


Figure 68





Low-level output voltage
vs
Differential input voltage $I_{OL}=5mA$ $V_{IC}=VDD/2$ $T_A=25^{\circ}C$

V_{DD}=10V

500

400

300

200

100

0

0

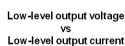
-1

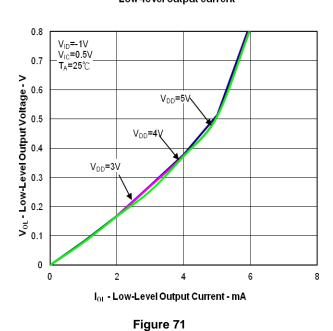
Vol - Low-Level Output Voltage - mV

Figure 70

 V_{ID} - Differential Input Voltage - V

-4





Low-level output voltage vs Low-level output current

-5

-7

-8 -9 -10

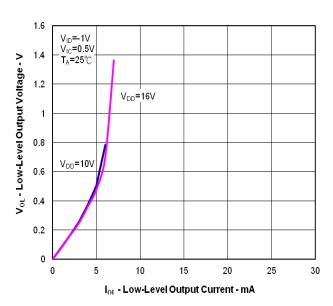


Figure 72



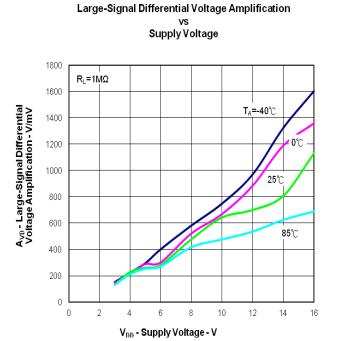


Figure 73

Input Bias Current and Input Offset Current

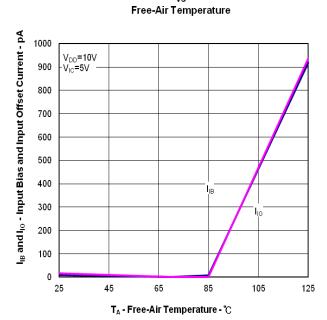


Figure 75



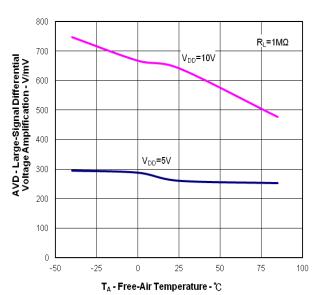


Figure 74

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

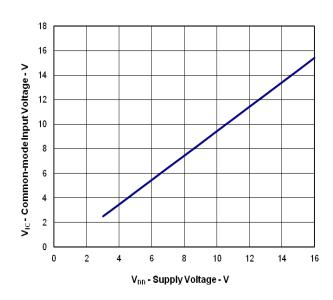
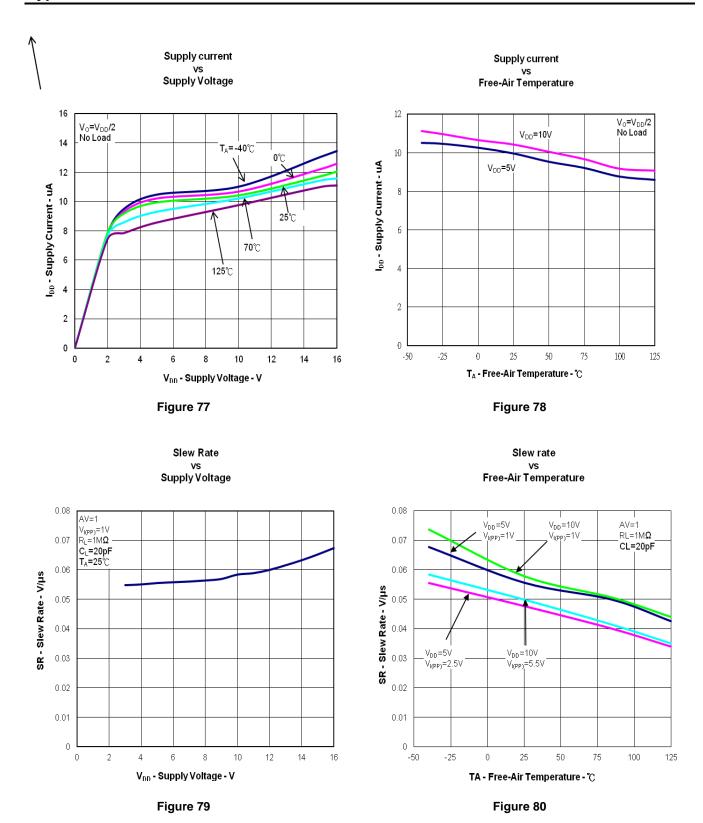


