

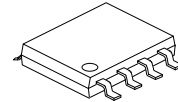


CMOS PRECISION DUAL OPERATIONAL AMPLIFIERS

DESCRIPTION

The UTC **ULC272** precision dual operational amplifiers combine a wide range of input offset voltage grades with low offset voltage drift, high input impedance, low noise, and speeds approaching that of general-purpose BIFET devices.

The extremely high input impedance, low bias currents, and high slew rates make these cost-effective devices ideal for applications which have previously been reserved for BIFET and NFET products. These advantages, in combination with good common-mode rejection and supply voltage rejection, make these devices a good choice for new state-of-the-art designs as well as for upgrading existing designs.



SOP-8

FEATURES

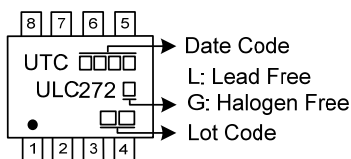
- * Low Input Offset Voltage Drift
- * Wide Range of Supply Voltages Over Specified Temperature
Range: -40°C to 85°C...4V to 16V
- * Single-Supply Operation
- * Common-Mode Input Voltage Range Extends Below the Negative Rail
- * Output Voltage Range Includes Negative Rail

ORDERING INFORMATION

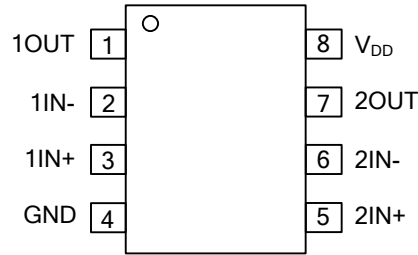
Ordering Number		Package	Packing
Lead Free	Halogen Free		
ULC272L-S08-R	ULC272G-S08-R	SOP-8	Tape Reel

<p>ULC272G-S08-R</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>	<p>(1) R: Tape Reel</p> <p>(2) S08: SOP-8</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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MARKING



