



# 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

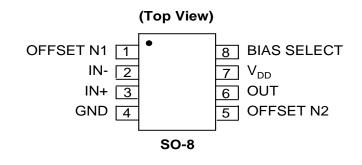
- Wide range of supply voltages over specified temperature range:
  - 0°C to 70°C . . . 3 V to 16 V -40°C to 85°C . . . 4 V to 16 V
- Single-Supply Operation
- Common-Mode Input Voltage Range
- Extends Below the Negative Rail
- Low Noise:

20 nV/ $\sqrt{\text{Hz}}$  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

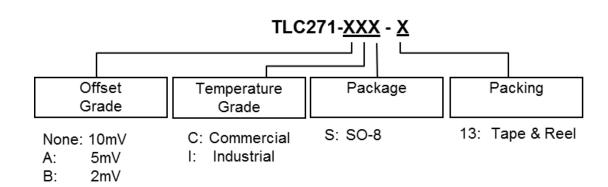
#### Notes:

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**



	Package	Offset	Operating	Packaging	13" Tape a	nd Reel
Device	Code	Voltage	Temperature Range	(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:

 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 <sub>DD</sub>	7	Supply
BIAS SELECT	8	Bias Mode Select



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

Symbol	P	arameter	Rating	Unit
V <sub>DD</sub>	Supply Voltage (Note 6)		18	V
V <sub>ID</sub>	Differential Input Voltage (Note 7)		$\pm V_{DD}$	V
V <sub>IN</sub>	Input Voltage Range (either input)	Input Voltage Range (either input)		V
I <sub>IN</sub>	Input Current		±5	mA
٥	Output Current		±30	mA
	Output Short-Circuit to GND (Note	8)	Continuous	
PD	Power Dissipation (Note 9)		1065	mW
<b>–</b>		C Grade	0 to +70	
T <sub>A</sub>	Operating Temperature Range	I Grade	-40 to +85	-U
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 (1.5k $\Omega$ 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**

Symbol	Doromoto	Parameter				l grade		
Symbol	Faramete	1	Min	Max	Min	Max		
V <sub>DD</sub>	Supply Voltage		3	16	4	16	V	
VIC	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 <sub>A</sub>	Operating Free Air Temperature		0	+70	-40	+85	°C	



I			
			Mode
	Linh	Rine	Mode

	as Mode				TL	C271C,	TLC27	71AC, 1	LC271	вс		
	Parameter		Conditions	TA	-	$I_{DD} = 5$		1	<sub>DD</sub> = 10		Unit	
					Min	Тур	Max	Min	Тур.	Max		
		TI 00740		+25°C		1.1	10		1.1	10		
		TLC271C	V∘ = 1.4V, V <sub>IC</sub> =	0 to +70°C	_		12			12		
VI°	Input Offset Voltage	TLC271AC	0V, R <sub>S</sub> =	+25 <sup>°</sup> C	—	0.9	5		0.9	5	mV	
۷I°	input Onset voltage	TLOZITAC	$50\Omega$ , $R_L =$	0 to 70 <sup>°</sup> C	—	—	6.5	—	—	6.5	mv	
		TLC271BC	10kΩ	25 <sup>°</sup> C	—	0.34	2	—	0.39	2		
		16027180		0 to +70 <sup>°</sup> C	—		3	—		3		
α <sub>VI°</sub>	Average Temperature Input Offset Voltage	Coefficient of	_	+25°C to 70 <sup>°</sup> C		1.8			2		µV/°C	
	Innut Offert Current (N	lata 10)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C	—	0.1	60		0.1	60	~^	
۱۰	Input Offset Current (N	Note 10)	$= V_{DD}/2$	+70 <sup>°</sup> C		7	300		7	300	рА	
l	Input Rice Current (No	to 10)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C	—	0.6	60	—	0.7	60	54	
I <sub>IB</sub>	Input Bias Current (No	ne TO)	$= V_{DD}/2$	+70 <sup>°</sup> C	—	40	600	—	50	600	рА	
	Common Mode Input V	/oltage (Note		+25 <sup>°</sup> C	-0.2 to 4	-0.3 to 4.2		-0.2 to 9	-0.3 to 9.2	_	V	
V <sub>ICR</sub>	11)		_	0 to +70 <sup>°</sup> 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 Volt	age	$V_{ID} = 100 \text{mV}, \text{ R}_{\text{L}}$ = 10k $\Omega$	0 <sup>°</sup> C	3	3.8		7.8	8.5		V	
			= 10K12	+70 <sup>°</sup> C	3	3.8		7.8	8.4	_		
			V 400	+25 <sup>°</sup> C		0	50		0	50		
V∘L	Low Level Output Volta	age	V <sub>ID</sub> = -100mV, I∘ <sub>L</sub> = 0	0 <sup>°</sup> C	—	0	50		0	50	mV	
			<sup>15</sup> L = 0	+70 <sup>°</sup> C	_	0	50		0	50		
	Lorgo Signal Differenti		P = 10kO (Nate	+25 <sup>°</sup> C	5	23		10	36			
$A_{VD}$	Large Signal Differentia	al voltage	R <sub>L</sub> = 10kΩ (Note 12)	0 <sup>°</sup> C	4	27		7.5	42	—	V/mV	
			12)	+70 <sup>°</sup> C	4	20		7.5	32	—		
				+25 <sup>°</sup> C	65	80		65	85			
CMRR	Common Mode Rejecti	ion Ratio	$V_{IC} = V_{ICRmin}$	0°C	60	84		60	88		dB	
				+70 <sup>°</sup> C	60	85		60	88			
	Supply Voltage Rejecti	on Patio	$V_{DD} = 5V$ to 10V,	+25°C	65	95		65	95			
<b>k</b> <sub>SVR</sub>	$(\Delta V_{DD}/\Delta V_{I^{\circ}})$	Un Ralio	$V_{\rm DD} = 3V 10 10V,$ $V_{\rm 0} = 1.4V$	0°C	60	94		60	94		dB	
				+70°C	60	96		60	96			
I <sub>I(SEL)</sub>	Input Current (BIAS SE	ELECT)	$V_{I(SEL)} = 0$	+25°C		-1.4			-1.9		μA	
			$V_{\circ} = V_{DD}/2,  V_{IC}$	+25°C		675	1600		950	2000		
I <sub>DD</sub>	Supply Current		= V <sub>DD</sub> /2, No	0°C	—	775	1800		1125	2200	μA	
			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  $V_{DD} = 5 \text{ V}$ ,  $V_{\circ} = 0.25 \text{ V}$  to 2 V; at  $V_{DD} = 10 \text{ V}$ ,  $V_{\circ} = 1 \text{ V}$  to 6 V.



	mode

ingn bie	as mode				Т	LC271I	. TLC2	71AI, T	LC271	BI		
	Parameter		Conditions	TA		/ <sub>DD</sub> = 5		1	 = 10		Unit	
				- ^	Min			Typ.	Max	•		
				+25 <sup>°</sup> C		1.1	10		1.1	10		
		TLC271I	V° = 1.4V, VIC =	-40 to 85 <sup>°</sup> C			13			13		
	lanut Offerst \ /elters		0V, R <sub>S</sub> =	+25 <sup>°</sup> C	—	0.9	5		0.9	5		
VI°	Input Offset Voltage	TLC271AI	$50\Omega$ , $R_L =$	-40 to 85 <sup>°</sup> C	—		7	—		7	mV	
		TLC271BI	10kΩ	+25 <sup>°</sup> C		0.34	2		0.39	2		
				-40 to 85 <sup>°</sup> C	—	—	3.5	—		3.5		
α <sub>VI°</sub>	Average Temperature	Coefficient of	—	+25 to 85 <sup>°</sup> C		1.8			2		µV/°C	
	Input Offeet Current ()	lata 12)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C		0.1	60		0.1	60	~ ^	
l °	Input Offset Current (N	Note 13)	= V <sub>DD</sub> /2	+85 <sup>°</sup> C	—	24	1000	—	26	1000	рА	
l	Input Bias Current (No	to 12)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C	—	0.6	60	—	0.7	60	рA	
I <sub>IB</sub>	Input Blas Current (NO	ile 13)	= V <sub>DD</sub> /2	+85 <sup>°</sup> C	—	200	2000	—	220	2000	рА	
	Common Mode Input V	t Voltage (Note		+25 <sup>°</sup> C	-0.2 to 4	-0.3 to 4.2	—	-0.2 to 9	-0.3 to 9.2	_	V	
V <sub>ICR</sub>	14)	0	_	-40 to +85 <sup>°</sup> 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 <sub>ID</sub> = 100mV, R <sub>L</sub> = 10kΩ	-40 <sup>°</sup> C	3	3.8		7.8	8.5		V	
			= 10K12	+85 <sup>°</sup> C	3	3.8	_	7.8	8.5	—		
			\/- 100m\/	+25 <sup>°</sup> C		0	50		0	50		
V∘L	Low Level Output Volta	ige	V <sub>ID</sub> = -100mV, I∘ <sub>L</sub> = 0	-40 <sup>°</sup> C	—	0	50	—	0	50	mV	
			112 - 0	+85 <sup>°</sup> C	—	0	50	—	0	50		
	Large Signal Differentia		$R_L = 10k\Omega$ (Note	+25 <sup>°</sup> C	5	23		10	36			
$A_{VD}$	Gain	al voltage	15)	-40 <sup>°</sup> C	3.5	32		7	46		V/mV	
			,	+85 <sup>°</sup> C	3.5	19		7	31			
				+25 <sup>°</sup> C	65	80		65	85			
CMRR	Common Mode Rejecti	on Ratio	$V_{IC} = V_{ICRmin}$	-40 <sup>°</sup> C	60	81		60	87	—	dB	
				+85 <sup>°</sup> C	60	86		60	88			
	Supply Voltage Rejecti	on Ratio	$V_{DD} = 5V$ to 10V,	+25 <sup>°</sup> C	65	95		65	95			
<b>k</b> <sub>SVR</sub>	$(\Delta V_{DD}/\Delta V_{I^{\circ}})$	on radio	V₀ = 1.4V	-40 <sup>°</sup> C	60	92		60	92		dB	
				+85 <sup>°</sup> C	60	96		60	96			
I <sub>I(SEL)</sub>	Input Current (BIAS SE	LECT)	$V_{I(SEL)} = 0$	+25 <sup>°</sup> C		-1.4			-1.9		μA	
			$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C		675	1600		950	2000		
I <sub>DD</sub>	Supply Current		$= V_{DD}/2$ , No	-40 <sup>°</sup> C		950	2200		1375	2500	μA	
			load	+85 <sup>°</sup> 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.



# TLC271, TLC271A, TLC271B

### **Electrical Characteristics**

	Parameter	Con	ditions	TA		71C, TLC TLC271B		Unit
					Min	Тур	Max	
				+25 <sup>°</sup> C		3.6	—	
		$R_L = 10k\Omega$ ,	$V_{I(PP)} = 1V$	0 <sup>°</sup> C	—	4	—	
SR	Clow Data at Unity Cain	$C_L = 20 pF$		+70 <sup>°</sup> C		3		
SK	Slew Rate at Unity Gain	See		+25 <sup>°</sup> C		2.9		V/µs
		Figure 92	V <sub>I(PP)</sub> = 2.5V	0 <sup>°</sup> C	—	3.1		
		ligule 92		+70 <sup>°</sup> 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 <sup>°</sup> C	—	200	_	
В∘м	Maximum Output Swing	$R_L = 10k\Omega$		0 <sup>°</sup> C		220		kHz
	Bandwidth	See Figure 92		+70 <sup>°</sup> C		140		1
				+25 <sup>°</sup> C		2.2	—	
B <sub>1</sub>	Unity Gain Bandwidth	$V_I = 10mV, C_L =$	= 20pF	0°C	_	2.5	T	MHz
·		See Figure 94		+70 <sup>°</sup> C	_	1.8	_	
		$F = B_1, V_1 = 10r$	mV.	+25 <sup>°</sup> C	_	49°	_	
фm	Phase Margin	$C_L = 20pF$		0°C		50°		1
<b>Y</b> 111	i naco margin	See Figure 94		+70 <sup>°</sup> C		46°		1
iah h								
	ias mode: V <sub>DD</sub> = 10V				•	1	•	
	ias mode: V <sub>DD</sub> = 10V				TLC2	71C, TLC	271AC,	
.9.1 5	ias mode: V <sub>DD</sub> = 10V Parameter	Cond	litions	TA		71C, TLC TLC271B		Unit
9.1.0		Cond	litions	TA				Unit
.911 0		Cond	litions	<b>T</b> <sub>A</sub> +25 <sup>°</sup> C		TLC271B	C	
.9.1.0			litions VI(PP) = 1V		Min	TLC271B Typ	C	
	Parameter	R <sub>L</sub> = 10kΩ,		+25 <sup>°</sup> C	Min	TLC271B Typ 5.3	C	
SR		R <sub>L</sub> = 10kΩ, C <sub>L</sub> = 20pF		+25 <sup>°</sup> C 0 <sup>°</sup> C	Min	<b>TLC271B</b> <b>Typ</b> 5.3 5.9	C	
	Parameter	R <sub>L</sub> = 10kΩ,		+25 <sup>°</sup> C 0 <sup>°</sup> C +70 <sup>°</sup> C	Min	TLC271B           Typ           5.3           5.9           4.3	C	
	Parameter	R <sub>L</sub> = 10kΩ, C <sub>L</sub> = 20pF	VI(PP) = 1V	+25 <sup>°</sup> C 0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C	Min — — —	Typ           5.3           5.9           4.3           4.6	C Max — — — —	
	Parameter	$R_L$ = 10kΩ, $C_L$ = 20pF See Figure 92 F = 1kHz, $R_S$ =	V <sub>I(PP)</sub> = 1V V <sub>I(PP)</sub> = 5.5V	+25 °C 0 °C +70 °C +25 °C 0 °C	Min — — — —	Typ           5.3           5.9           4.3           4.6           5.1	BC Max — — — — — —	 V/µs
SR	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage	$R_L$ = 10kΩ, $C_L$ = 20pF See Figure 92 F = 1kHz, $R_S$ = See Figure 93	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $20\Omega$	+25 °C 0 °C +70 °C +25 °C 0 °C +70 °C 	Min — — — —	Typ           5.3           5.9           4.3           4.6           5.1           3.8	BC Max — — — — — —	 V/µs
SR	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing	$R_L$ = 10kΩ, $C_L$ = 20pF See Figure 92 F = 1kHz, $R_S$ =	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $20\Omega$	+25 °C 0 °C +70 °C +25 °C 0 °C +70 °C +25 °C +25 °C	Min —— —— —— —— ——	Typ           5.3           5.9           4.3           4.6           5.1           3.8           25	BC Max ———— ——— ——— ——— ———— ————	 V/µs
SR	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage	$R_L = 10k\Omega$ , $C_L = 20pF$ See Figure 92 $F = 1kHz$ , $R_S =$ See Figure 93 $V_{\circ} = V_{\circ H}$ , $C_L = 2$	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $20\Omega$	+25°C 0°C +70°C +25°C 0°C +70°C +25°C +25°C	Min —— —— —— —— —— ——	Typ           5.3           5.9           4.3           4.6           5.1           3.8           25           200	Max Max 	 V/μs 
SR	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing	$R_L = 10k\Omega$ , $C_L = 20pF$ See Figure 92 $F = 1kHz$ , $R_S =$ See Figure 93 $V_\circ = V_{\circ H}$ , $C_L = 2$ $R_L = 10k\Omega$ See Figure 92	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $200F,$	+25°C 0°C +70°C +25°C 0°C +70°C +25°C +25°C 0°C +25°C 0°C +70°C	Min —— —— —— —— —— ——	Typ           5.3           5.9           4.3           4.6           5.1           3.8           25           200           220	Max Max 	 V/μs  nV/√Hz
SR Vn B∘M	Parameter         Slew Rate at Unity Gain         Equivalent Input Noise Voltage         Maximum Output Swing         Bandwidth	$R_{L} = 10k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S} =$ See Figure 93 $V^{\circ} = V^{\circ}H, C_{L} = 2$ $R_{L} = 10k\Omega$ See Figure 92 $V_{I} = 10mV, C_{L} = 2$	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $200F,$	+25°C 0°C +70°C +25°C 0°C +70°C +25°C +25°C 0°C +70°C +70°C +25°C	Min —— —— —— —— —— —— ——	Typ           5.3           5.9           4.3           4.6           5.1           3.8           25           200           220           140           2.2	BC Max 	 V/μs  nV/√Hz kHz
SR	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing	$R_L = 10k\Omega$ , $C_L = 20pF$ See Figure 92 $F = 1kHz$ , $R_S =$ See Figure 93 $V_\circ = V_{\circ H}$ , $C_L = 2$ $R_L = 10k\Omega$ See Figure 92	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $200F,$	+25°C 0°C +70°C +25°C 0°C +70°C +25°C +25°C 0°C +70°C +25°C 0°C +25°C 0°C +25°C 0°C	Min —— —— —— —— —— —— —— —— ——	Typ           5.3           5.9           4.3           4.6           5.1           3.8           25           200           220           140           2.2           2.5	Max Max 	 V/μs  nV/√Hz
SR Vn B∘M	Parameter         Slew Rate at Unity Gain         Equivalent Input Noise Voltage         Maximum Output Swing         Bandwidth	$R_{L} = 10k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S} =$ See Figure 93 $V^{\circ} = V^{\circ}H, C_{L} = 2$ $R_{L} = 10k\Omega$ See Figure 92 $V_{I} = 10mV, C_{L} =$ See Figure 94	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ 200 20pF, = 20pF	+25°C 0°C +70°C +25°C 0°C +70°C +25°C +25°C 0°C +25°C 0°C +25°C 0°C +25°C 0°C +25°C 0°C +70°C +25°C 0°C +25°C	Min —— —— —— —— —— —— —— —— —— —— ——	Typ           5.3           5.9           4.3           4.6           5.1           3.8           25           200           220           140           2.2           2.5           1.8	Max       —	 V/μs nV/√Hz kHz
SR Vn B∘M	Parameter         Slew Rate at Unity Gain         Equivalent Input Noise Voltage         Maximum Output Swing         Bandwidth	$R_{L} = 10k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S} =$ See Figure 93 $V^{\circ} = V^{\circ}H, C_{L} = 2$ $R_{L} = 10k\Omega$ See Figure 92 $V_{I} = 10mV, C_{L} = 2$	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ 200 20pF, = 20pF	+25°C 0°C +70°C +25°C 0°C +70°C +25°C +25°C 0°C +70°C +25°C 0°C +25°C 0°C +25°C 0°C	Min	Typ           5.3           5.9           4.3           4.6           5.1           3.8           25           200           220           140           2.2           2.5	Max       ——	 V/μs nV/√Hz kHz



