

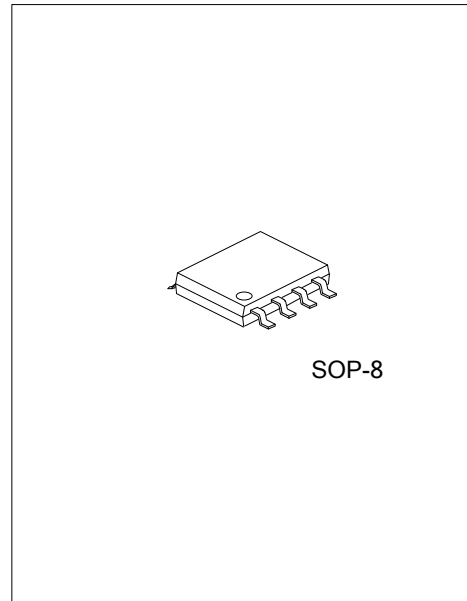


ULV7002

Preliminary

CMOS IC

1.5V, 0.23 μ A/CH, ULTRALOW POWER, RAIL-TO-RAIL INPUT/OUTPUT DUAL CMOS OPERATIONAL AMPLIFIER



DESCRIPTION

The UTC **ULV7002** is dual ultralow power operational amplifiers designed to extend battery life and performance for portable applications. The operating voltage range of 1.5V to 5.5V and supply current of 0.23 μ A/ch (dual) typical, with stable over temperature and input voltage change make them deal for micropower oxygen sensors, gas sensors and remote sensor applications.

In addition to the ultralow power and low operating voltage, rail-to-rail input and output, input offset voltage of 3.0mV, input bias current of 1pA typical and ability to drive 470pF loads, make the UTC **ULV7002** series ideal when requiring excellent performance in battery powered applications.

FEATURES

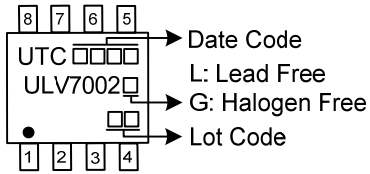
- * Supply Current: 0.23 μ A/ch typ.
- * Operating Voltage: 1.5V~5.5V
- * Input Offset Voltage: 3.0mV max.
- * Input Bias Current: 1pA typ.
- * Rail-to-Rail Input/Output
- * CMOS Technology

ORDERING INFORMATION

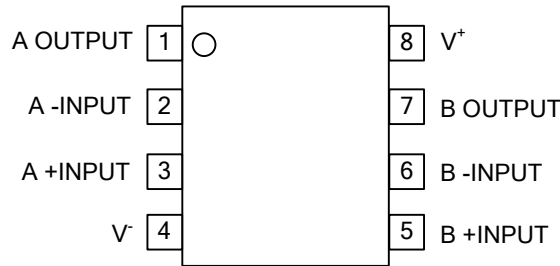
| Ordering Number | | Package | Packing |
|-----------------|----------------|---------|-----------|
| Lead Free | Halogen Free | | |
| ULV7002L-S08-R | ULV7002G-S08-R | SOP-8 | Tape Reel |

| | |
|---|--|
| <p>ULV7002G-S08-R</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p> | <p>(1) R: Tape Reel (2) S08: SOP-8 (3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|---|--|