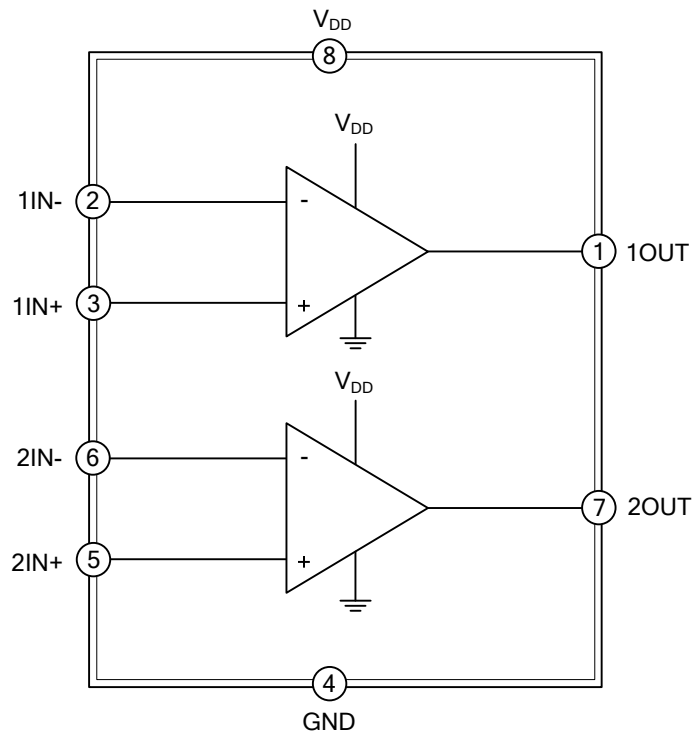
■ PIN CONFIGURATION



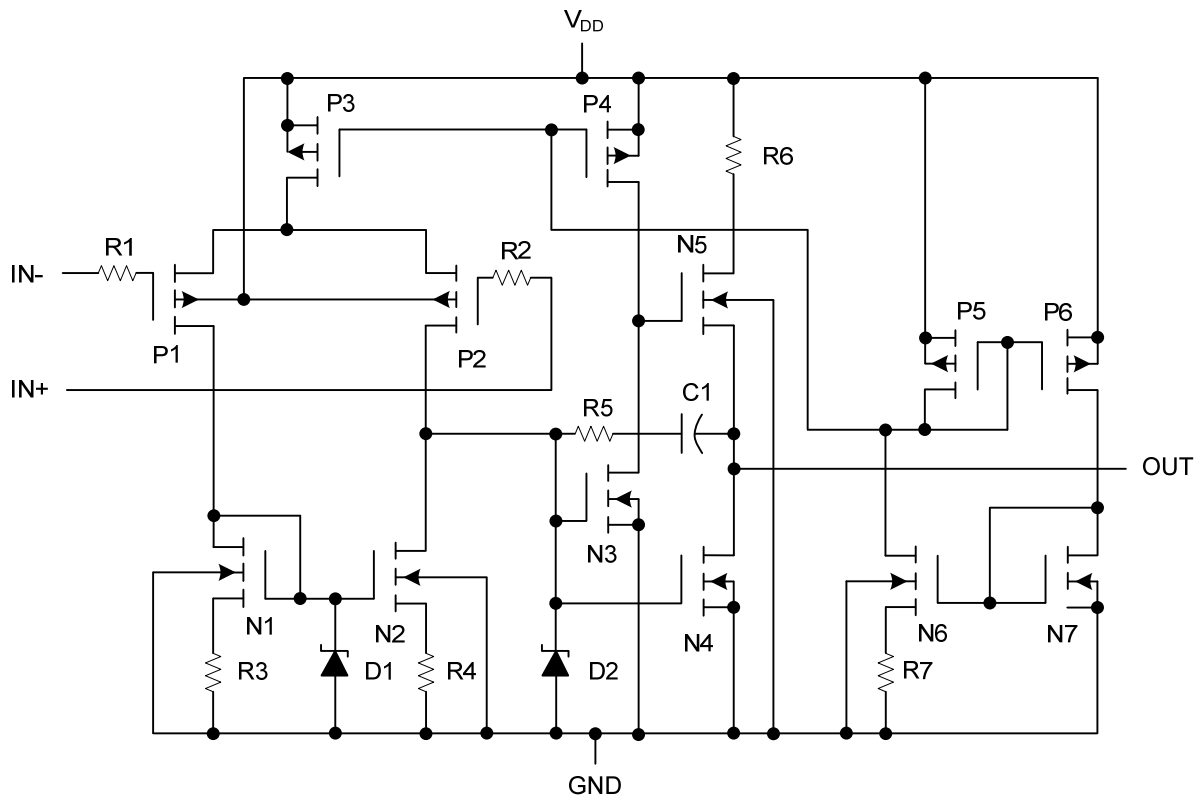
■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	1OUT	Channel 1 output pin
2	1IN-	Inverting input for channel 1
3	1IN+	Non-inverting input for channel 1
4	GND	Ground
5	2IN+	Non-inverting input for channel 2
6	2IN-	Inverting input for channel 2
7	2OUT	Channel 2 output pin
8	V _{DD}	Supply voltage input pin

■ BLOCK DIAGRAM



■ EQUIVALENT SCHEMATIC (each amplifier)



■ ABSOLUTE MAXIMUM RATING (unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage (Note 2)	V_{DD}	18	V
Differential Input Voltage (Note 3)	V_{ID}	$\pm V_{DD}$	V
Input Voltage Range (any Input)	V_I	$-0.3 \sim V_{DD}$	V
Input Current	I_I	± 5	mA
Output Current (Each Output)	I_O	± 30	mA
Total Current into V_{DD}		45	mA
Total Current Out of GND		45	mA
Power Dissipation ($T_A=25^\circ\text{C}$)	P_D	725	W
Operating Free-Air Temperature	T_A	$-40 \sim +85$	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	$-65 \sim +150$	$^\circ\text{C}$

- Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
 2. All voltage values, except differential voltages, are with respect to network ground.
 3. Differential voltages are at IN+ with respect to IN-.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Supply Voltage	V_{DD}	4		16	V
Common-Mode Input Voltage	V_{IC}	$V_{DD}=5\text{V}$	-0.2	3.5	V
		$V_{DD}=10\text{V}$	-0.2	8.5	V
Operating Free-Air Temperature	T_A	-40		+85	$^\circ\text{C}$

■ ELECTRICAL CHARACTERISTICS

(Specified free-air temperature, $V_{DD}=5\text{V}$, $T_A=25^\circ\text{C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Input Offset Voltage	V_{IO}	$V_O=1.4\text{V}$, $V_{IC}=0$, $R_S=50\Omega$, $R_L=10\text{k}\Omega$	$T_A=25^\circ\text{C}$		1.1	10	mV
			$T_A=-40^\circ\text{C} \sim 85^\circ\text{C}$			13	mV
Temperature Coefficient of Input offset Voltage	α_{VIO}			1.8		$\mu\text{V}/^\circ\text{C}$	
Input Offset Current (Note 1)	I_{IO}	$V_O=2.5\text{V}$, $V_{IC}=2.5\text{V}$		0.1		pA	
Input Bias Current (Note 1)	I_{IB}	$V_O=2.5\text{V}$, $V_{IC}=2.5\text{V}$		0.6		pA	
Common Mode Input Voltage Range (Note 2)	V_{ICR}		$T_A=25^\circ\text{C}$	-0.2~4	-0.3~4.2	V	
			$T_A=-40^\circ\text{C} \sim +85^\circ\text{C}$	-0.2~3.5		V	
High Level Output Voltage	V_{OH}	$V_{ID}=100\text{mV}$, $R_L=10\text{k}\Omega$	3.2	3.8		V	
Low Level Output Voltage	V_{OL}	$V_{ID}=-100\text{mV}$, $I_{OL}=0$		0	50	mV	
Large-Signal Differential Voltage Amplification	A_{VD}	$V_O=1\text{V} \sim 6\text{V}$, $R_L=10\text{k}\Omega$	5	23		V/mV	
Common-Mode Rejection Ratio	CMRR	$V_{IC}=V_{ICR_MIN}$	65	80		dB	
Supply-Voltage Rejection Ratio ($\Delta V_{DD}/\Delta V_{IO}$)	K_{SVR}	$V_{DD}=5\text{V} \sim 10\text{V}$, $V_O=1.4\text{V}$	65	95		dB	
Supply Current (Two Amplifiers)	I_{DD}	$V_O=5\text{V}$, $V_{IC}=5\text{V}$, No Load		1.4	3.2	mA	

- Notes: 1. The typical values of input bias current and input offset current below 5pA were determined mathematically
 2. This range also applies to each input individually.

■ ELECTRICAL CHARACTERISTICS

(Specified free-air temperature, $V_{DD}=10V$, $T_A=25^\circ C$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	V_{IO}	$V_O=1.4V$, $V_{IC}=0$, $R_S=50\Omega$, $R_L=10k\Omega$	$T_A=25^\circ C$	1.1	10	mV
			$T_A=-40^\circ C\sim 85^\circ C$		13	mV
Temperature Coefficient of Input offset Voltage	α_{VIO}			2		$\mu V/^\circ C$
Input Offset Current (Note 1)	I_{IO}	$V_O=5V$, $V_{IC}=5V$		0.1		pA
Input Bias Current (Note 1)	I_{IB}	$V_O=5V$, $V_{IC}=5V$		0.7		pA
Common Mode Input Voltage Range (Note 2)	V_{ICR}		$T_A=25^\circ C$	-0.2~9	-0.3~9.2	V
			$T_A=-40^\circ C\sim 85^\circ C$	-0.2~8.5		V
High Level Output Voltage	V_{OH}	$V_{ID}=100mV$, $R_L=10k\Omega$	7.8	8.5		V
Low Level Output Voltage	V_{OL}	$V_{ID}=-100mV$, $I_{OL}=0$		0	50	mV
Large-Signal Differential Voltage Amplification	A_{VD}	$V_O=1V\sim 6V$, $R_L=10k\Omega$	10	36		V/mV
Common-Mode Rejection Ratio	CMRR	$V_{IC}=V_{ICR_MIN}$	65	85		dB
Supply-Voltage Rejection Ratio ($\Delta V_{DD}/\Delta V_{IO}$)	k_{SVR}	$V_{DD}=5V\sim 10V$, $V_O=1.4V$	65	95		dB
Supply Current (Two Amplifiers)	I_{DD}	$V_O=5V$, $V_{IC}=5V$, No Load		1.4	4	mA

