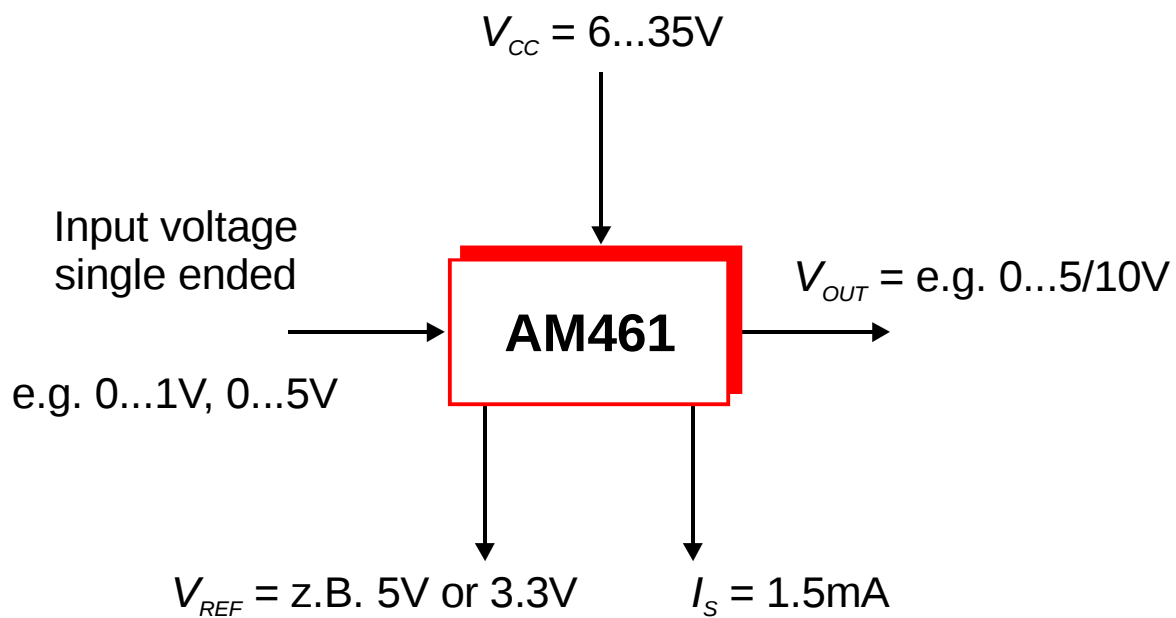


## PRINCIPLE FUNCTION

Amplification of Single Ended Signals (Voltage)  
Protection Functions for External Devices  
Additional Adjustable Current/Voltage Source



## TYPICAL APPLICATIONS

- Impedance Converter
- Adjustable Voltage Source
- Voltage Regulator with Additional Functions
- Protection IC for Microcontroller (Frame ASIC Concept [1])
- Protected Current Source

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## FEATURES

- Supply Voltage Range: 6...35V
- Wide Operating Temperature Range:  $-40^{\circ}\text{C}$ ... $+85^{\circ}\text{C}$
- Voltage Reference: 5V
- Additional Voltage/Current Source
- Operational Amplifier Stage with Integrated Driver Output
- Adjustable Gain
- Adjustable Output Voltage Range e.g. 0...5/10V, others
- Reverse Polarity Protection
- Short Circuit Protection
- Output Current Limitation
- Low-Cost: Replaces a Multitude Number of Discrete Components

## DESCRIPTION

The AM461 is a universal useable amplifier and protection IC with a multitude of additional functions. The IC contains of an externally adjustable operational amplifier for conditioning of single ended input signals. This amplifier has an integrated output driver stage with the ability to source up to 5mA without the need of any external transistor. In addition, a voltage reference for the supply of external components and another operational amplifier that can be used as current/voltage source or comparator is integrated.

Basic features of the IC are the wide range integrated of protection functions. The IC is protected against reverse polarity and has a build-in output current limitation. Using the amplifier IC AM461 it is possible to generate stable standard voltages ranges (e.g. 0-5/10V) in an easy and low-cost way.