igh bias mode: $V_{DD} = 5V$	
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Parameter		Conditions		TA	TLC	271I, TLC TLC271E		Unit
					Min	Тур	Max	_
				+25 <sup>°</sup> C		3.6		
		R <sub>L</sub> = 10kΩ,	$V_{I(PP)} = 1V$	-40 <sup>°</sup> C		4.5		
		$C_L = 20 pF$	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	+85 <sup>°</sup> C		2.8		
SR	Slew rate at unity gain	See		+25 <sup>°</sup> C	_	2.9		V/µs
		Figure 92	V <sub>I(PP)</sub> = 2.5V	-40 <sup>°</sup> C	_	3.5		
			. ,	+85 <sup>°</sup> C	_	2.3		
Vn	Equivalent input noise voltage	$F = 1 \text{kHz}, R_S = 20\Omega$ See Figure 93		+25 <sup>°</sup> C	_	25	_	nV/√Hz
		V∘ = V∘ <sub>H</sub> , C <sub>L</sub> =	= 20pF, R <sub>L</sub> =	+25 <sup>°</sup> C		320		
В∘м	Maximum output swing	10kΩ See Figure		-40 <sup>°</sup> C	—	380		kHz
	bandwidth			+85 <sup>°</sup> C	—	250		
				+25 <sup>°</sup> C		1.7		
B1	Unity gain bandwidth		_=20pF See	-40 <sup>°</sup> C		2.6		MHz
		Figure 94		+85 <sup>°</sup> C		1.2		
		$F = B_1, V_1 = 1$	0mV. Ci =	+25 <sup>°</sup> C	_	46°		
φm	Phase margin	20pF	See Figure		_	49°		
••••	0	94	0	+85 <sup>°</sup> C		43°		
ligh b	ias mode: V <sub>DD</sub> = 10V				-			
-				<b>.</b>	TLC271I, TLC271AI, TI C271BI			
	Parameter	Con	ditions	т	TLC			Unit
	Parameter	Con	ditions	TA		TLC271E	81	Unit
	Parameter	Con	ditions		TLC: Min	TLC271E Typ		Unit
	Parameter			+25°C	Min	<b>TLC271E</b> <b>Typ</b> 5.3	BI Max	Unit
	Parameter	R <sub>L</sub> = 10kΩ,	ditions VI(PP) = 1V	+25 <sup>°</sup> C -40 <sup>°</sup> C	Min —	TLC271E           Typ           5.3           6.8	BI Max —	Unit
SR	Parameter Slew rate at unity gain			+25 <sup>°</sup> C -40 <sup>°</sup> C +85 <sup>°</sup> C	Min —	TLC271E           Typ           5.3           6.8           4	BI Max —	Unit V/µs
SR		$R_L = 10k\Omega,$ $C_L = 20pF$ See	VI(PP) = 1V	+25 <sup>°</sup> C -40 <sup>°</sup> C +85 <sup>°</sup> C +25 <sup>°</sup> C	Min —	TLC271E           Typ           5.3           6.8           4           4.6	BI Max —	
SR		R <sub>L</sub> = 10kΩ, C <sub>L</sub> = 20pF		+25 <sup>°</sup> C -40 <sup>°</sup> C +85 <sup>°</sup> C +25 <sup>°</sup> C -40 <sup>°</sup> C	Min 	Typ           5.3           6.8           4           5.8	BI	
SR		$R_{L} = 10k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S}$	V <sub>I(PP)</sub> = 1V V <sub>I(PP)</sub> = 5.5V	+25 <sup>°</sup> C -40 <sup>°</sup> C +85 <sup>°</sup> C +25 <sup>°</sup> C	Min —— —— —— ——	TLC271E           Typ           5.3           6.8           4           4.6	BI	
	Slew rate at unity gain	$R_L$ = 10kΩ, $C_L$ = 20pF See Figure 92 F = 1kHz, R <sub>S</sub> Figure 93	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega  \text{See}$	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C	Min —— —— —— ——	Typ           5.3           6.8           4           5.8           3.5           25	BI	V/µs
Vn	Slew rate at unity gain Equivalent input noise voltage Maximum output swing	$R_{L} = 10k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S}$	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega  \text{See}$ $= 20\text{pF},  \text{R}_{L} = 1000$	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C +25°C	Min —— —— —— ——	Typ           5.3           6.8           4           4.6           5.8           3.5           25           200	BI	V/µs nV/√Hz
	Slew rate at unity gain	$R_{L} = 10k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S}$ Figure 93 $V_{\circ} = V_{\circ H}, C_{L} =$	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega  \text{See}$	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C +25°C -40°C	Min — — — — — — —	Typ           5.3           6.8           4           5.8           3.5           25           200           260	Max Max 	V/µs
Vn	Slew rate at unity gain Equivalent input noise voltage Maximum output swing	$R_{L} = 10k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S}$ Figure 93 $V_{\circ} = V_{\circ H}, C_{L} = 10k\Omega$ 92	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega  See$ $: 20pF,  R_L =$ $See \ Figure$	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C +25°C -40°C +85°C	Min — — — — — — —	Typ           5.3           6.8           4           5.8           3.5           25           200           260           130	Max Max 	V/µs nV/√Hz
V <sub>n</sub> B∘ <sub>M</sub>	Slew rate at unity gain Equivalent input noise voltage Maximum output swing bandwidth	$R_{L} = 10k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S}$ Figure 93 $V_{\circ} = V_{\circ H}, C_{L} = 10k\Omega$ 92 $V_{I} = 10mV, C_{I}$	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega  \text{See}$ $= 20\text{pF},  \text{R}_{L} = 1000$	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C +25°C -40°C +85°C +85°C +25°C	Min — — — — — — —	Typ           5.3           6.8           4           4.6           5.8           3.5           25           200           260           130           2.2	Max Max 	V/µs nV/√Hz kHz
Vn	Slew rate at unity gain Equivalent input noise voltage Maximum output swing	$R_{L} = 10k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S}$ Figure 93 $V_{\circ} = V_{\circ H}, C_{L} = 10k\Omega$ 92	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega  See$ $: 20pF,  R_L =$ $See \ Figure$	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C -40°C +85°C +25°C +25°C -40°C +25°C -40°C	Min	Typ           5.3           6.8           4           4.6           5.8           3.5           25           200           260           130           2.2           3.1	Max Max  	V/µs nV/√Hz
V <sub>n</sub> B∘ <sub>M</sub>	Slew rate at unity gain Equivalent input noise voltage Maximum output swing bandwidth	$R_{L} = 10k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S}$ Figure 93 $V_{\circ} = V_{\circ H}, C_{L} =$ $10k\Omega$ 92 $V_{I} = 10mV, C_{I}$ Figure 94	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega  See$ $= 20pF,  R_L = See \ Figure$ $L = 20pF  See$	+25°C -40°C +85°C +25°C -40°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C +40°C +25°C +40°C +85°C	Min —— —— —— —— —— —— —— —— —— —— —— ——	Typ           5.3           6.8           4           4.6           5.8           3.5           25           200           260           130           2.2           3.1           1.7	Max Max —— —— —— —— —— —— —— —— —— —— —— ——	V/µs nV/√Hz kHz
Vn B∘M	Slew rate at unity gain Equivalent input noise voltage Maximum output swing bandwidth	$R_{L} = 10k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S}$ Figure 93 $V_{\circ} = V_{\circ H}, C_{L} = 10k\Omega$ 92 $V_{I} = 10mV, C_{I}$	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega  See$ $= 20pF,  R_L = See \ Figure$ $L = 20pF  See$	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C -40°C +85°C +25°C +25°C -40°C +25°C -40°C	Min	Typ           5.3           6.8           4           4.6           5.8           3.5           25           200           260           130           2.2           3.1	Max       ——	V/µs nV/√Hz kHz



Medium	bias	mode

wealum	bias mode				ТИ	C271C	TI C2	71AC, 1		BC	
	Parameter		Conditions	TA		$J_{DD} = 5^{\circ}$		1	LC271		Unit
	Farameter		Conditions	'A	Min	Тур	Max	Min	тур.	Max	Onit
				+25 <sup>°</sup> C		1.1	10		1.1	10	
		TLC271C	V∘ = 1.4V, V <sub>IC</sub> =		_		12	_		12	
			$0^{\circ} = 1.4^{\circ},  0^{\circ} = 1.4^{\circ},  0^{\circ} = 0^{\circ}$	+25 <sup>°</sup> C		0.9	5	_	0.9	5	
VI°	Input Offset Voltage	TLC271AC	$50\Omega$ , $R_L =$	0 to +70 <sup>°</sup> C		_	6.5	_	_	6.5	mV
			100kΩ	+25 <sup>°</sup> C	_	0.25	2	_	0.26	2	
		TLC271BC		0 to +70 <sup>°</sup> C	_		3	—		3	
α∨ı∘	Average temperature coefficient of input offset voltage			25 to +70 <sup>°</sup> C		1.7		2.1		L	µV/°C
		( 10)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C		0.1	60	—	0.1	60	
١p	Input offset current (No	ote 16)	= V <sub>DD</sub> /2	+70 <sup>°</sup> C	—	7	300	—	7	300	рА
	lanut hing summert (blat	- 10)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C	—	0.6	60	—	0.7	60	- 0
I <sub>IB</sub>	Input bias current (Not	e 16)	= V <sub>DD</sub> /2	+70 <sup>°</sup> C	—	40	600	—	50	600	рА
	Common mode input vo	oltage (Note		+25 <sup>°</sup> C	-0.2 to 4	-0.3 to 4.2		-0.2 to 9	-0.3 to 9.2		V
V <sub>ICR</sub>	17)			0 to +70 <sup>°</sup> C	-0.2 to 3.5			-0.2 to 8.5	_	_	V
				+25 <sup>°</sup> C	3.2	3.9		8	8.7		
V∘н	High level output voltag	je	$V_{ID} = 100 \text{mV}, \text{R}_{\text{L}}$ = 100k $\Omega$	0 <sup>°</sup> C	3	3.9	_	7.8	8.7		V
			= 100K22	+70 <sup>°</sup> C	3	4		7.8	8.7		
			)/ <u>100m</u> )/	+25 <sup>°</sup> C	—	0	50	—	0	50	
V∘L	Low level output voltag	е	V <sub>ID</sub> = -100mV, I∘ <sub>L</sub> = 0	o°C	—	0	50	—	0	50	mV
			I°L = 0	+70 <sup>°</sup> C	—	0	50	—	0	50	
			D = 1001/0	+25 <sup>°</sup> C	25	170		25	275		
A <sub>VD</sub>	Large signal differential	l voltage gain	R <sub>L</sub> = 100kΩ (Note 18)	o°C	15	200		15	320	—	V/mV
				+70 <sup>°</sup> C	15	140		15	230		
				+25 <sup>°</sup> C	65	91		65	94		
CMRR	Common mode rejection	on ratio	$V_{IC} = V_{ICRmin}$	0°C	60	91		60	94		dB
				+70 <sup>°</sup> C	60	92		60	94	—	
	Supply voltage rejection	n ratio	V <sub>DD</sub> = 5V to 10V,	+25 <sup>°</sup> C	70	93		70	93		
k <sub>SVR</sub>	$(\Delta V_{DD}/\Delta V_{I^{\circ}})$	11100	V₀ = 1.4V	00	60	92		60	92		dB
				+70 <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	<u> </u>	-130			-160		nA
			$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C	<u> </u>	105	280		143	300	
I <sub>DD</sub>	Supply current		= V <sub>DD</sub> /2, No	0°C	<u>                                     </u>	125	320	—	173	400	μA
			load	+70 <sup>°</sup> 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.