MARKING



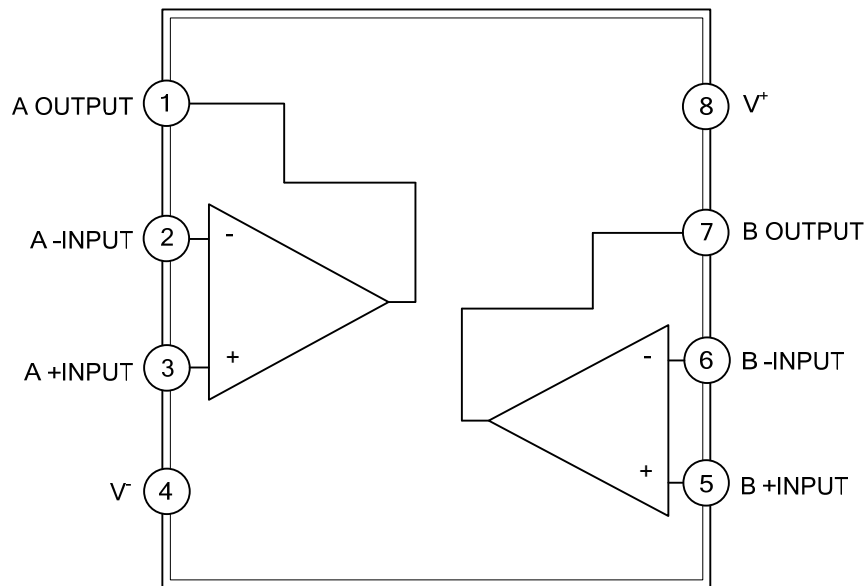
PIN CONFIGURATION



PIN DESCRIPTION

| PIN NO. | PIN NAME | DESCRIPTION |
|---------|----------------|---------------------------------|
| 1 | A OUTPUT | Output pin of A AMP |
| 2 | A -INPUT | Invert input pin of A AMP |
| 3 | A +INPUT | Non-invert input of A AMP |
| 4 | V ⁻ | Negative (lowest) power supply |
| 5 | B +INPUT | Non-invert input of B AMP |
| 6 | B -INPUT | Invert input pin of B AMP |
| 7 | B OUTPUT | Output pin of B AMP |
| 8 | V ⁺ | Positive (highest) power supply |

BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

| PARAMETER | SYMBOL | RATINGS | UNIT |
|-------------------------------------|-------------|----------------------------|------|
| Supply Voltage | $V^+ - V^-$ | 7 | V |
| Differential Input Voltage (Note 1) | V_{ID} | ± 7 (Note 2) | V |
| Input Voltage | V_{IN} | $V^- - 0.3 \sim V^+ + 0.3$ | V |
| Power Dissipation (Note 3) | P_D | 500 | mW |
| Operating Temperature Range | T_{OPR} | -40 ~ +105 | °C |
| Storage Temperature Range | T_{STG} | -55 ~ +125 | °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. Differential voltage is the voltage difference between +INPUT and -INPUT.

3. For supply voltage less than +7V, the absolute maximum rating is equal to the supply voltage.

4. Power dissipation is the power that can be consumed by the IC at $T_A=25^\circ\text{C}$, and is the typical measured value based on JEDEC condition. When using the IC over $T_A=25^\circ\text{C}$ subtract the value
 $[\text{mW}/^\circ\text{C}] = P_D / (T_{STG}(\text{Max.}) - 25)$ per temperature.

2-layer: EIA/JEDEC STANDARD Test board (76.2x114.3x1.6mm, 2layers, FR-4) mounting.

■ RECOMMENDED OPERATING CONDITION ($T_A=25^\circ\text{C}$, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|----------------|-------------|-----------------|-----|-----|-----|------|
| Supply Voltage | $V^+ - V^-$ | | 1.5 | | 5.5 | V |

■ ELECTRICAL CHARACTERISTICS

($V^+=5\text{V}$, $V^-=0\text{V}$, $V_{CM}=2.5\text{V}$, $R_L=100\text{k}\Omega$ to 2.5V, $T_A=25^\circ\text{C}$, unless otherwise specified)