## BLOCK DIAGRAM

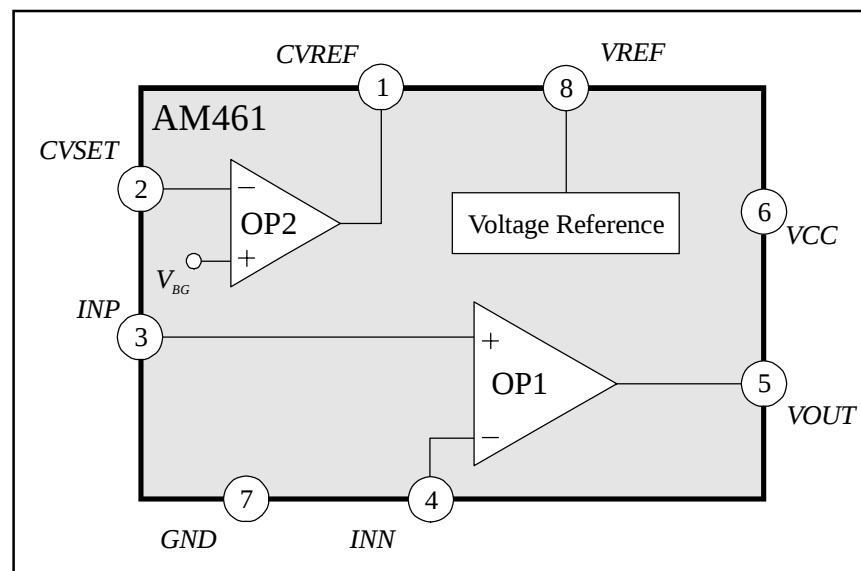


Figure 1: Block diagram AM461

## ELECTRICAL SPECIFICATIONS

$T_{amb} = 25^{\circ}\text{C}$ ,  $V_{CC} = 24\text{V}$ ,  $I_{REF} = 1\text{mA}$ ,  $C_1 = 2.2\mu\text{F}$  (unless otherwise noted)

| Parameter                                         | Symbol        | Conditions                                                       | Min.     | Typ.     | Max.         | Unit                        |
|---------------------------------------------------|---------------|------------------------------------------------------------------|----------|----------|--------------|-----------------------------|
| Voltage Range                                     | $V_{CC}$      |                                                                  | 6        |          | 35           | V                           |
| Quiescent Current                                 | $I_{CC}$      | $T_{amb} = -40...+85^{\circ}\text{C}$ , $I_{REF} = 0\text{mA}$   |          |          | 1.5          | mA                          |
| <b>Temperature Specifications</b>                 |               |                                                                  |          |          |              |                             |
| Operating                                         | $T_{amb}$     |                                                                  | -40      |          | 85           | $^{\circ}\text{C}$          |
| Storage                                           | $T_{st}$      |                                                                  | -55      |          | 125          | $^{\circ}\text{C}$          |
| Junction                                          | $T_J$         |                                                                  |          |          | 150          | $^{\circ}\text{C}$          |
| Thermal Resistance                                | $\Theta_{ja}$ | DIL8 plastic package                                             |          | 110      |              | $^{\circ}\text{C}/\text{W}$ |
|                                                   | $\Theta_{ja}$ | SO8 plastic package                                              |          | 180      |              | $^{\circ}\text{C}/\text{W}$ |
| <b>Voltage Reference</b>                          |               |                                                                  |          |          |              |                             |
| Voltage                                           | $V_{REF}$     |                                                                  | 4.75     | 5.00     | 5.25         | V                           |
| Current                                           | $I_{REF}$     |                                                                  | 1.0      |          | 10.0         | mA                          |
| $V_{REF}$ vs. Temperature                         | $dV_{REF}/dT$ | $T_{amb} = -40...+85^{\circ}\text{C}$                            |          | $\pm 90$ | $\pm 140$    | ppm/ $^{\circ}\text{C}$     |
| Line Regulation                                   | $dV_{REF}/dV$ | $V_{CC} = 6\text{V}...35\text{V}$                                |          | 30       | 80           | ppm/V                       |
|                                                   | $dV_{REF}/dV$ | $V_{CC} = 6\text{V}...35\text{V}$ , $I_{REF} \approx 5\text{mA}$ |          | 60       | 150          | ppm/V                       |
| Load Regulation                                   | $dV_{REF}/dI$ |                                                                  |          | 0.05     | 0.10         | %/mA                        |
|                                                   | $dV_{REF}/dI$ | $I_{REF} \approx 5\text{mA}$                                     |          | 0.06     | 0.15         | %/mA                        |
| <b>Current/Voltage Source OP2</b>                 |               |                                                                  |          |          |              |                             |
| Internal Reference                                | $V_{BG}$      |                                                                  | 1.20     | 1.27     | 1.35         | V                           |
| $V_{BG}$ vs. Temperature                          | $dV_{BG}/dT$  | $T_{amb} = -40...+85^{\circ}\text{C}$                            |          | $\pm 60$ | $\pm 140$    | ppm/ $^{\circ}\text{C}$     |
| Current Source: $I_{CV} = V_{BG}/R_{SET}$         |               |                                                                  |          |          |              |                             |
| Adjustable Current Range                          | $I_{CVREF}$   |                                                                  | 0        |          | 10           | mA                          |
| Output Voltage                                    | $V_{CVREF}$   | $V_{CC} < 18\text{V}$                                            | $V_{BG}$ |          | $V_{CC} - 4$ | V                           |
|                                                   | $V_{CVREF}$   | $V_{CC} \geq 18\text{V}$                                         | $V_{BG}$ |          | 13           | V                           |
| Voltage Source: $V_{CV} = V_{BG} (1 + R_4 / R_3)$ |               |                                                                  |          |          |              |                             |
| Adjustable Voltage Range                          | $V_{CVREF}$   | $V_{CC} < 18\text{V}$                                            | 0.4      |          | $V_{CC} - 4$ | V                           |
|                                                   | $V_{CVREF}$   | $V_{CC} \geq 18\text{V}$                                         | 0.4      |          | 13           | V                           |
| Output Current                                    | $I_{CVREF}$   | Source, $R_3 + R_4 \geq 100\text{k}\Omega$                       |          |          | 10           | mA                          |
|                                                   | $I_{CVREF}$   | Sink                                                             |          |          | -100         | $\mu\text{A}$               |
| Load Capacitance @ $V_{CVREF}$                    | $C_{CVREF}$   | Source mode                                                      | 0        | 1        | 10           | nF                          |