Figure 76







Typical Performance Characteristics Low Bias Mode

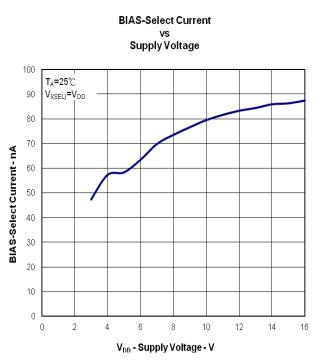
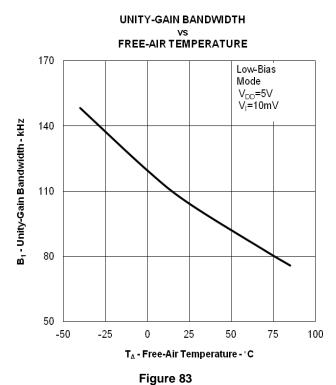


Figure 81



MAXIMUM PEAK-TO-PEAK OUTPUTVOLTAGE

VS

FREQUENCY

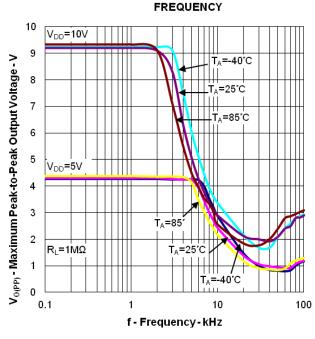


Figure 82

UNITY-GAIN BANDWIDTH VS SUPPLY VOLTAGE

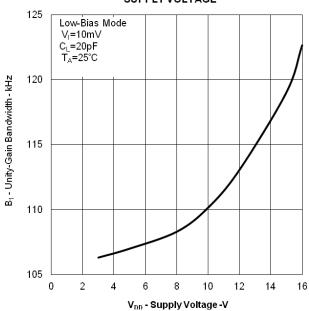


Figure 84



Typical Performance Characteristics Low Bias Mode

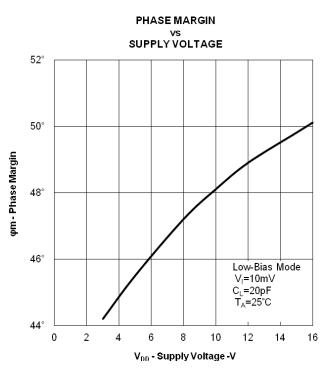
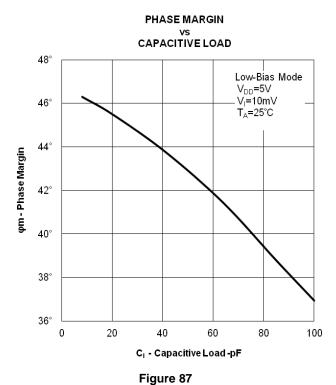


Figure 85



PHASE MARGIN vs FREE-AIR TEMPERATURE

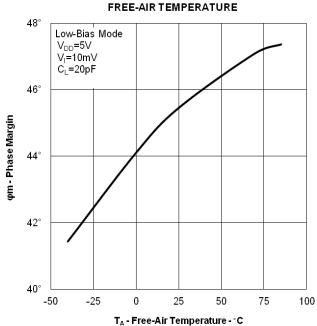


Figure 86

EQUIVALENT INPUT NOISE VOLTAGE

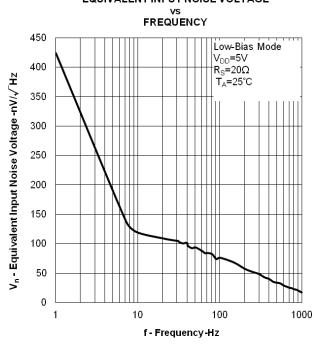
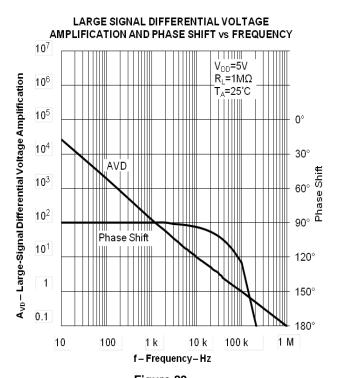