#### Medium bias mode

mearan	bias mode				Т	LC271I	, TLC2	71AI, T	LC271	BI	
	Parameter		Conditions	TA	١	/ <sub>DD</sub> = 5	V	V	<sub>DD</sub> = 10	v	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 <sup>°</sup> C			13			13	
N/	Innut Offerst \ /elters		0V, R <sub>S</sub> =	+25 <sup>°</sup> C		0.9	5		0.9	5	
VI°	Input Offset Voltage	TLC271AI	50 $\Omega$ , R <sub>L</sub> =	-40 to +85 <sup>°</sup> C		_	7			7	mV
		TLC271BI	100kΩ	+25 <sup>°</sup> C	—	0.25	2	—	0.26	2	
		TLC2/TBI		-40 to +85 <sup>°</sup> C	—	—	3.5	—		3.5	
α <sub>VI°</sub>	Average temperature c input offset voltage	oefficient of		+25 to +85 <sup>°</sup> C		1.7			2.1		µV/°C
	Input offect ourrent (N	ata 10)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C		0.1	60		0.1	60	<b>n</b> 4
llo.	Input offset current (No	ote 19)	= V <sub>DD</sub> /2	+85 <sup>°</sup> C		24	1000		26	1000	рА
l	Input biog ourront (Not	o 10)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C	—	0.6	60		0.7	60	۳Å
I <sub>IB</sub>	Input bias current (Not	e 19)	$= V_{DD}/2$	+85 <sup>°</sup> C	—	200	2000		220	2000	рА
	Common mode input v	oltage (Note		+25 <sup>°</sup> C	-0.2 to 4	-0.3 to 4.2		-0.2 to 9	-0.3 to 9.2	—	V
V <sub>ICR</sub>	Common mode input voltage (Note 20)			-40 to +85 <sup>°</sup> C	-0.2 to 3.5	—		-0.2 to 8.5			V
				+25 <sup>°</sup> C	3.2	3.9		8	8.7		
V∘H	High level output voltag	ge	V <sub>ID</sub> = 100mV, R <sub>L</sub> = 100kΩ	-40 <sup>°</sup> C	3	3.9		7.8	8.7		V
			- 100K22	+85 <sup>°</sup> C	3	4		7.8	8.7		
			V 100mV	+25 <sup>°</sup> C	—	0	50	—	0	50	
V∘L	Low level output voltag	е	V <sub>ID</sub> = -100mV, I∘ <sub>L</sub> = 0	-40 <sup>°</sup> C		0	50	—	0	50	mV
				+85 <sup>°</sup> C	—	0	50	—	0	50	
			R <sub>L</sub> = 100kΩ	+25 <sup>°</sup> C	25	170		25	275	—	
$A_{VD}$	Large signal differentia	l voltage gain	(Note 21)	-40 <sup>°</sup> C	15	270	_	15	390	_	V/mV
				+85 <sup>°</sup> C	15	130		15	220	_	
				+25 <sup>°</sup> C	65	91		65	94	_	
CMRR	Common mode rejection	on ratio	$V_{IC} = V_{ICRmin}$	-40 <sup>°</sup> C	60	90		60	93		dB
				+85 <sup>°</sup> C	60	90		60	94	_	
	Supply voltage rejectio	n ratio	$V_{DD} = 5V$ to 10V,	+25 <sup>°</sup> C	70	93		70	93		
<b>k</b> <sub>SVR</sub>	$(\Delta V_{DD}/\Delta V_{I^{\circ}})$	ITTAILO	V <sub>DD</sub> = 3V to 10V, V∘ = 1.4V	-40 <sup>°</sup> C	60	91		60	91	—	dB
				+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 <sub>DD</sub>	Supply current		= V <sub>DD</sub> /2, No	-40 C	<u> </u>	158	400		225	450	μΑ
			load	+85 <sup>°</sup> 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  $V_{DD} = 5 \text{ V}$ ,  $V_{\circ} = 0.25 \text{ V}$  to 2 V; at  $V_{DD} = 10 \text{ V}$ ,  $V_{\circ} = 1 \text{ V}$  to 6 V.



# TLC271, TLC271A, TLC271B

### **Electrical Characteristics**

	Parameter	Cone	ditions	T₄		71C, TLC TLC271B		Unit
					Min	Тур	Max	
				+25 <sup>°</sup> C		0.43		
		R <sub>L</sub> = 100kΩ,	$V_{I(PP)} = 1V$	0 <sup>°</sup> C		0.46		
		$C_L = 20 pF$		+70 <sup>°</sup> C		0.36		
SR	Slew rate at unity gain	See		+25 <sup>°</sup> C		0.4		V/µs
		Figure 92	V <sub>I(PP)</sub> = 2.5V	0 <sup>°</sup> C		0.43		
				+70 <sup>°</sup> C	_	0.34	_	
Vn	Equivalent input noise voltage	F = 1kHz, R <sub>S</sub> = 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 <sup>°</sup> C		55		
В∘м	Maximum output swing	100kΩ	See	0 <sup>°</sup> C		60	<u> </u>	kHz
	bandwidth	Figure 92		+70 <sup>°</sup> C		50	<u> </u>	1
				+25 <sup>°</sup> C		525	<u> </u>	
B <sub>1</sub>	Unity gain bandwidth	$V_{I} = 10 \text{mV}, C_{L}$	= 20pF See	0 <sup>°</sup> C	<u> </u>	600	<u> </u>	MHz
		Figure 94		+70 <sup>°</sup> C		400		
		$F = B_1, V_1 = 10$	mV, CL =	+25 <sup>°</sup> C		40°		
фm	Phase margin	20pF		0 <sup>°</sup> C		41°		
		94	-	+70 <sup>°</sup> C	_	39°		
lediu	m bias mode: V <sub>DD</sub> = 10V							•
					TLC2	Unit		
	Parameter	Con	ditions	T <sub>A</sub>		TLC271B	C	Unit
					Min	Tun		
			-		IVIIII	Тур	Max	
				+25 <sup>°</sup> C		0.62		
		R <sub>L</sub> = 100kΩ,	V <sub>I(PP)</sub> = 1V	+25 <sup>°</sup> C 0 <sup>°</sup> C				
сD	Slow Poto et Unity Coin	R <sub>L</sub> = 100kΩ, C <sub>L</sub> = 20pF	V <sub>I(PP)</sub> = 1V	-		0.62		
SR	Slew Rate at Unity Gain		VI(PP) = 1V	0°C		0.62 0.67		 
SR	Slew Rate at Unity Gain	$C_L = 20 pF$	V <sub>I(PP)</sub> = 1V V <sub>I(PP)</sub> = 5.5V	0 <sup>°</sup> C +70 <sup>°</sup> C		0.62 0.67 0.51		
SR	Slew Rate at Unity Gain	C <sub>L</sub> = 20pF See		0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C		0.62 0.67 0.51 0.56		
SR Vn	Slew Rate at Unity Gain	C <sub>L</sub> = 20pF See	V <sub>I(PP)</sub> = 5.5V	0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C 0 <sup>°</sup> C		0.62 0.67 0.51 0.56 0.61		
	Equivalent Input Noise Voltage	C <sub>L</sub> = 20pF See Figure 92 F = 1kHz, R <sub>S</sub> =	V <sub>I(PP)</sub> = 5.5V = 20Ω	0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C 0 <sup>°</sup> C +70 <sup>°</sup> C		0.62 0.67 0.51 0.56 0.61 0.46		V/µs
	Equivalent Input Noise Voltage Maximum Output Swing	C <sub>L</sub> = 20pF See Figure 92 F = 1kHz, R <sub>S</sub> = See Figure 93	V <sub>I(PP)</sub> = 5.5V = 20Ω	0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C 0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C		0.62 0.67 0.51 0.56 0.61 0.46 32		V/µs
Vn	Equivalent Input Noise Voltage	$C_L = 20pF$ See Figure 92 $F = 1kHz, R_S =$ See Figure 93 $V^\circ = V^\circ H, C_L =$	V <sub>I(PP)</sub> = 5.5V = 20Ω 20pF,	0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C 0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C +25 <sup>°</sup> C		0.62 0.67 0.51 0.56 0.61 0.46 32 35		V/µs nV/√Hz
Vn	Equivalent Input Noise Voltage Maximum Output Swing	$C_L = 20pF$ See Figure 92 $F = 1kHz, R_S =$ See Figure 93 $V^\circ = V^\circ_H, C_L =$ $R_L = 100k\Omega$ See Figure 92	V <sub>I(PP)</sub> = 5.5V = 20Ω 20pF,	0°C +70°C +25°C 0°C +70°C +25°C +25°C 0°C		0.62 0.67 0.51 0.56 0.61 0.46 32 35 40		V/µs nV/√Hz
Vn	Equivalent Input Noise Voltage Maximum Output Swing	$C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S} =$ See Figure 93 $V^{\circ} = V^{\circ}H, C_{L} =$ $R_{L} = 100k\Omega$ See Figure 92 $V_{I} = 10mV, C_{L}$	V <sub>I(PP)</sub> = 5.5V = 20Ω 20pF, 2 = 20pF	0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C 0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C +25 <sup>°</sup> C 0 <sup>°</sup> C +70 <sup>°</sup> C		0.62 0.67 0.51 0.56 0.61 0.46 32 35 40 30		V/µs nV/√Hz
V <sub>n</sub> B∘ <sub>M</sub>	Equivalent Input Noise Voltage Maximum Output Swing Bandwidth	$C_L = 20pF$ See Figure 92 $F = 1kHz, R_S =$ See Figure 93 $V^\circ = V^\circ_H, C_L =$ $R_L = 100k\Omega$ See Figure 92	V <sub>I(PP)</sub> = 5.5V = 20Ω 20pF, 2 = 20pF	0°C +70°C +25°C 0°C +70°C +25°C +25°C +25°C +70°C +25°C +25°C		0.62 0.67 0.51 0.56 0.61 0.46 32 35 40 30 635		V/µs nV/√Hz kHz
V <sub>n</sub> B∘M	Equivalent Input Noise Voltage Maximum Output Swing Bandwidth	$C_L = 20pF$ See Figure 92 $F = 1kHz, R_S =$ See Figure 93 $V^\circ = V^\circ_H, C_L =$ $R_L = 100k\Omega$ See Figure 92 $V_I = 10mV, C_L$ See Figure 94	V <sub>I(PP)</sub> = 5.5V = 20Ω 20pF, = 20pF	0°C +70°C +25°C 0°C +70°C +25°C +25°C 0°C +25°C +25°C +25°C 0°C +25°C 0°C		0.62 0.67 0.51 0.56 0.61 0.46 32 35 40 30 635 710		V/µs nV/√Hz kHz
V <sub>n</sub> B∘ <sub>M</sub>	Equivalent Input Noise Voltage Maximum Output Swing Bandwidth	$C_L = 20pF$ See Figure 92 $F = 1kHz, R_S =$ See Figure 93 $V^\circ = V^\circ_H, C_L =$ $R_L = 100k\Omega$ See Figure 92 $V_I = 10mV, C_L$ See Figure 94	$V_{I(PP)} = 5.5V$ = 200 20pF, = 20pF = 20pF	0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C 0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C +25 <sup>°</sup> C 0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C 0 <sup>°</sup> C +70 <sup>°</sup> C +70 <sup>°</sup> C +70 <sup>°</sup> C		0.62 0.67 0.51 0.56 0.61 0.46 32 35 40 30 635 710 510		V/µs nV/√Hz kHz



	Parameter	Con	ditions	TA	TLC	271I, TLC TLC271E		Unit
					Min	Тур	Max	_
				+25 <sup>°</sup> C	—	0.43	—	
		R <sub>L</sub> = 100kΩ,	$V_{I(PP)} = 1V$	-40 <sup>°</sup> C	_	0.51	—	
0.5		$C_L = 20 pF$		+85 <sup>°</sup> C	_	0.35	—	
SR	Slew rate at unity gain	See		+25 <sup>°</sup> C	_	0.4	—	V/µs
		Figure 92	V <sub>I(PP)</sub> = 2.5V	-40 <sup>°</sup> C	—	0.48	—	
				+85 <sup>°</sup> C	—	0.32	—	
Vn	Equivalent input noise voltage	F = 1kHz, R <sub>S</sub> : 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 <sup>°</sup> C	—	55	—	
В∘м	Maximum output swing	100kΩ	See	-40 <sup>°</sup> C	—	75	—	kHz
	bandwidth	Figure 92		+85 <sup>°</sup> C		45		
				+25 <sup>°</sup> C	_	525	_	
B <sub>1</sub>	Unity gain bandwidth		= 20pF See	-40 <sup>°</sup> C	_	770	_	MHz
		Figure 94		+85 <sup>°</sup> C		370		
		$F = B_1, V_1 = 10$	$OmV, C_L =$	+25 <sup>°</sup> C		40°		
фm	Phase margin	20pF	See Figure	-40 <sup>°</sup> C		43°		T
		94	-	+85 <sup>°</sup> C		38°	—	
ediur	m bias mode: V <sub>DD</sub> = 10V					•		
					TLC	271I, TLC	271AI.	
	Parameter	Conditions		TA	TLC271BI			Linit
		Con	ditions	TA				Unit
		Con	ditions	T <sub>A</sub>	Min			Unit
		Con	ditions	<b>Τ</b> <sub>Α</sub> +25 <sup>°</sup> C		TLC271E	81	
		Con R <sub>L</sub> = 100kΩ,	ditions V <sub>I(PP)</sub> = 1V		Min	TLC271E Typ	81	
00	Claur Data at Unity Onin			+25 <sup>°</sup> C	Min	TLC271E Typ 0.62	81	
SR	Slew Rate at Unity Gain	R∟ = 100kΩ,		+25 <sup>°</sup> C -40 <sup>°</sup> C	Min	TLC271E Typ 0.62 0.77	61 Max 	
SR	Slew Rate at Unity Gain	R <sub>L</sub> = 100kΩ, C <sub>L</sub> = 20pF		+25 <sup>°</sup> C -40 <sup>°</sup> C +85 <sup>°</sup> C	Min 	TLC271E Typ 0.62 0.77 0.47	BI	
SR	Slew Rate at Unity Gain	R <sub>L</sub> = 100kΩ, C <sub>L</sub> = 20pF See	V <sub>I(PP)</sub> = 1V	+25 <sup>°</sup> C -40 <sup>°</sup> C +85 <sup>°</sup> C +25 <sup>°</sup> C	Min — — — —	TLC271E Typ 0.62 0.77 0.47 0.56	BI Max	
SR Vn	Slew Rate at Unity Gain Equivalent Input Noise Voltage	R <sub>L</sub> = 100kΩ, C <sub>L</sub> = 20pF See	V <sub>I(PP)</sub> = 1V V <sub>I(PP)</sub> = 5.5V = 20Ω	+25°C -40°C +85°C +25°C -40°C	Min — — — —	Typ           0.62           0.77           0.47           0.56           0.7	BI	
	Equivalent Input Noise Voltage	$R_L = 100k\Omega$ , $C_L = 20pF$ See Figure 92 $F = 1kHz$ , $R_S$ =	$\frac{V_{I(PP)} = 1V}{V_{I(PP)} = 5.5V}$ $= 20\Omega$	+25°C -40°C +85°C +25°C -40°C +85°C	Min — — — —	Typ           0.62           0.77           0.47           0.56           0.7           0.44	BI	 
	Equivalent Input Noise Voltage Maximum Output Swing	$R_L = 100k\Omega$ , $C_L = 20pF$ See Figure 92 $F = 1kHz$ , $R_S =$ See Figure 93	$\frac{V_{I(PP)} = 1V}{V_{I(PP)} = 5.5V}$ $= 20\Omega$	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C	Min — — — — — —	Typ           0.62           0.77           0.47           0.56           0.7           0.44           32	BI	 
Vn	Equivalent Input Noise Voltage	R <sub>L</sub> = 100kΩ, C <sub>L</sub> = 20pF See Figure 92 $F = 1kHz, R_S = 3$ See Figure 93 V° = V° <sub>H</sub> , C <sub>L</sub> =	V <sub>I(PP)</sub> = 1V V <sub>I(PP)</sub> = 5.5V = 20Ω 20pF,	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C	Min — — — — — —	Typ           0.62           0.77           0.47           0.56           0.7           0.44           32           35	BI	 V/μs  nV/√Hz
Vn	Equivalent Input Noise Voltage Maximum Output Swing	$R_{L} = 100k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S} = 32$ See Figure 93 $V_{\circ} = V_{\circ H}, C_{L} = R_{L} = 100k\Omega$ See Figure 92	V <sub>I(PP)</sub> = 1V V <sub>I(PP)</sub> = 5.5V = 20Ω 20pF,	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C +25°C -40°C	Min — — — — — —	Typ           0.62           0.77           0.47           0.56           0.7           0.44           32           35           45	BI	 V/μs  nV/√Hz
Vn	Equivalent Input Noise Voltage Maximum Output Swing	$R_{L} = 100 k\Omega,$ $C_{L} = 20 pF$ See Figure 92 $F = 1 kHz, R_{S} = 32$ See Figure 93 $V_{\circ} = V_{\circ H}, C_{L} = R_{L} = 100 k\Omega$ See Figure 92 $V_{I} = 10 mV, C_{L}$	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ = 20 $\Omega$ 20pF,	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C -40°C +85°C -40°C +85°C	Min —— —— —— —— —— —— —— —— ——	TLC271E Typ 0.62 0.77 0.47 0.56 0.7 0.44 32 35 45 25	BI Max ———————————————————————————————————	 V/μs  nV/√Hz
V <sub>n</sub> B∘M	Equivalent Input Noise Voltage Maximum Output Swing Bandwidth	$R_{L} = 100k\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S} = 32$ See Figure 93 $V_{\circ} = V_{\circ H}, C_{L} = R_{L} = 100k\Omega$ See Figure 92	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ = 20 $\Omega$ 20pF,	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C +25°C +85°C +25°C	Min	Typ           0.62           0.77           0.47           0.56           0.7           0.44           32           35           45           25           635	Max Max              	V/µs NV/√Hz
V <sub>n</sub> B∘M	Equivalent Input Noise Voltage Maximum Output Swing Bandwidth	R <sub>L</sub> = 100kΩ, C <sub>L</sub> = 20pF See Figure 92 $F = 1kHz, R_S = 32$ V° = V°H, C <sub>L</sub> = R <sub>L</sub> = 100kΩ See Figure 92 V <sub>I</sub> = 10mV, C <sub>L</sub> See Figure 94	V <sub>I(PP)</sub> = 1V V <sub>I(PP)</sub> = 5.5V = 20Ω 20pF, = 20pF	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C -40°C +85°C +25°C -40°C +85°C +85°C +85°C	Min	TLC271E Typ 0.62 0.77 0.47 0.56 0.7 0.44 32 35 45 25 635 880	Max Max              	V/µs NV/√Hz
V <sub>n</sub> B∘M	Equivalent Input Noise Voltage Maximum Output Swing Bandwidth	R <sub>L</sub> = 100kΩ, C <sub>L</sub> = 20pF See Figure 92 $F = 1kHz, R_S = 32$ V° = V°H, C <sub>L</sub> = R <sub>L</sub> = 100kΩ See Figure 92 V <sub>I</sub> = 10mV, C <sub>L</sub> See Figure 94	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ = 20 $\Omega$ 20pF, = 20pF	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C	Min	TLC271E Typ 0.62 0.77 0.47 0.56 0.7 0.44 32 35 45 25 635 880 480	Max Max              	V/µs NV/√Hz