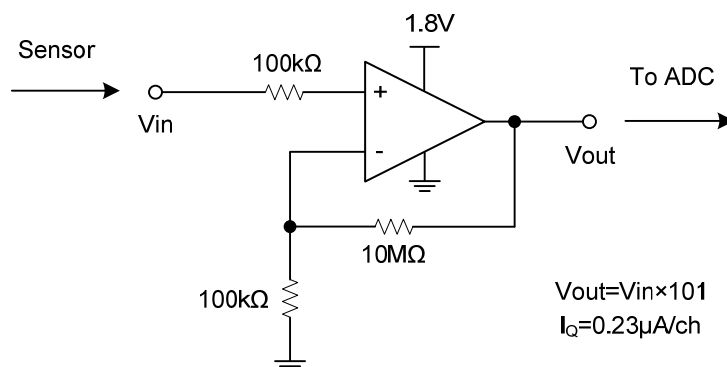
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---------------------------------|-----------|---|-----|------|------|------------------------|
| DC CHARACTERISTICS | | | | | | |
| Supply Current (All Channel) | I_Q | No Signal | | 0.46 | 0.76 | μA |
| Input Offset Voltage | V_{IO} | $V_{CM}=0\text{V}$ | | 0.5 | 3.0 | mV |
| Input Bias Current | I_B | | | 1 | | pA |
| Input Offset Current | I_{IO} | | | 1 | | pA |
| Voltage Gain | A_V | $V_{OUT}=0.5\text{V}\sim 4.5\text{V}$ | 70 | 100 | | dB |
| Common-Mode Rejection Ratio | CMR | $V_{CM}=0\text{V}\sim 5\text{V}$ | 60 | 80 | | dB |
| Supply Voltage Rejection Ratio | SVR | $V^+=1.5\text{V}\sim 5.5\text{V}$, $V_{CM}=0\text{V}$ | 55 | 90 | | dB |
| Maximum Output Voltage | V_{OH} | $R_L=100\text{k}\Omega$ to 2.5V | 4.9 | 4.95 | | V |
| | V_{OL} | $R_L=100\text{k}\Omega$ to 2.5V | | 0.05 | 0.1 | V |
| Common-Mode Input Voltage Range | V_{ICM} | CMR $\geq 60\text{dB}$ | 0 | | 5 | V |
| AC CHARACTERISTICS | | | | | | |
| Slew Rate | SR | $G_V=0\text{dB}$, $C_L=20\text{pF}$, $V_{IN}=1\text{Vpp}$ | | 1 | | V/ms |
| Unity-Gain Frequency | f_T | $G_V=20\text{dB}$, $C_L=20\text{pF}$ | | 1.1 | | kHz |
| Phase Margin | Φ_M | $C_L=20\text{pF}$ | | 60 | | deg |
| Gain Margin | G_M | $C_L=20\text{pF}$ | | 30 | | dB |
| Equivalent Input Noise Voltage | V_{NI} | $f=100\text{Hz}$ | | 700 | | nV/ $\sqrt{\text{Hz}}$ |

■ ELECTRICAL CHARACTERISTICS

($V^+=1.8V$, $V^-=0V$, $V_{CM}=0.9V$, $R_L=100k\Omega$ to $0.9V$, $T_A=25^\circ C$ unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---------------------------------|-----------|---|-----|------|------|-----------------|
| DC CHARACTERISTICS | | | | | | |
| Supply Current (All Channel) | I_Q | No Signal | | 0.42 | 0.72 | μA |
| Input Offset Voltage | V_{IO} | $V_{CM}=0V$ | | 0.5 | 3.0 | mV |
| Input Bias Current | I_B | | | 1 | | pA |
| Input Offset Current | I_{IO} | | | 1 | | pA |
| Voltage Gain | A_V | $V_{OUT}=0.5V\sim 1.3V$ | 70 | 100 | | dB |
| Common-Mode Rejection Ratio | CMR | $V_{CM}=0V\sim 1.8V$ | 55 | 80 | | dB |
| Supply Voltage Rejection Ratio | SVR | $V^+=1.5V\sim 5.5V$, $V_{CM}=0V$ | 55 | 90 | | dB |
| Maximum Output Voltage | V_{OH} | $R_L=100k\Omega$ to $0.9V$ | 1.7 | 1.75 | | V |
| | V_{OL} | $R_L=100k\Omega$ to $0.9V$ | | 0.05 | 0.1 | V |
| Common-Mode Input Voltage Range | V_{ICM} | CMR ≥ 55 dB | 0 | | 1.8 | V |
| AC CHARACTERISTICS | | | | | | |
| Slew Rate | SR | $G_V=0$ dB, $C_L=20$ pF, $V_{IN}=1$ Vpp | | 0.9 | | V/ms |
| Unity-Gain Frequency | f_T | $G_V=20$ dB, $C_L=20$ pF | | 1 | | kHz |
| Phase Margin | Φ_M | $C_L=20$ pF | | 60 | | deg |
| Gain Margin | G_M | $C_L=20$ pF | | 30 | | dB |
| Equivalent Input Noise Voltage | V_{NI} | $f=100$ Hz | | 800 | | nV/ \sqrt{Hz} |

■ TYPICAL APPLICATION CIRCUIT



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. UTC reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.