Notes: 1. The typical values of input bias current and input offset current below 5pA were determined mathematically

2. This range also applies to each input individually.

■ OPERATING CHARACTERISTICS (at specified free-air temperature, $V_{DD}=5V$, $T_A=25^\circ C$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Slew Rate at Unity Gain	SR	$R_L=10k\Omega$, $C_L=20pF$, See Figure 1	$V_{IPP}=1V$	3.6		V/ μs
			$V_{IPP}=2.5V$	2.9		V/ μs
Equivalent Input Noise Voltage	V_N	$f=1kHz$, $R_S=20\Omega$, See Figure 2		25		nV/\sqrt{Hz}
Maximum Output-Swing Bandwidth	B_{OM}	$V_O=V_{OH}$, $C_L=20pF$, $R_L=10k\Omega$, See Figure 1		320		kHz
Unity-Gain Bandwidth	B_1	$V_I=10mV$, $C_L=20pF$, See Figure 3		1.7		MHz
Phase Margin	ϕ_m	$V_I=10mV$, $f=B_1$, $C_L=20pF$, See Figure 3		46°		

■ OPERATING CHARACTERISTICS (at specified free-air temperature, $V_{DD}=10V$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Slew Rate at Unity Gain	SR	$R_L=10k\Omega$, $C_L=20pF$, See Figure 1	$V_{IPP}=1V$	5.3		V/ μs
			$V_{IPP}=5.5V$	4.6		V/ μs
Equivalent Input Noise Voltage	V_N	$f=1kHz$, $R_S=20\Omega$, See Figure 2		25		nV/\sqrt{Hz}
Maximum Output-Swing Bandwidth	B_{OM}	$V_O=V_{OH}$, $C_L=20pF$, $R_L=10k\Omega$, See Figure 1		200		kHz
Unity-Gain Bandwidth	B_1	$V_I=10mV$, $C_L=20pF$, See Figure 3		2.2		MHz
Phase Margin	ϕ_m	$V_I=10mV$, $f=B_1$, $C_L=20pF$, See Figure 3		49°		

■ PARAMETER MEASUREMENT INFORMATION

Because the UTC **ULC272** is optimized for single-supply operation, circuit configurations used for the various tests often present some inconvenience since the input signal, in many cases, must be offset from ground. This inconvenience can be avoided by testing the device with split supplies and the output load tied to the negative rail. A comparison of single-supply versus split-supply test circuits is shown below. The use of either circuit gives the same result.