Low bia	as mode										
					TL	C271C,	TLC27	71AC, 1	<b>FLC271</b>	вс	
	Parameter		Conditions	TA	١	/ <sub>DD</sub> = 5	V	V	<sub>DD</sub> = 10	٧	Unit
					Min	Тур	Max	Min	Тур.	Max	
		TI 00740		+25 <sup>°</sup> C	_	1.1	10	—	1.1	10	
		TLC271C	V∘ = 1.4V, V <sub>IC</sub> =	0 to +70 <sup>°</sup> C	—		12	—		12	
		TI 00744.0	0V, Rs =	+25 <sup>°</sup> C	—	0.9	5	—	0.9	5	
VI°	Input Offset Voltage	TLC271AC	50Ω, R <sub>L</sub> =	0 to +70 <sup>°</sup> C			6.5	—		6.5	mV
			1ΜΩ	+25 <sup>°</sup> C		0.24	2	_	0.26	2	
		TLC271BC		0 to +70 <sup>°</sup> C			3	_		3	
αvı°	Average Temperature Input Offset Voltage	Coefficient of	_	+25 to +70 <sup>°</sup> C		1.1			1		µV/°C
_			$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C	_	0.1	60	—	0.1	60	
۱º	Input Offset Current (I	Note 22)	$= V_{DD}/2$	+70 <sup>°</sup> C	—	7	300	—	8	300	pА
			$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C	_	0.6	60	—	0.7	60	
IIB	Input Bias Current (No	ote 22)	= V <sub>DD</sub> /2	+70 <sup>°</sup> C	_	40	600	—	50	600	pА
	Common Mode Input V	/oltage (Note		+25 <sup>°</sup> C	-0.2 to	-0.3 to 4.2		-0.2 to 9	-0.3 to 9.2		V
VICR	23)		_	0 to +70 <sup>°</sup> C	-0.2 to 3.5	—		-0.2 to 8.5	_		V
				+25 <sup>°</sup> C	3.2	4.1		8	8.9	_	V
V∘н	High Level Output Volt	tage	$V_{ID} = 100 \text{mV}, \text{R}_{L}$	0 <sup>°</sup> C	3	4.1		7.8	8.9	_	
		•	= 1MΩ	+70 <sup>°</sup> C	3	4.2	_	7.8	8.9	_	
				+25 <sup>°</sup> C		0	50	—	0	50	
V∘L	Low Level Output Volt	age	$V_{ID} = -100 \text{mV},$	0 <sup>°</sup> C	—	0	50	—	0	50	m∨
			l∘∟ = 0	+70 <sup>°</sup> C	—	0	50	—	0	50	
				+25 <sup>°</sup> C	50	520	_	50	870	_	
Avd	Large Signal Differenti	al Voltage	$R_L = 1M\Omega$ (Note	0 <sup>°</sup> C	50	700		50	1030		V/mV
	Gain		24)	+70 <sup>°</sup> C	50	380	_	50	660	_	
				+25 <sup>°</sup> C	65	94	_	65	97	_	
CMRR	Common Mode Reject	ion Ratio	$V_{IC} = V_{ICRmin}$	0 <sup>°</sup> C	60	95		60	97		dB
				+70 <sup>°</sup> C	60	95		60	97		
	Cumple Malta and Data	ian Dati-		+25 <sup>°</sup> C	70	97	_	70	97	_	
<b>k</b> svr	Supply Voltage Reject (ΔV <sub>DD</sub> /ΔV <sub>I°</sub> )	ion Katio	V <sub>DD</sub> = 5V to 10V, V∘ = 1.4V	00	60	97	_	60	97	_	dB
			V - 1.4V	+70 <sup>°</sup> C	60	98		60	98		
I <sub>I(SEL)</sub>	Input Current (BIAS SI	ELECT)	$V_{I(SEL)} = 0$	+25 <sup>°</sup> C	—	65			95		nA
			$V_{\circ} = V_{DD}/2, V_{IC}$		—	10	17	—	14	23	
IDD	Supply Current		$= V_{DD}/2$ , No	0 <sup>°</sup> C	—	12	21	—	18	33	μA
			load	+70 <sup>°</sup> 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  $V_{DD} = 5$  V, V<sub>°</sub> = 0.25 V to 2 V; at  $V_{DD} = 10$  V, V<sub>°</sub> = 1 V to 6 V.



		mode
<b>N</b>	niae	mode

Low bia	is mode				-	02741	TI 00	74	1 0 0 7 4 1	DI	
	Parameter		Conditions	TA		$l_{DD} = 5^{\circ}$		71AI, T	LC2711 DD = 10		Unit
	Farameter		Conditions	I A	Min		Max	v Min		v Max	Unit
				+25 <sup>°</sup> C		Тур			Тур.		
		TLC271I		+25 C -40 to +85 °C		1.1	10		1.1	10	
			$V_{\circ} = 1.4V, V_{IC} =$	-40 10 +85 C +25 °C			13			13	
VI°	Input Offset Voltage	TLC271AI	0V, R <sub>S</sub> = 50Ω, R <sub>L</sub> =	+25 C -40 to +85 °C		0.9	5		0.9	5	mV
			1MΩ	-40 10 +85 C +25 °C			7		0.06	7 2	
		TLC271BI		-40 to +85°C		0.24	3.5		0.26		
α <sub>VI°</sub>	Average Temperature Coefficient of			+25 to +85 °C		1.1	3.0	<u> </u>			µV/°C
	Input Offset Voltage										•
١ <sub>١°</sub>	Input Offset Current (N	lote 25)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C		0.1	60		0.1	60	рА
			$= V_{DD}/2$	+85 <sup>°</sup> C		24	1000		26	1000	-
I <sub>IB</sub>	Input Bias Current (No	ote 25)	$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C		0.6	60		0.7	60	pА
			$= V_{DD}/2$	+85 <sup>°</sup> C	_	200	2000		220	2000	
	Common Mode Input V	/oltage		+25 <sup>°</sup> C	-0.2 to 4	-0.3 to 4.2	_	-0.2 to 9	-0.3 to 9.2	—	V
V <sub>ICR</sub>	(Note 26)			-40 to +85 <sup>°</sup> C	-0.2 to 3.5			-0.2 to 8.5	_	_	V
				+25 <sup>°</sup> C	3	4.1	_	8	8.9	_	
V∘H	High Level Output Volt	age	V <sub>ID</sub> = 100mV, R <sub>L</sub> = 1MΩ	-40 <sup>°</sup> C	3	4.1		7.8	8.9		V
			- 110122	+85 <sup>°</sup> C	3	4.2		7.8	8.9		
			100 M	+25 <sup>°</sup> C		0	50		0	50	mV
V∘L	Low Level Output Volta	age	V <sub>ID</sub> = -100mV, I∘ <sub>L</sub> = 0	-40 <sup>°</sup> C		0	50	—	0	50	
			1% = 0	+85 <sup>°</sup> C	—	0	50	—	0	50	
	Lanna Cinnal Differenti			+25 <sup>°</sup> C	50	520		50	870	_	
A <sub>VD</sub>	Large Signal Differentia	al voltage	R <sub>L</sub> = 1MΩ (Note 27)	-40 <sup>°</sup> C	50	900		50	1550	_	V/mV
	Call		21)	+85 <sup>°</sup> C	50	330	_	50	585	—	
				+25 <sup>°</sup> C	65	94		65	97		
CMRR	Common Mode Rejecti	on Ratio	$V_{IC} = V_{ICRmin}$	-40 <sup>°</sup> C	60	95		60	97	_	dB
				+85 <sup>°</sup> C	60	95		60	98		
	Supply Voltage Rejecti	on Potio	V <sub>DD</sub> = 5V to 10V,	+25 <sup>°</sup> C	70	97		70	97	_	
<b>k</b> SVR	$(\Delta V_{DD}/\Delta V_{I^{\circ}})$	UII Ralio	V <sub>DD</sub> = 5V to 10V, V∘ = 1.4V	-40 <sup>°</sup> C	60	97		60	97		dB
			••	+85 <sup>°</sup> C	60	98		60	98		
I <sub>I(SEL)</sub>	Input Current (BIAS SE	ELECT)	$V_{I(SEL)} = 0$	+25 <sup>°</sup> C		65			95		nA
			$V_{\circ} = V_{DD}/2, V_{IC}$	+25 <sup>°</sup> C	—	10	17	—	14	23	
I <sub>DD</sub>	Supply Current		$= V_{DD}/2$ , No	-40 <sup>°</sup> C		16	27		25	43	μA
Notes:			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  $V_{DD} = 5 \text{ V}$ ,  $V_{\circ} = 0.25 \text{ V}$  to 2 V; at  $V_{DD} = 10 \text{ V}$ ,  $V_{\circ} = 1 \text{ V}$  to 6 V.



# TLC271, TLC271A, TLC271B

# **Electrical Characteristics**

	Parameter	Con	ditions	TA		71C, TLC TLC271B		Unit
					Min	Тур	Max	—
				+25 <sup>°</sup> C		0.03	—	
		R <sub>L</sub> = 1MΩ,	$V_{I(PP)} = 1V$	0 <sup>°</sup> C	—	0.04	—	
SR	Slow Data at Unity Cain	$C_L = 20 pF$		+70 <sup>°</sup> C	—	0.03	—	)/////
эк	Slew Rate at Unity Gain	See		+25 <sup>°</sup> C	—	0.03	—	V/µs
		Figure 92	V <sub>I(PP)</sub> = 2.5V	o°C		0.03	—	
				+70 <sup>°</sup> C		0.02	—	
Vn	Equivalent Input Noise Voltage	F = 1kHz, R <sub>S</sub> See Figure 93		+25 <sup>°</sup> C	_	68	—	nV/√Hz
	Maximum Output Swing $V_{4} = V_{44} C_{4} = 20$			+25 <sup>°</sup> C		5		
В∘м	Maximum Output Swing		20pF, R <sub>L</sub> = 1MΩ	0 <sup>°</sup> C	_	6	—	kHz
	Bandwidth	See Figure 92	:	+70 <sup>°</sup> C	—	4.5	—	1
				+25 <sup>°</sup> C	—	85	—	1
B <sub>1</sub>	Unity Gain Bandwidth	$V_I = 10 \text{mV}, C_L$		0°C		100		MHz
		See Figure 94		+70 <sup>°</sup> C		65		
				+25 <sup>°</sup> C	_	34°	_	
фm	Phase Margin		$DmV, C_L = 20pF$	0°C		36°	_	-
••••	5	See Figure 94		+70 <sup>°</sup> C	_	30°		
ow bi	ias mode: V <sub>DD</sub> = 10V							1
					TLC2			
	Develop	Conditions				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	21170,	11014
	Parameter	Con	ditions	TA		TLC271B		Unit
	Parameter	Con	ditions	T <sub>A</sub>				Unit
	Parameter	Con	ditions	<b>T</b> ▲ +25 <sup>°</sup> C		TLC271B	c	
		<b>Con</b> R <sub>L</sub> = 1MΩ,	ditions VI(PP) = 1V		Min	TLC271B Typ	C Max	
<u> </u>				+25 <sup>°</sup> C	Min —	TLC271B Typ 0.05	C Max —	 
SR	Slew Rate at Unity Gain	R <sub>L</sub> = 1MΩ,		+25 <sup>°</sup> C 0 <sup>°</sup> C	Min —	TLC271B Typ 0.05 0.05	C Max —	
SR		R <sub>L</sub> = 1MΩ, C <sub>L</sub> = 20pF		+25 <sup>°</sup> C 0 <sup>°</sup> C +70 <sup>°</sup> C	Min 	TLC271B Typ 0.05 0.05 0.04	C Max 	 
SR		R <sub>L</sub> = 1MΩ, C <sub>L</sub> = 20pF See	VI(PP) = 1V	+25 <sup>°</sup> C 0 <sup>°</sup> C +70 <sup>°</sup> C +25 <sup>°</sup> C	Min — — —	TLC271B Typ 0.05 0.05 0.04 0.04	C Max — — —	 
SR Vn		R <sub>L</sub> = 1MΩ, C <sub>L</sub> = 20pF See	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega$	+25 °C 0 °C +70 °C +25 °C 0 °C	Min — — — —	Typ           0.05           0.04           0.04	C Max — — — —	  V/μs
	Slew Rate at Unity Gain	$R_L = 1M\Omega,$ $C_L = 20pF$ See Figure 92 $F = 1kHz, R_S$ See Figure 93	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega$	+25°C 0°C +70°C +25°C 0°C +70°C +70°C	Min — — — —	Typ           0.05           0.04           0.05           0.04           0.05	C Max — — — —	  V/μs
	Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing	$R_L = 1M\Omega$ , $C_L = 20pF$ See Figure 92 $F = 1kHz$ , $R_S$ See Figure 93 $V^\circ = V^\circ H$ , $C_L =$	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega$ $= 20PF, R_{L} = 1M\Omega$	+25 °C 0 °C +70 °C +25 °C 0 °C +70 °C +25 °C	Min —— —— —— —— ——	Typ           0.05           0.04           0.05           0.04           0.05           0.04           0.05	C Max — — — — — — — — —	  V/μs
Vn	Slew Rate at Unity Gain	$R_L = 1M\Omega,$ $C_L = 20pF$ See Figure 92 $F = 1kHz, R_S$ See Figure 93	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega$ $= 20PF, R_{L} = 1M\Omega$	+25 °C 0 °C +70 °C +25 °C 0 °C +70 °C +25 °C +25 °C +25 °C	Min —— —— —— —— ——	Typ           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.104           0.05           0.104           1	C Max —— —— —— —— —— ——	 V/μs  nV/√Hz
Vn	Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing	R <sub>L</sub> = 1MΩ, C <sub>L</sub> = 20pF See Figure 92 F = 1kHz, R <sub>S</sub> See Figure 93 V° = V° <sub>H</sub> , C <sub>L</sub> = See Figure 92	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ = 200 20pF, RL = 1MΩ	+25°C 0°C +70°C +25°C 0°C +70°C +25°C +25°C +25°C 0°C	Min —— —— —— —— ——	Typ           0.05           0.04           0.05           0.04           0.05           0.04           1	C Max —— —— —— —— —— ——	 V/μs  nV/√Hz
Vn	Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing Bandwidth	$R_{L} = 1M\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S}$ See Figure 93 $V^{\circ} = V^{\circ}H, C_{L} =$ See Figure 92 $V_{I} = 10mV, C_{L}$	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ = 200 20pF, R <sub>L</sub> = 1MΩ = 20pF	+25°C 0°C +70°C +25°C 0°C +70°C +25°C +25°C 0°C +70°C +70°C	Min —— —— —— —— —— —— —— ——	Typ           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           68           1           1.3           0.9	C Max —— —— —— —— —— —— —— —— —— ——	 V/μs  nV/√Hz
Vn B∘M	Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing	R <sub>L</sub> = 1MΩ, C <sub>L</sub> = 20pF See Figure 92 F = 1kHz, R <sub>S</sub> See Figure 93 V° = V° <sub>H</sub> , C <sub>L</sub> = See Figure 92	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ = 200 20pF, R <sub>L</sub> = 1MΩ = 20pF	+25°C 0°C +70°C +25°C 0°C +70°C +25°C +25°C 0°C +70°C +70°C +25°C	Min —— —— —— —— —— —— —— —— —— —— ——	Typ           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           68           1           1.3           0.9           110	C Max —— —— —— —— —— —— —— —— —— —— —— ——	 V/μs nV/√Hz kHz
Vn B∘M	Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing Bandwidth	R <sub>L</sub> = 1MΩ, C <sub>L</sub> = 20pF See Figure 92 F = 1kHz, R <sub>S</sub> · See Figure 93 V° = V°H, C <sub>L</sub> = See Figure 92 V <sub>1</sub> = 10mV, C <sub>L</sub> See Figure 94	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ = 200 20pF, R <sub>L</sub> = 1MΩ = 20pF	+25°C 0°C +70°C +25°C 0°C +70°C +25°C +25°C 0°C +70°C +25°C 0°C +70°C +70°C +70°C	Min	Typ           0.05           0.04           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           0.04           0.05           1.3           0.9           110           125	C Max —— —— —— —— —— —— —— —— —— —— —— —— ——	 V/μs nV/√Hz kHz
Vn B∘M	Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing Bandwidth	R <sub>L</sub> = 1MΩ, C <sub>L</sub> = 20pF See Figure 92 F = 1kHz, R <sub>S</sub> · See Figure 93 V° = V°H, C <sub>L</sub> = See Figure 92 V <sub>1</sub> = 10mV, C <sub>L</sub> See Figure 94	$V_{I(PP)} = 1V$ $V_{I(PP)} = 5.5V$ $= 20\Omega$ $= 20pF, R_L = 1M\Omega$ = 20pF = 20pF	+25°C 0°C +70°C +25°C 0°C +70°C +25°C +25°C 0°C +70°C +25°C 0°C +25°C 0°C +25°C 0°C	Min	Typ           0.05           0.04           0.04           0.05           0.04           0.05           1.3           0.9           110           125           90	C Max — — — — — — — — — — — — — — — — — — —	V/µs nV/√Hz kHz