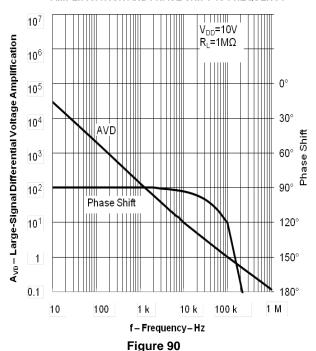
Figure 88



Typical Performance Characteristics Low Bias Mode



LARGE SIGNAL DIFFERENTIAL VOLTAGE
AMPLIFICATION AND PHASE SHIFT VS FREQUENCY





Application Information

Bias select feature

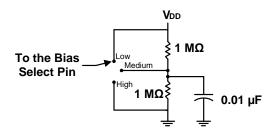
The TLC271 offers a bias-select feature that allows the user to select any one of three bias levels depending on the level of performance desired. The trade-off between bias levels relates to ac performance and power dissipation as below.

Typical values T _A = +25°C, V _{DD} = 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 ₁	Unity Gain Bandwidth	1.7	0.5	0.09	MHz
φ _m	Phase Margin	46°	40°	34°	_
A _{VD}	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 _{DD} -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.

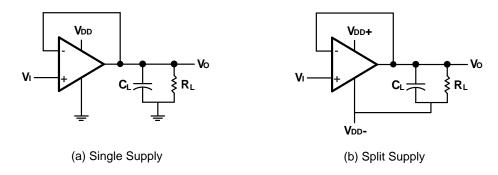


Figure 92 Measurement circuit with either single or split supply

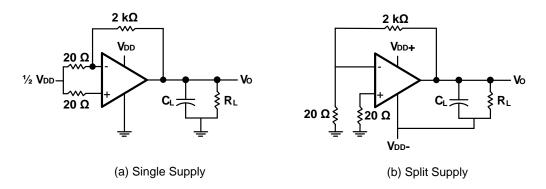


Fig 93 Noise measurement with single or split supply

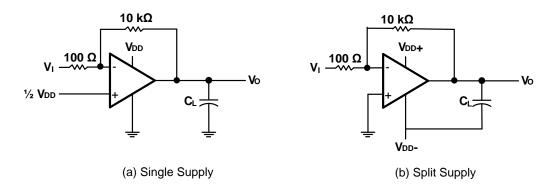


Figure 94 Gain of 100 with single or split supply



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.

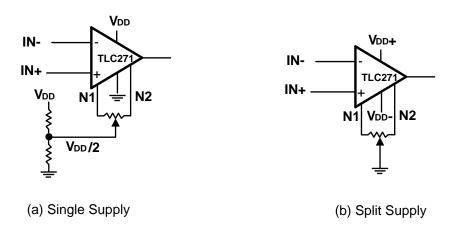


Figure 95 Offset Nulling Circuits

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.