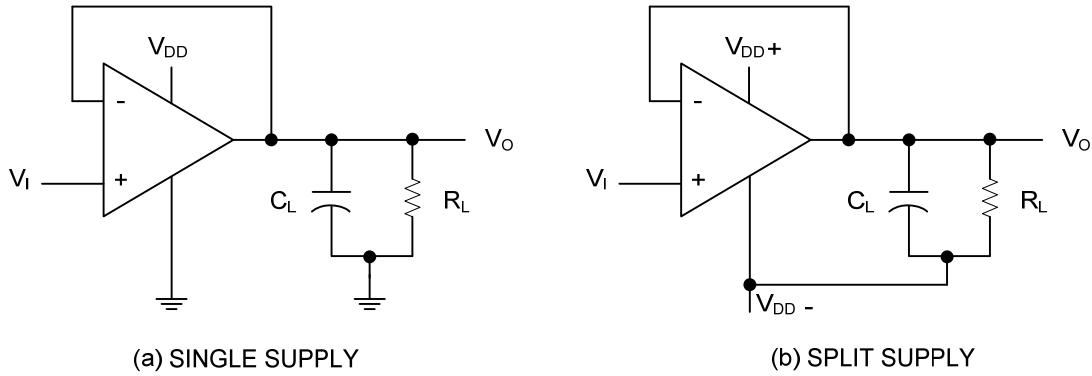


Figure 1. Unity-Gain Amplifier

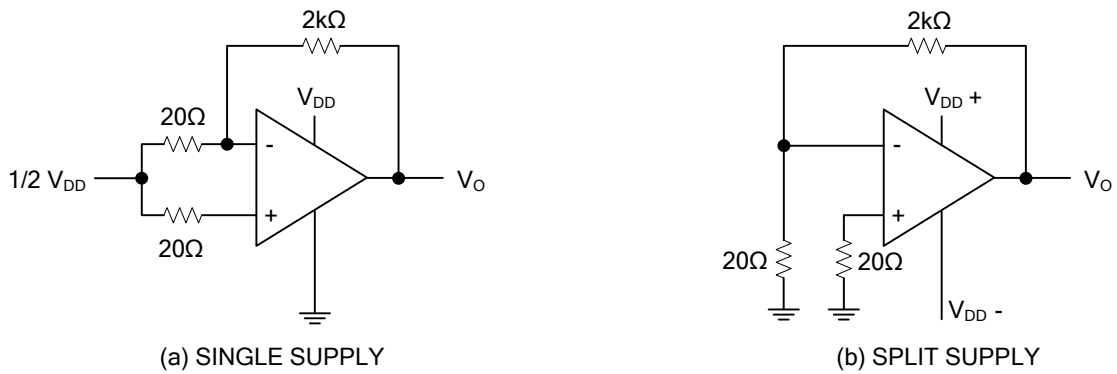


Figure 2. Noise-Test Circuit

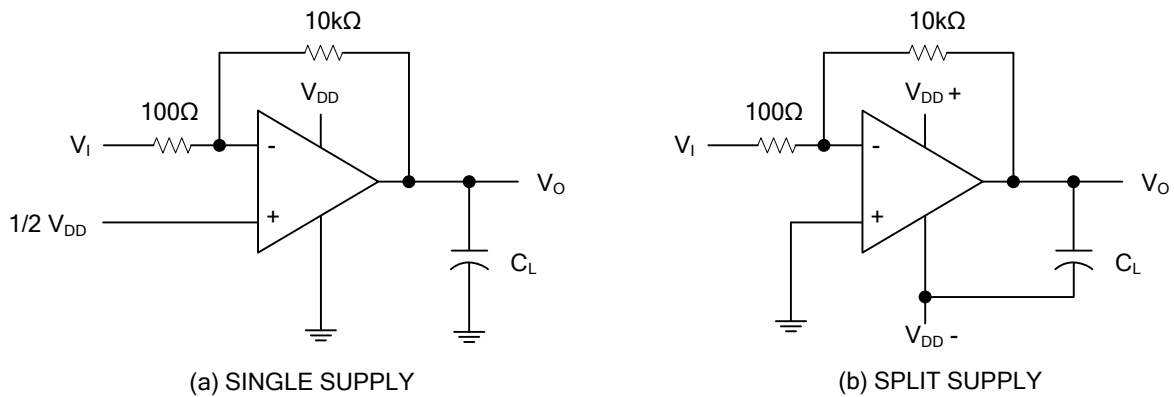


Figure 3. Gain-of-100 Inverting Amplifier

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