	Parameter	Cond	litions	TA	TLC	271I, TLC TLC271E		Unit
					Min	Тур	Max	
				+25 <sup>°</sup> C	_	0.03	_	
		R <sub>L</sub> = 1MΩ,	$V_{I(PP)} = 1V$	-40 <sup>°</sup> C	_	0.04	—	
		$C_L = 20 pF$		+85 <sup>°</sup> C	_	0.03		
SR	Slew Rate at Unity Gain	See		+25 <sup>°</sup> C	_	0.03	—	V/µs
		Figure 92	V <sub>I(PP)</sub> = 2.5V	-40 <sup>°</sup> C	_	0.04	—	
				+85 <sup>°</sup> C	_	0.02		
Vn	Equivalent Input Noise Voltage	F = 1kHz, R <sub>S</sub> = See Figure 93	20Ω	+25 <sup>°</sup> C	_	68	_	nV/√Hz
				+25 <sup>°</sup> C	_	5		
В∘м	Maximum Output Swing		20pF, R <sub>L</sub> = 1MΩ	-40 <sup>°</sup> C		7	—	kHz
	Bandwidth	See Figure 92		+85 <sup>°</sup> C		4		
				+25 <sup>°</sup> C	_	85	_	
B <sub>1</sub>	Unity Gain Bandwidth	$V_I = 10mV, C_L$	= 20pF	-40 <sup>°</sup> C		130	_	MHz
		See Figure 94		+85 <sup>°</sup> C		55	_	
				+25 <sup>°</sup> C	_	34°		
фm	Phase Margin		mV, $C_L = 20pF$	-40 <sup>°</sup> C	_	38°		
Ŧ	· · · · · · · · · · · · · · · · · · ·	See Figure 94		+85 <sup>°</sup> C	_	28°	T	-
ow hi	a mada: \/ _ 10\/					-		
- 11 MI	as mode: v <sub>DD</sub> = 10v							
	as mode: V <sub>DD</sub> = 10V				TLC	271I, TLC	271AI,	
	Parameter	Conc	litions	TA	TLC	271I, TLC TLC271E		Unit
		Conc	litions	TA	TLC:			Unit
		Conc	litions	<b>T</b> <sub>A</sub> +25 <sup>°</sup> C		TLC271E	81	Unit —
						TLC271E Typ	81	Unit 
	Parameter	R <sub>L</sub> = 1MΩ,	VI(PP) = 1V	+25 <sup>°</sup> C -40 <sup>°</sup> C		TLC271E           Typ           0.05           0.06	81	
SR				+25 <sup>°</sup> C -40 <sup>°</sup> C +85 <sup>°</sup> C	Min — —	TLC271E Typ 0.05 0.06 0.03	BI Max 	Unit — V/µs
	Parameter	R <sub>L</sub> = 1MΩ, C <sub>L</sub> = 20pF	V <sub>I(PP)</sub> = 1V	+25 <sup>°</sup> C -40 <sup>°</sup> C +85 <sup>°</sup> C +25 <sup>°</sup> C	Min 	Typ           0.05           0.06           0.03           0.04	BI Max	
	Parameter	$R_L = 1M\Omega$ , $C_L = 20pF$ See		+25 °C -40 °C +85 °C +25 °C -40 °C	Min 	Typ           0.05           0.06           0.03           0.04           0.05	BI Max	-
	Parameter	$R_L = 1M\Omega$ , $C_L = 20pF$ See Figure 92 $F = 1kHz$ , $R_S =$	V <sub>I</sub> (PP) = 1V V <sub>I</sub> (PP) = 5.5V : 20Ω	+25 <sup>°</sup> C -40 <sup>°</sup> C +85 <sup>°</sup> C +25 <sup>°</sup> C	Min — — — —	Typ           0.05           0.06           0.03           0.04	BI Max	-
SR	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage	$R_L = 1M\Omega$ , $C_L = 20pF$ See Figure 92 $F = 1kHz$ , $R_S =$ See Figure 93	V <sub>I</sub> (PP) = 1V V <sub>I</sub> (PP) = 5.5V ÷ 20Ω	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C	Min — — — —	Typ           0.05           0.06           0.03           0.04           0.05	BI Max	 V/µs
SR Vn	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing	$R_{L} = 1M\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S} =$ See Figure 93 $V_{\circ} = V_{\circ}H, C_{L} =$	V <sub>I</sub> (PP) = 1V V <sub>I</sub> (PP) = 5.5V : 20Ω	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C +25°C	Min — — — —	Typ           0.05           0.06           0.03           0.04           0.05           0.03           1	BI Max	 V/μs  nV/√Hz
SR Vn	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage	$R_L = 1M\Omega$ , $C_L = 20pF$ See Figure 92 $F = 1kHz$ , $R_S =$ See Figure 93	V <sub>I</sub> (PP) = 1V V <sub>I</sub> (PP) = 5.5V ÷ 20Ω	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C +25°C -40°C	Min — — — —	Typ           0.05           0.06           0.03           0.04           0.05           0.03           0.4           0.5           1           1.4	BI Max	 V/µs
SR Vn	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing	$R_{L} = 1M\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S} =$ See Figure 93 $V^{\circ} = V^{\circ}H, C_{L} =$ See Figure 92	V <sub>I</sub> (PP) = 1V V <sub>I</sub> (PP) = 5.5V : 20Ω 20pF, R <sub>L</sub> = 1MΩ	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C -40°C +85°C -40°C +85°C	Min — — — —	Typ           0.05           0.06           0.03           0.04           0.05           0.03           68           1           1.4           0.8	BI Max	 V/μs  nV/√Hz
SR Vn B∘M	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing Bandwidth	$R_{L} = 1M\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S} =$ See Figure 93 $V^{\circ} = V^{\circ}H, C_{L} =$ See Figure 92 $V_{I} = 10mV, C_{L}$	V <sub>I</sub> (PP) = 1V V <sub>I</sub> (PP) = 5.5V : 20Ω 20pF, R <sub>L</sub> = 1MΩ	+25°C -40°C +85°C +25°C -40°C +25°C +25°C +25°C +25°C +25°C +85°C +25°C +25°C	Min — — — —	Typ           0.05           0.06           0.03           0.04           0.05           0.03           68           1           1.4           0.8           110	BI Max 	V/µs NV/√Hz
SR Vn	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing	$R_{L} = 1M\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S} =$ See Figure 93 $V^{\circ} = V^{\circ}H, C_{L} =$ See Figure 92	V <sub>I</sub> (PP) = 1V V <sub>I</sub> (PP) = 5.5V : 20Ω 20pF, R <sub>L</sub> = 1MΩ	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C	Min — — — —	Typ           0.05           0.06           0.03           0.04           0.05           0.03           0.4           0.05           0.03           68           1           1.4           0.8           110           155	BI Max 	 V/μs  nV/√Hz
SR Vn B∘M	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing Bandwidth	$R_{L} = 1M\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S} =$ See Figure 93 $V^{\circ} = V^{\circ}H, C_{L} =$ See Figure 92 $V_{I} = 10mV, C_{L}$	V <sub>I</sub> (PP) = 1V V <sub>I</sub> (PP) = 5.5V : 20Ω 20pF, R <sub>L</sub> = 1MΩ	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C +25°C -40°C +85°C +25°C -400°C +85°C	Min — — — —	Typ           0.05           0.06           0.03           0.04           0.05           0.03           68           1           1.4           0.8           110           155           80	BI Max 	V/µs NV/√Hz
SR Vn B∘M	Parameter Slew Rate at Unity Gain Equivalent Input Noise Voltage Maximum Output Swing Bandwidth	$R_{L} = 1M\Omega,$ $C_{L} = 20pF$ See Figure 92 $F = 1kHz, R_{S} =$ See Figure 93 $V^{\circ} = V^{\circ}H, C_{L} =$ See Figure 92 $V_{I} = 10mV, C_{L}$ See Figure 94	V <sub>I</sub> (PP) = 1V V <sub>I</sub> (PP) = 5.5V : 20Ω 20pF, R <sub>L</sub> = 1MΩ	+25°C -40°C +85°C +25°C -40°C +85°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C +25°C	Min — — — —	Typ           0.05           0.06           0.03           0.04           0.05           0.03           0.4           0.05           0.03           68           1           1.4           0.8           110           155	BI Max 	V/µs NV/√Hz

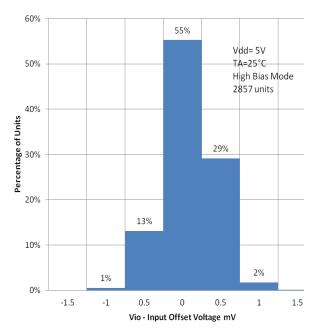


# TLC271, TLC271A, TLC271B

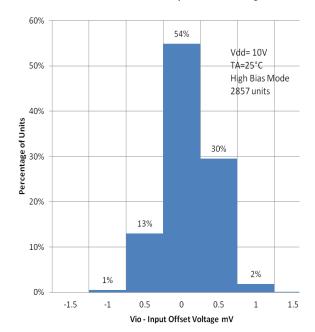
# Typical Performance Characteristics Table Index of Graphs

				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
N/		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
۱ı	Input Offset Current	vs. Free Air Temperature	15	45	75
V <sub>IC</sub>	Common Mode Input Voltage	vs. Supply Voltage	16	46	76
	Supply Current	vs. Supply Voltage	17	47	77
IDD	Supply Current	vs. Free Air Temperature	18	48	78
SR	Slew Rate	vs. Supply Voltage	19	49	79
SK	Siew Rale	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
P	Unity Gain Bandwidth	vs. Free Air Temperature	23	53	83
B <sub>1</sub>		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
φm	Phase Margin	vs. Free Air Temperature	26	56	86
		vs. Capacitive Load	27	57	87
Vn	Equivalent Input Noise Voltage	vs. Frequency	28	58	88
<b>∮</b> shift	Phase Shift	vs. Frequency	29,30	59,60	89,90





Distribution of TLC271 Input Offset Voltage



#### Distribution of TLC271 Input Offset Voltage



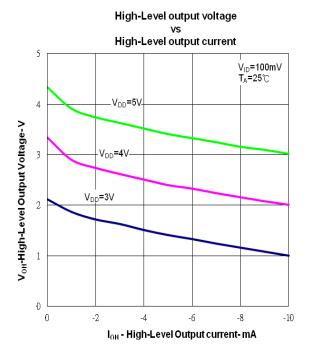


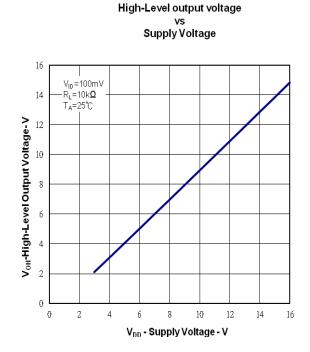
Figure 1

Figure 3

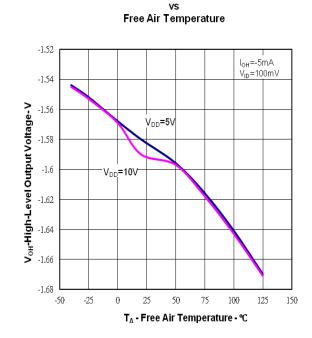
High-Level output voltage VS High-Level output current 18 . V<sub>ID</sub>=100mV T<sub>A</sub>=25°C 16 V<sub>DD</sub>=16V 14 V<sub>0H</sub>-High-Level Output Voltage-V 12 10 V<sub>DD</sub>=10V 8 б 4 2 0 -5 -15 -20 -25 -30 -35 0 -10 -40  $I_{\rm OH}$  - High-Level Output current- mA