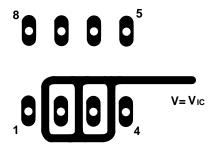


Figure 96 Bias Current Guarding for High Input Impedance Applications



Typical Application Circuits

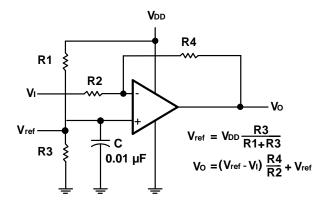


Figure 97 Inverting Amplifier With Voltage Reference

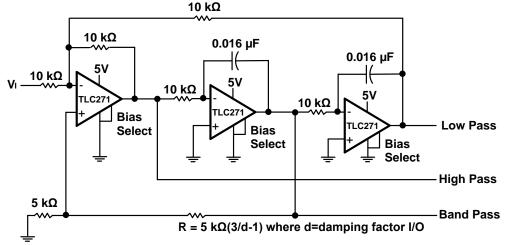


Figure 98 State Variable Filter

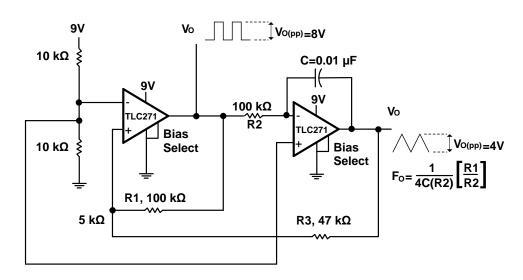


Figure 99 Single Supply Function Generator



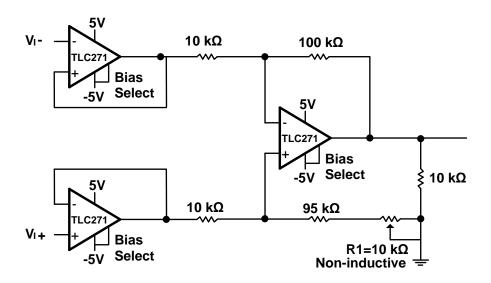


Figure 100 Low Power Instrumentation Amplifier

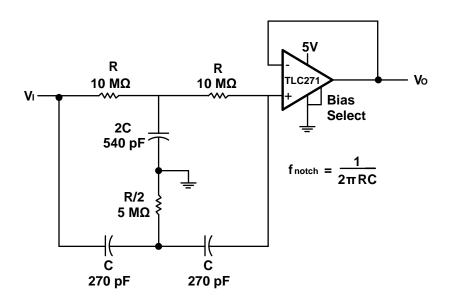


Figure 101 Single Supply Twin-T Notch Filter



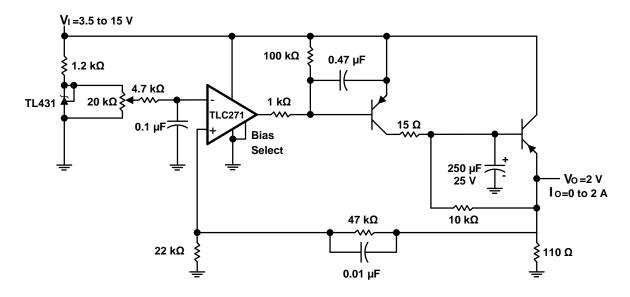


Figure 102 Power Supply

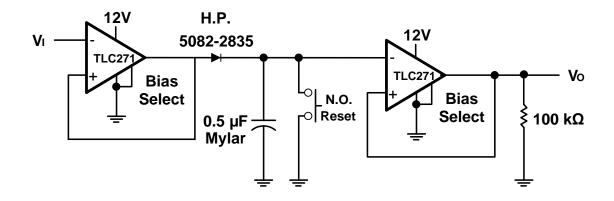


Figure 103 Positive Peak Detector



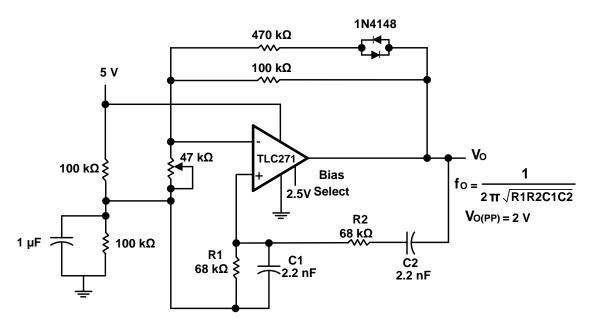


Figure 104 Wein Oscillator

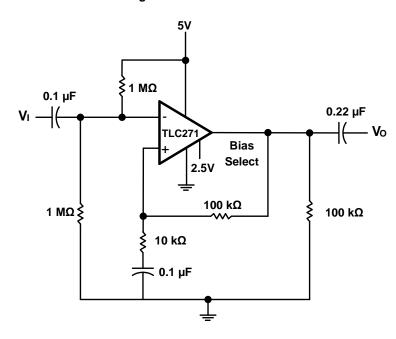


Figure 105 Single-Supply AC Amplifier



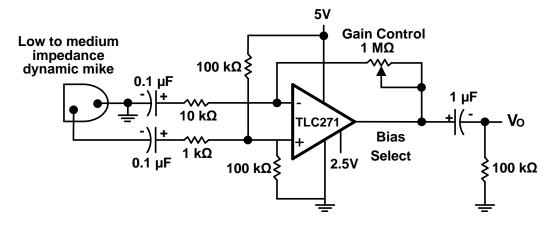


Figure 106 Microphone Preamplifier

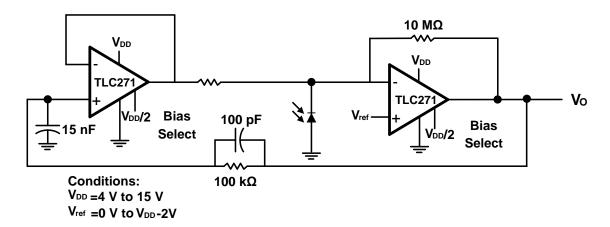