High-Level output voltage

Figure 6

Low-level output voltage vs common-mode input voltage

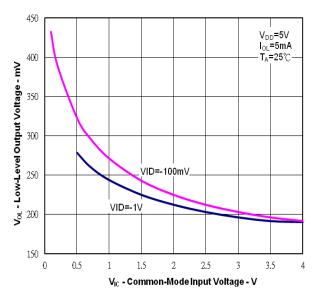


Figure 7

Low-level output voltage vs common-mode input voltage

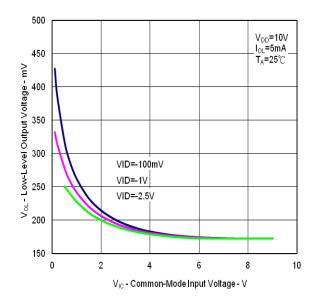
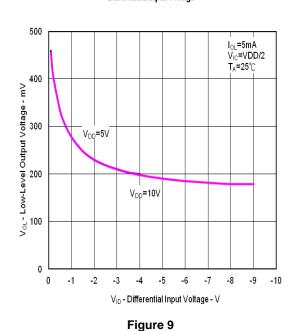
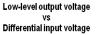
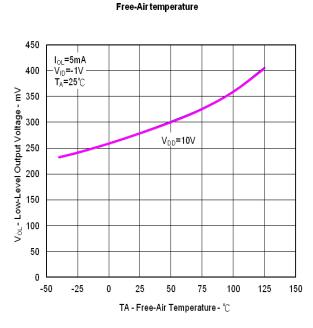


Figure 8









Low-level output voltage

vs



Low-level output voltage vs Low-level output current

V<sub>DD</sub>=4

4

Figure 11

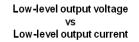
Io1 - Low-Level Output Current - mA

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

2

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

6



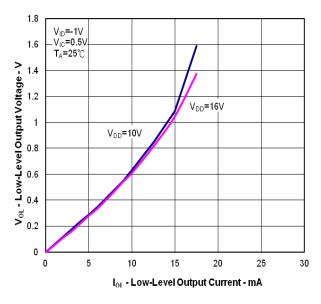


Figure 12

0.8

0.7

0.6

0.5

0.4

0.3

0.2

0.1

0

0

V<sub>oL</sub> - Low-Level Output Voltage - V

V<sub>ID</sub>=-1V

V<sub>IC</sub>=0.5V

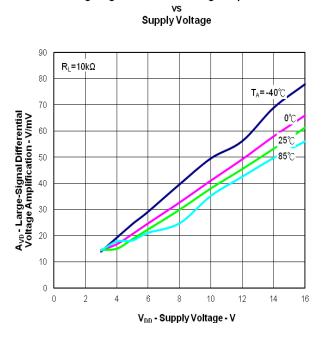
T<sub>A</sub>=25℃

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

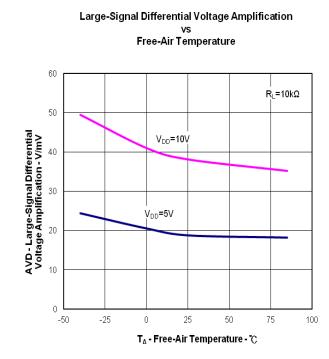
8



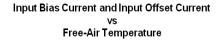
Large-Signal Differential Voltage Amplification

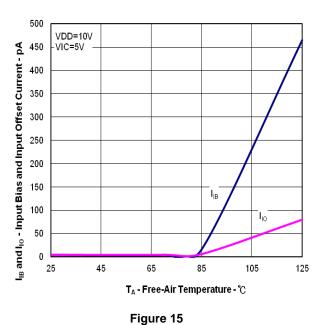




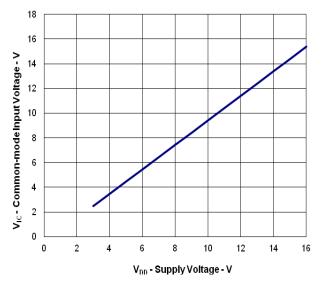






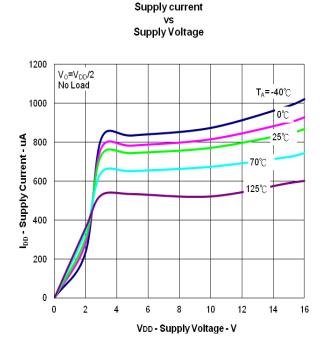


Common-mode input voltage (positive limit) vs Supply Voltage



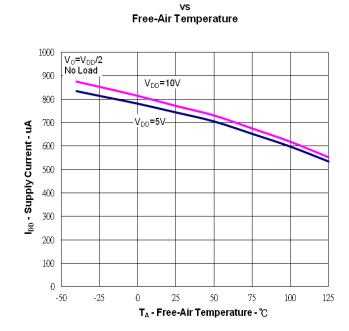












Supply current

Figure 18

6 AV=1 V<sub>I(PP)</sub>=1V R<sub>L</sub>=10k**Ω** 5 C<sub>L</sub>=20pF T<sub>A</sub>=25℃ **SR - Slew Rate - V/JJS** 1 0 2 8 0 4 6 10 12 14 16 V<sub>DD</sub> - Supply Voltage - V

Figure 19

Slew rate vs Free-Air Temperature

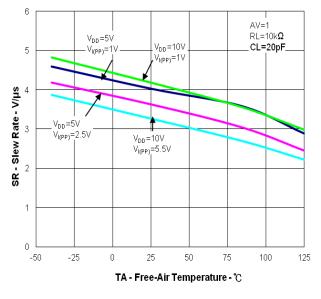
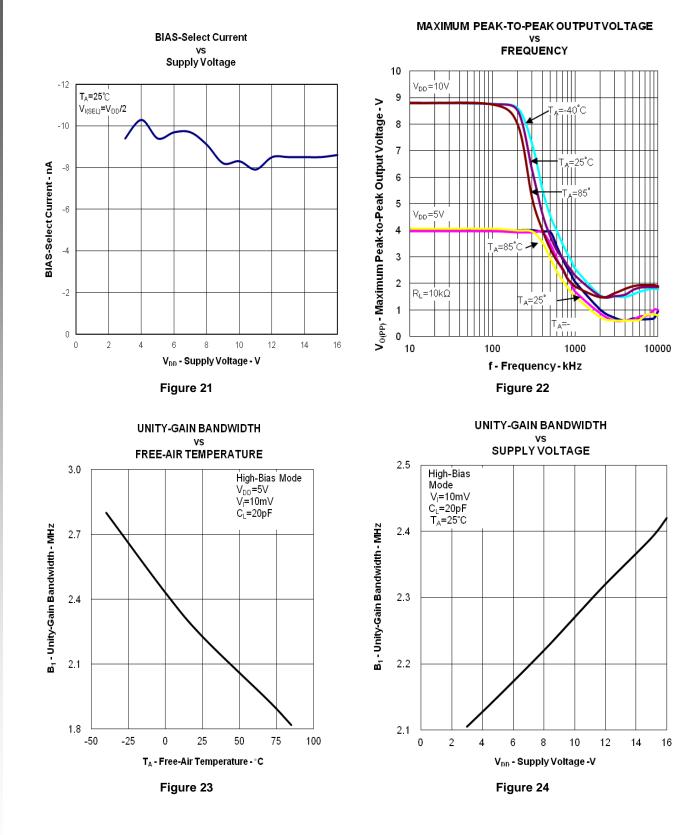
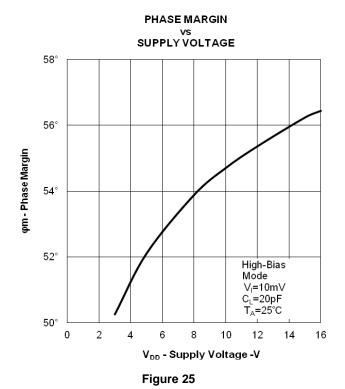


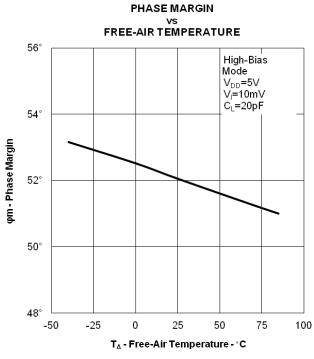
Figure 20













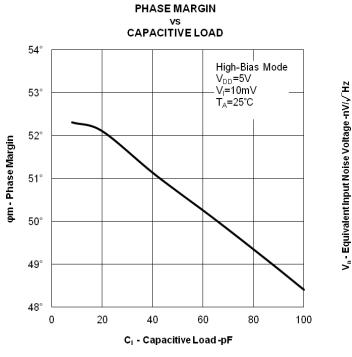


Figure 27

#### EQUIVALENT INPUT NOISE VOLTAGE vs FREQUENCY

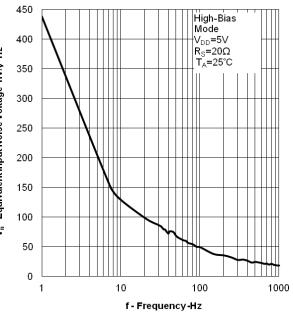
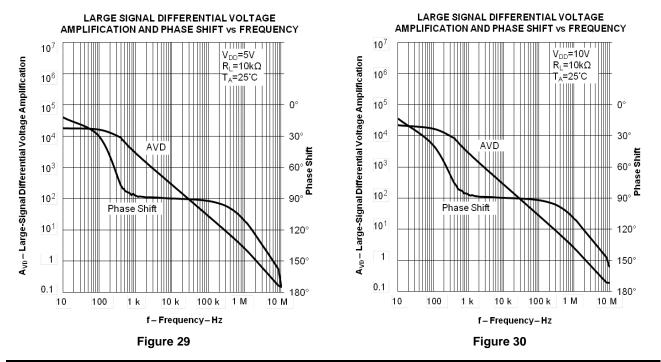


Figure 28





# Typical Performance Characteristics Medium Bias Mode

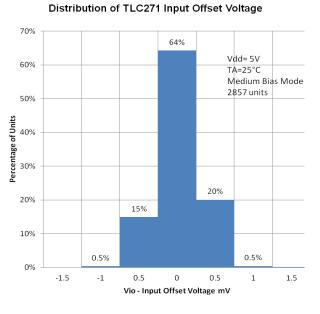
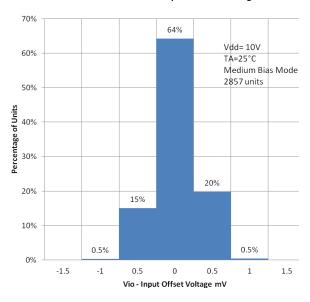


Figure 31

Distribution of TLC271 Input Offset Voltage







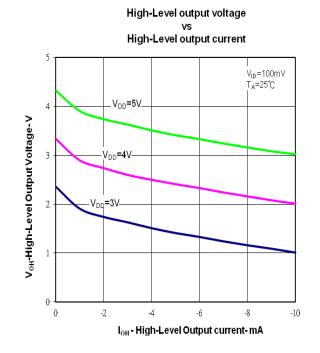
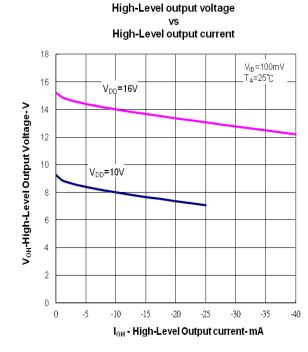


Figure 33







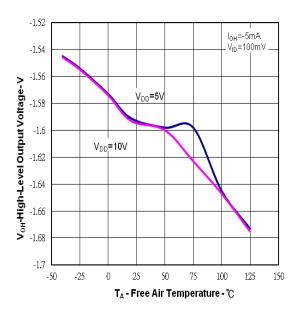
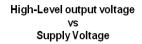


Figure 36



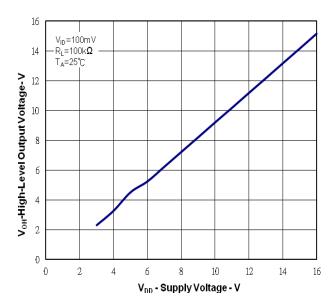
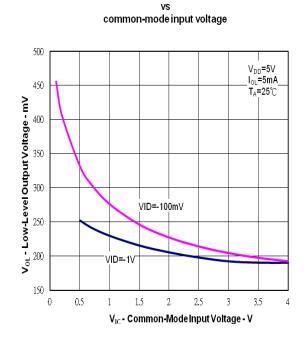


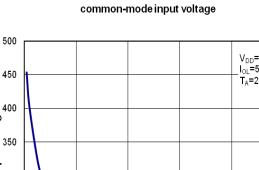
Figure 35





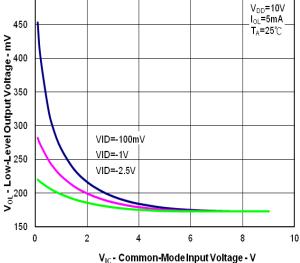
Low-level output voltage

Figure 37



Low-level output voltage

vs





Low-level output voltage ٧S Free-Air temperature

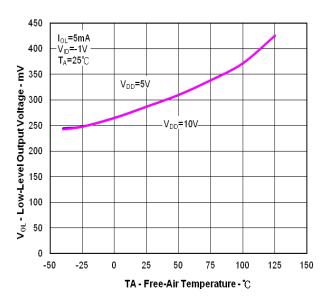


Figure 40

Low-level output voltage VS **Differential input voltage** 

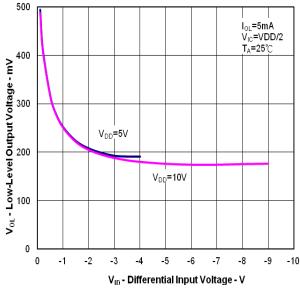
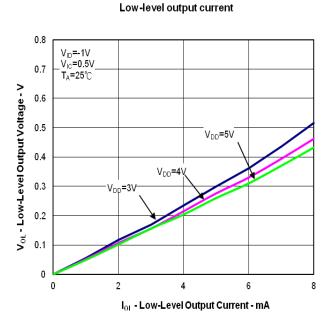


Figure 39

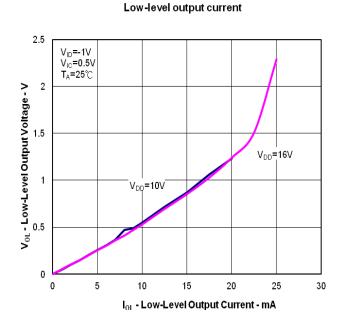




Low-level output voltage

vs

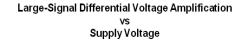
Figure 41



Low-level output voltage

vs





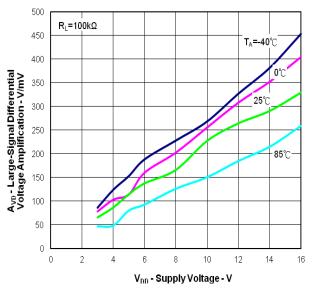


Figure 43

Large-Signal Differential Voltage Amplification vs Free-Air Temperature

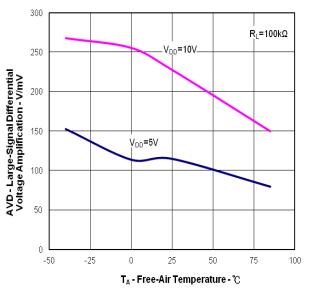


Figure 44

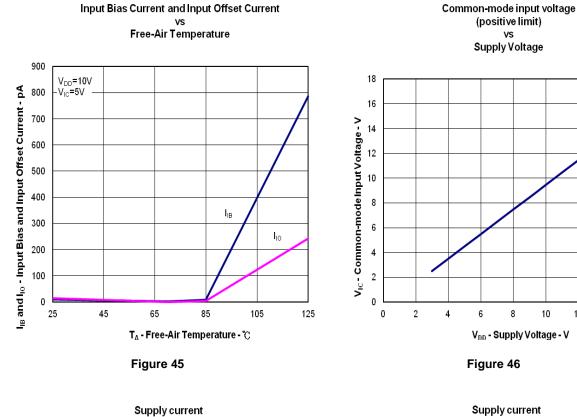


**New Product** 

(positive limit)

vs Supply Voltage

# **Typical Performance Characteristics Medium Bias Mode**



vs Supply Voltage

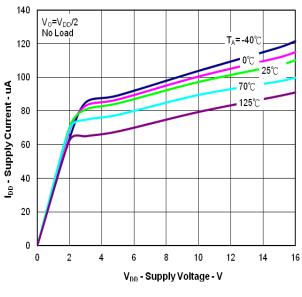


Figure 47

Supply current ٧S Free-Air Temperature

8

VDD - Supply Voltage - V

6

Figure 46

10

12

16

14

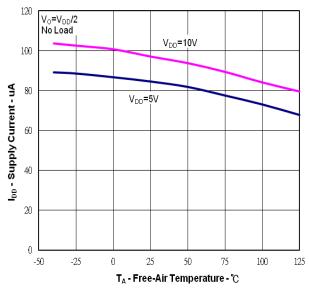
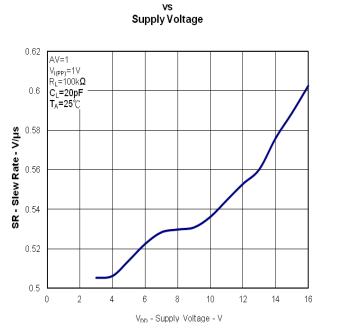