Figure 107 Photo-Diode Amplifier With Ambient Light Rejection

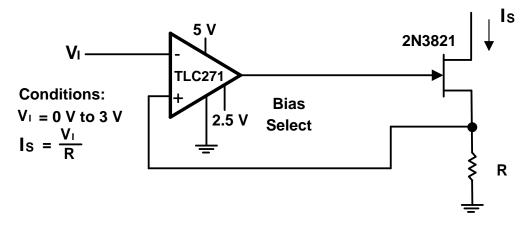
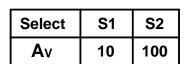


Figure 108 Precision Low-Current Sink





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

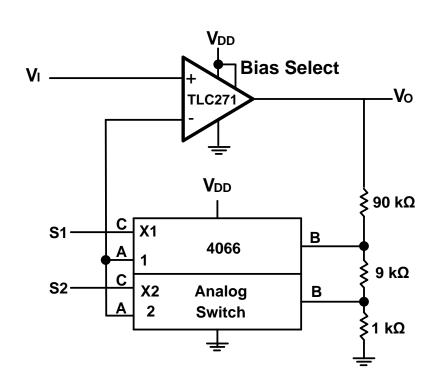


Figure 109 Amplifier With Digital Gain Selection

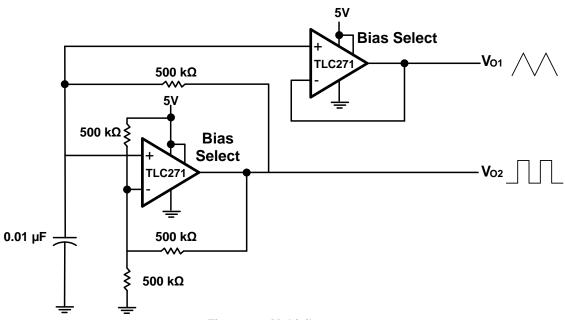


Figure 110 Multivibrator



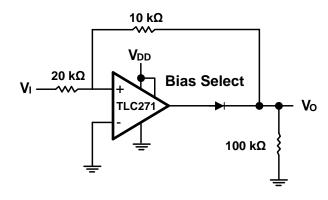
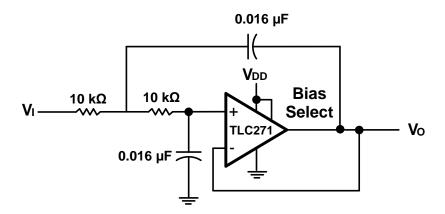


Figure 111 Full Wave Rectifier



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

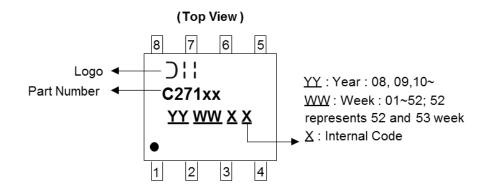
Figure 112 Two-Pole Low-Pass Butterworth Filter



Marking Information

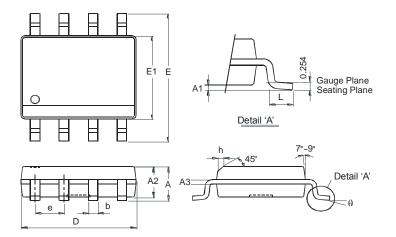
SO-8

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	ı	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	ı	0.35				
٦	0.62	0.82				
θ	0°	8°				
All Dimensions in mm						



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