Figure 48





Slew Rate

Free-Air Temperature 0.8 AV=1 \_RL=100k**Ω** V<sub>DD</sub>=5V 0.7 V<sub>DD</sub>=10V CL=20pF V<sub>I(PP)</sub>=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 0 25 50 75 100 125 TA - Free-Air Temperature - °C

Slew rate

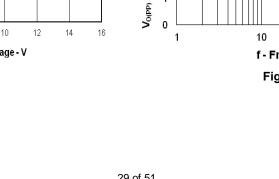
vs

Figure 49

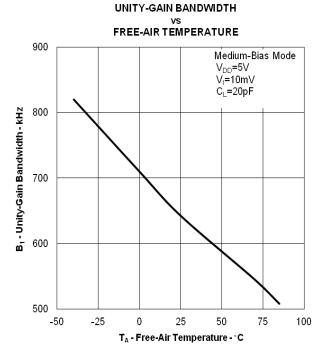


**BIAS-Select Current** ٧S FREQUENCY Supply Voltage 10 V<sub>DD</sub>=10V -14 T<sub>A</sub>=25℃ 9 V<sub>o(PP)</sub> - Maximum Peak-to-Peak Output Voltage - V V<sub>I(SEL)</sub>=V<sub>DD</sub> ,=-40°C -12 8 =25° 7 -10 ,=85°C BIAS-Select Current - nA 6 -8 5 v<sub>dd</sub>=5v -6 4 T<sub>A</sub>=85° 3 -4 2 R<sub>L</sub>=100k -2 1 -40°C 0 0 2 8 10 12 0 4 6 14 16 10 100 1000 1 V<sub>DD</sub> - Supply Voltage - V f - Frequency - kHz Figure 51 Figure 52

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE ٧S









56°

54°

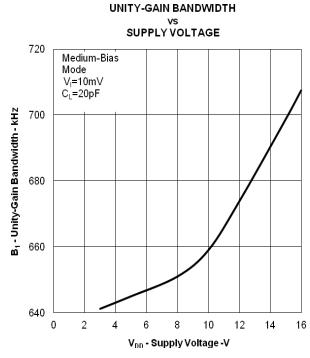
52°

50°

0

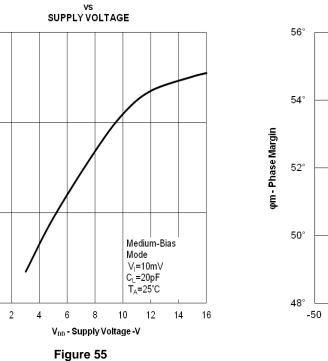
φm - Phase Margin

PHASE MARGIN





# 



vs FREE-AIR TEMPERATURE

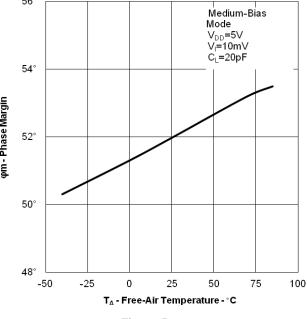
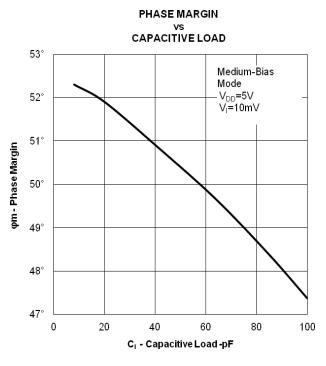


Figure 56



EQUIVALENT INPUT NOISE VOLTAGE

## **Typical Performance Characteristics Medium Bias Mode**



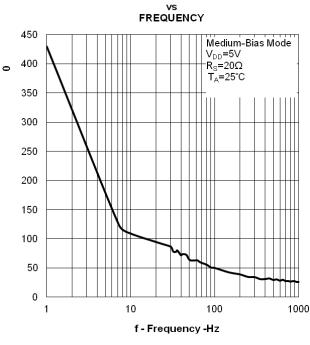
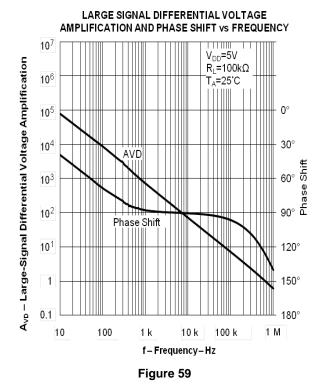
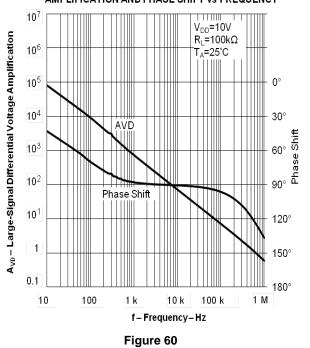


Figure 57

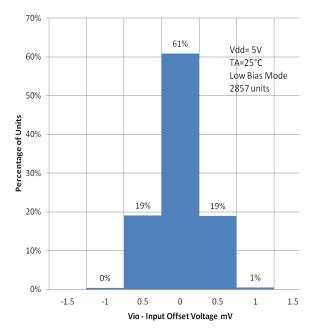




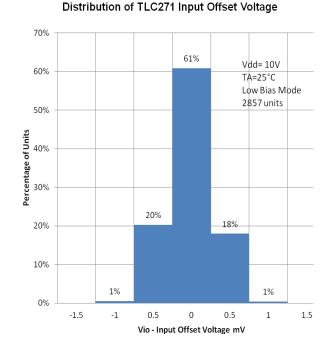
LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT vs FREQUENCY



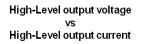




#### Distribution of TLC271 Input Offset Voltage



#### Figure 61



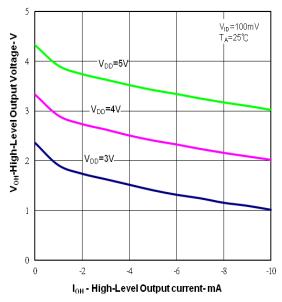
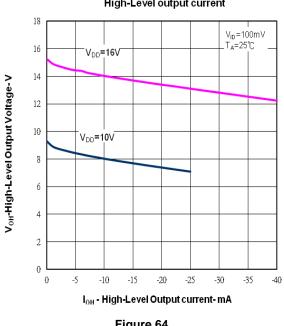


Figure 63

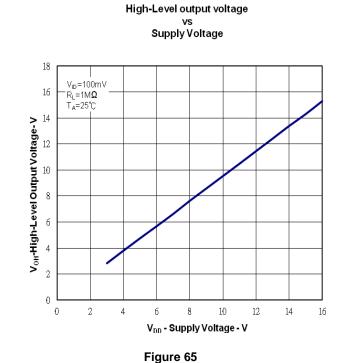
Figure 62

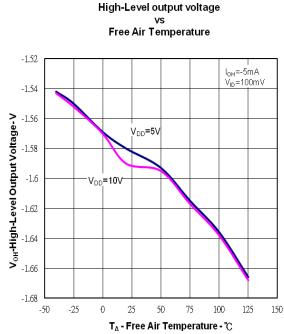


High-Level output voltage vs High-Level output current

Figure 64









l ow-level output voltag

Low-level output voltage vs common-mode input voltage

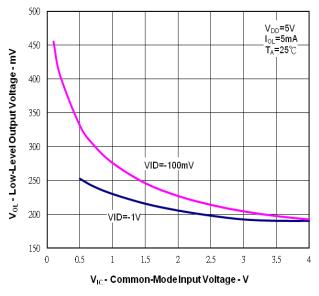
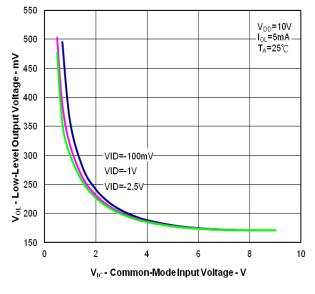


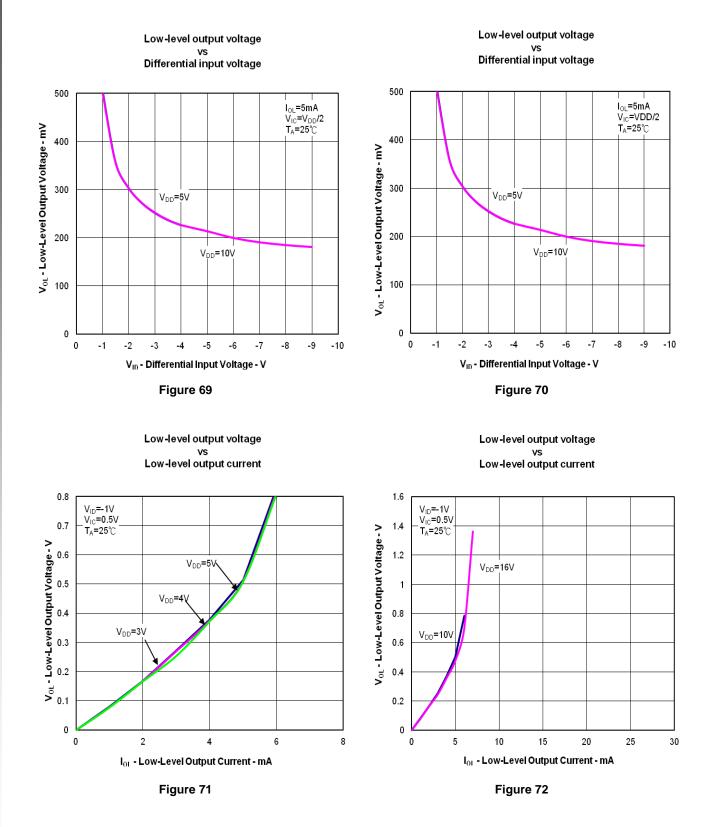
Figure 67

Low-level output voltage vs common-mode input voltage

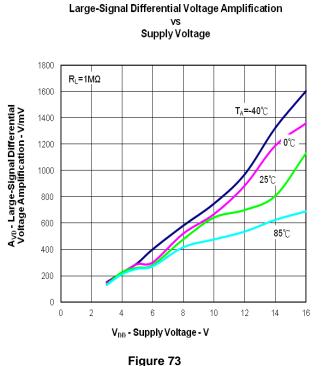












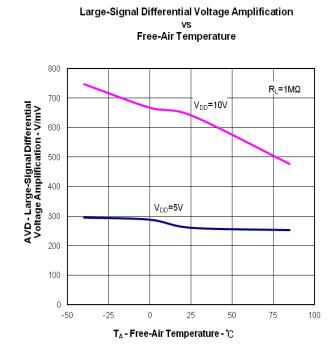


Figure 74

Common-mode input voltage

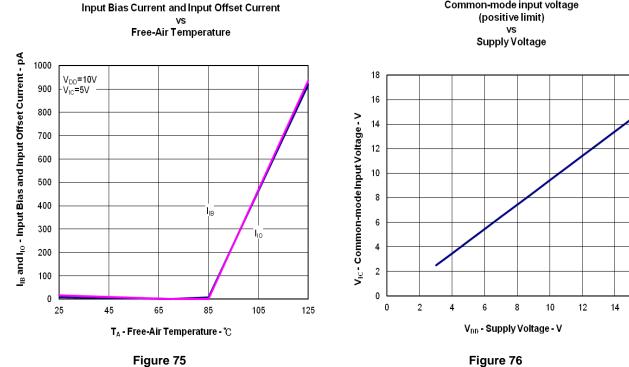


Figure 76

16



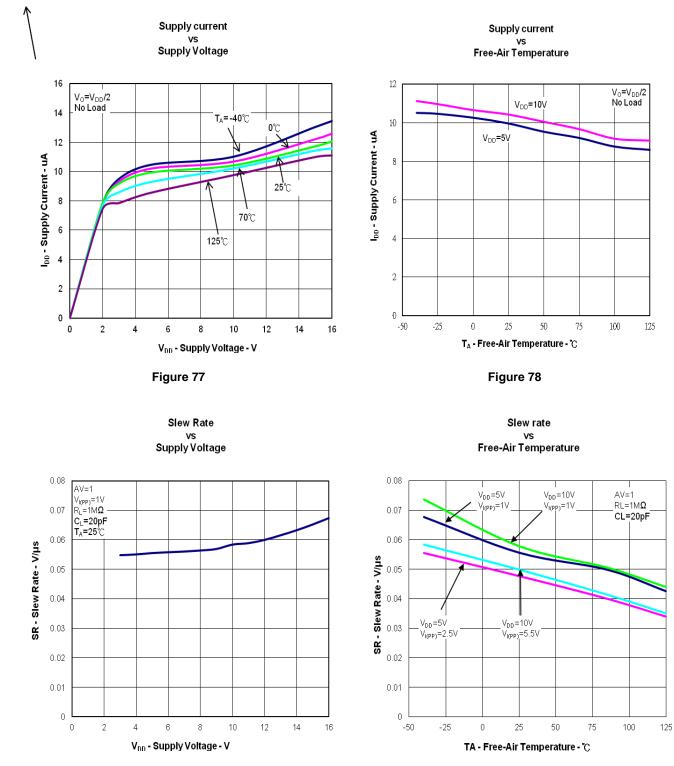
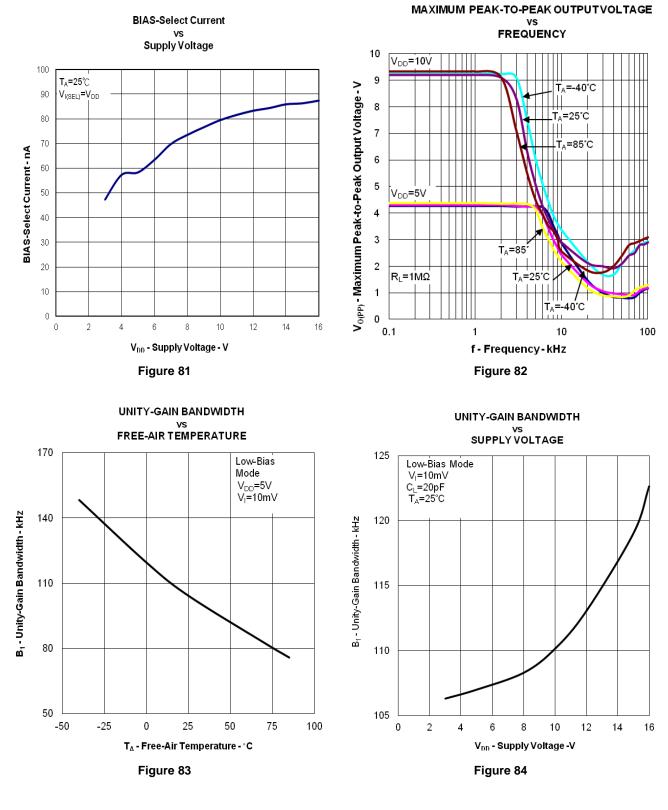


Figure 79

Figure 80

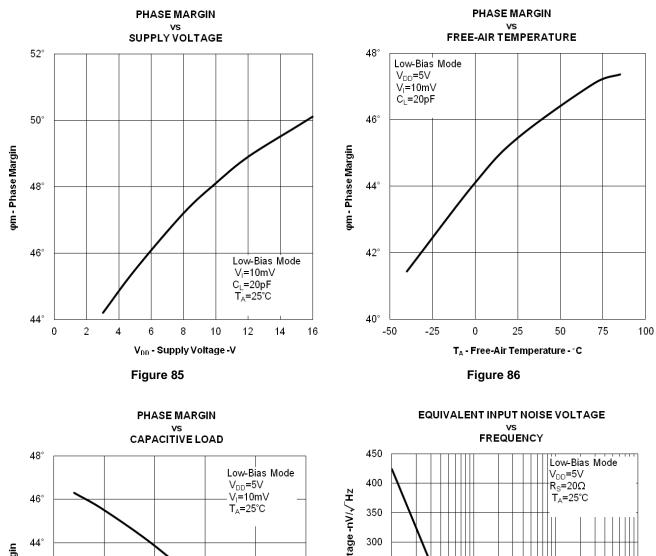


## **Typical Performance Characteristics Low Bias Mode**





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



PHASE MARGIN VS CAPACITIVE LOAD 46° 46° 44° 42° 40° 40° 38° 36° 0 20 40 60 80 100 C<sub>1</sub> - Capacitive Load -pF Figure 87

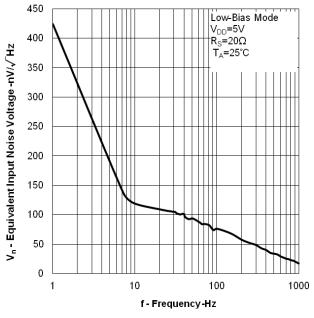
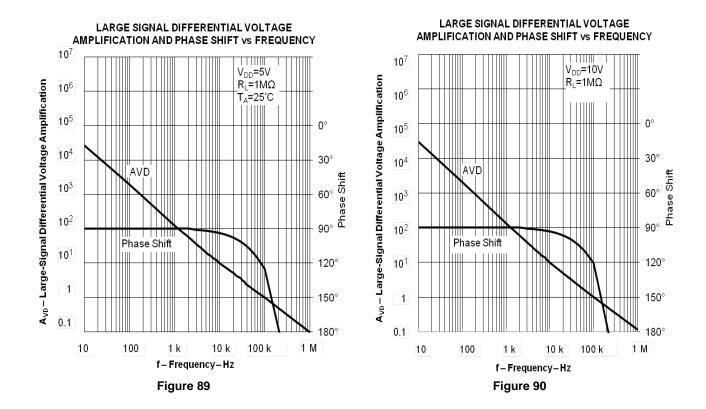


Figure 88



## Typical Performance Characteristics Low Bias Mode





### **Application Information**

#### **Bias select feature**

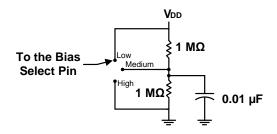
The TLC271 offers a bias-select feature that allows the user to select any one of three bias levels depending on the level of performance desired. The trade-off between bias levels relates to ac performance and power dissipation as below.

Typical values $T_A = +25$ °C, $V_{DD} = 5V$		Mode			
		High bias	Medium bias	Low bias	Units
		$R_L = 10k\Omega$	$R_L = 100 k\Omega$	$R_L = 1M\Omega$	
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
фm	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 <sub>DD</sub>
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.

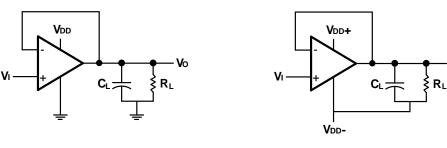


Vo

### Application Information (cont.)

#### Parameter measurement circuits

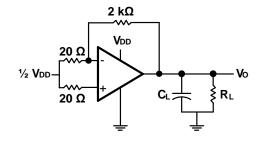
Because the TLC271 is optimized for single-supply operation, circuit configurations used for the various tests can present some difficulties since the input signal must be offset from ground. This issue can be avoided by testing the device with split supplies and the output load tied to the negative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

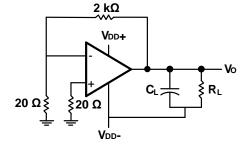


(a) Single Supply



#### Figure 92 Measurement circuit with either single or split supply

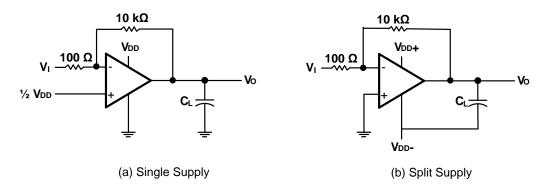




(a) Single Supply



Fig 93 Noise measurement with single or split supply



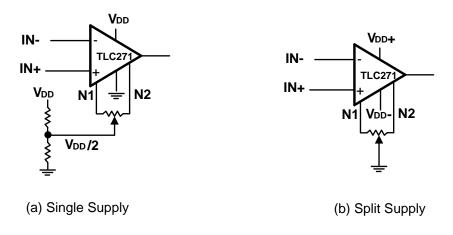
#### Figure 94 Gain of 100 with single or split supply



### **Application Notes**

#### **Offset Voltage Nulling Circuit**

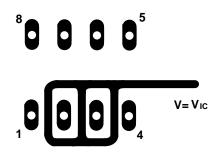
The TLC271 offers external input offset null control. Nulling of the input off set voltage may be achieved by adjusting a  $100-k\Omega$  potentiometer connected between the offset null terminals with the wiper connected as shown in Figure 95. The amount of nulling range varies with the bias selection. 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**

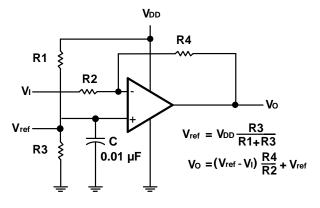
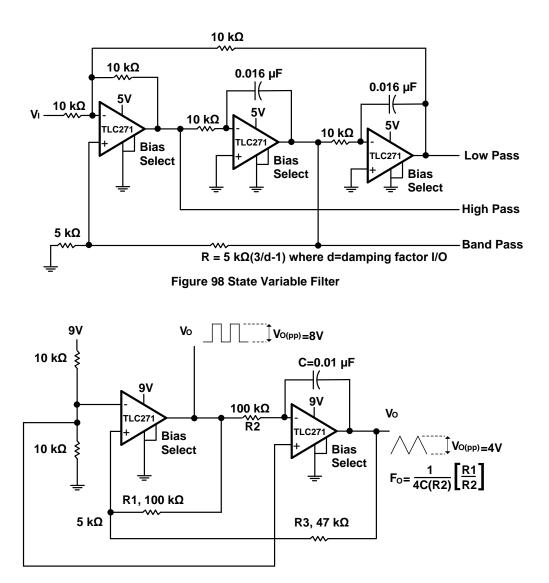
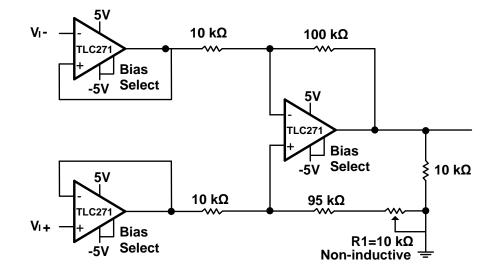


Figure 97 Inverting Amplifier With Voltage Reference

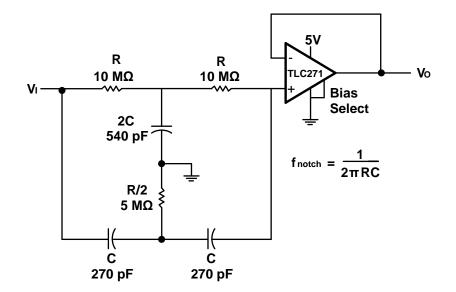


#### Figure 99 Single Supply Function Generator













# TLC271, TLC271A, TLC271B

### Typical Application Circuits (cont.)

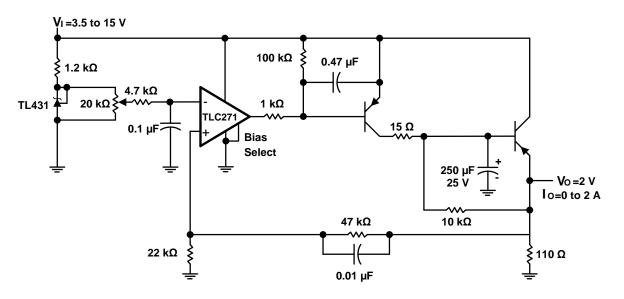


Figure 102 Power Supply

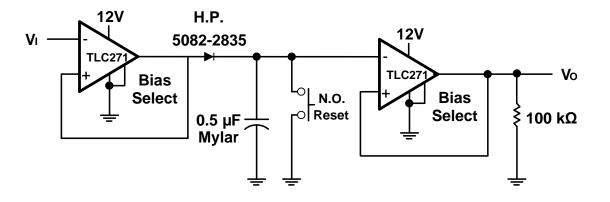


Figure 103 Positive Peak Detector



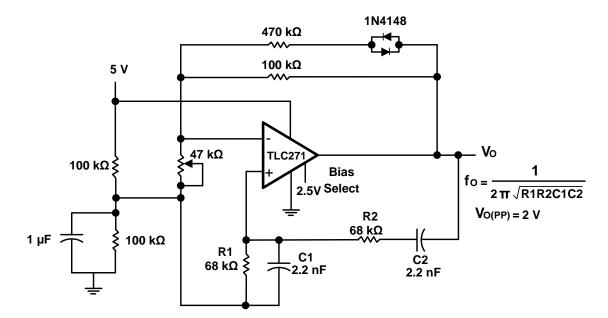


Figure 104 Wein Oscillator

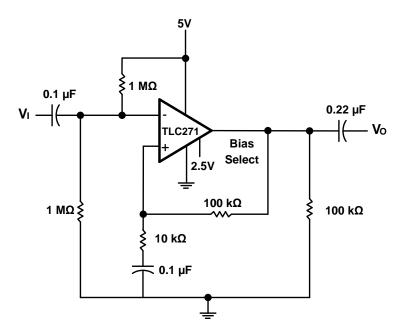


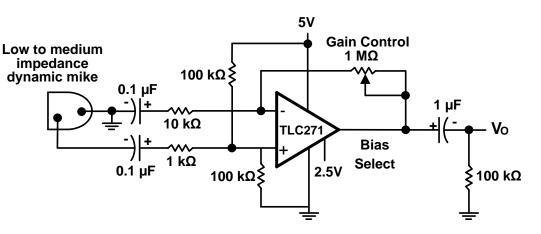
Figure 105 Single-Supply AC Amplifier

TLC271, TLC271A, TLC271B Document number: DS35395 Rev. 1 - 0



## TLC271, TLC271A, TLC271B

### Typical Application Circuits (cont.)



**Figure 106 Microphone Preamplifier** 

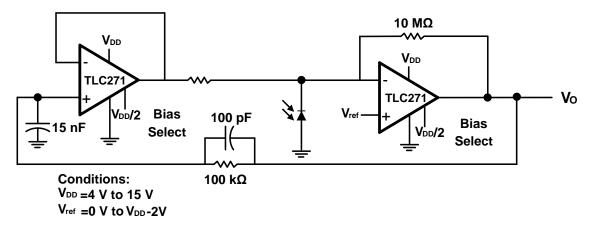
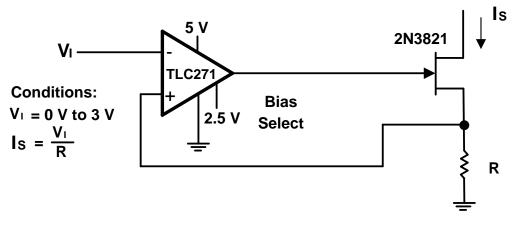
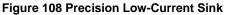
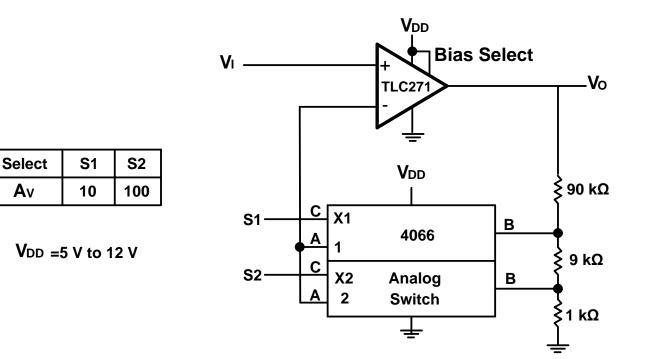


Figure 107 Photo-Diode Amplifier With Ambient Light Rejection

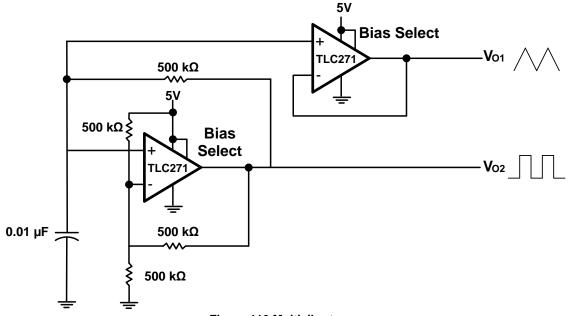




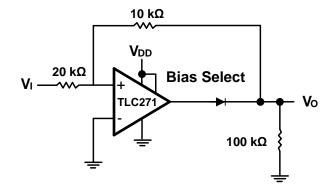




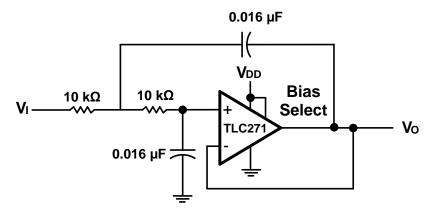












Nomalized to  $F_C = 1 \text{ kHz}$  and  $R_{\perp} = 10 \text{ k}\Omega$ 

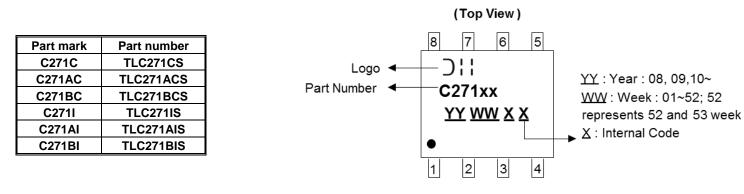
Figure 112 Two-Pole Low-Pass Butterworth Filter

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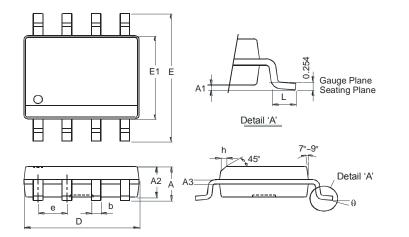
### **Marking Information**

### SO-8



### **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			
E	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					



## TLC271, TLC271A, TLC271B

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