| Parameter                           | Symbol       | Conditions                                               | Min. | Typ.      | Max.         | Unit             |
|-------------------------------------|--------------|----------------------------------------------------------|------|-----------|--------------|------------------|
| <b>Voltage Output Stage OP1</b>     |              |                                                          |      |           |              |                  |
| Adjustable Gain                     | $G_{OP1}$    |                                                          | 1    |           |              |                  |
| Input Range                         | $I_R$        | $V_{CC} < 10V$                                           | 0    |           | $V_{CC} - 5$ | V                |
|                                     | $I_R$        | $V_{CC} \geq 10V$                                        | 0    |           | 5            | V                |
| Power Supply Rejection Ratio        | $PSRR$       |                                                          | 80   | 90        |              | dB               |
| Offset Voltage                      | $V_{OS}$     |                                                          |      | $\pm 0.5$ | $\pm 2$      | mV               |
| $V_{OS}$ vs. Temperature            | $dV_{OS}/dT$ |                                                          |      | $\pm 3$   | $\pm 7$      | $\mu V/^\circ C$ |
| Input Bias Current                  | $I_B$        |                                                          |      | 5         | 12           | nA               |
| $I_B$ vs. Temperature               | $dI_B/dT$    |                                                          |      | 3.5       | 10           | pA/°C            |
| Output Voltage Range                | $V_{OUT}$    | $V_{CC} < 18V$                                           | 0    |           | $V_{CC} - 5$ | V                |
|                                     | $V_{OUT}$    | $V_{CC} \geq 18V$                                        | 0    |           | 13           | V                |
| Output Current Limitation           | $I_{LIM}$    | $V_{OUT} \geq 10V, R_1 + R_2 \geq 100k\Omega$            | 5    | 7         | 10           | mA               |
| Output Current                      | $I_{OUT}$    | Source                                                   | 0    |           | $I_{LIM}$    | mA               |
| Output Resistance                   | $R_{OUT}$    | Source                                                   |      | 0.5       |              | $\Omega$         |
| Load Resistance                     | $R_L$        |                                                          | 2    | 10        | 100          | k $\Omega$       |
| Load Capacitance @ $V_{OUT}$        | $C_L$        |                                                          | 0    |           | 500          | nF               |
| <b>Protection Functions</b>         |              |                                                          |      |           |              |                  |
| Protection against reverse polarity |              | Ground vs. $V_{CC}$ vs. $V_{OUT}$ , $R_1 \geq 20k\Omega$ |      |           | 35           | V                |

Currents flowing into the IC are negative

## BOUNDARY CONDITIONS

| Parameter                             | Symbol      | Conditions | Min. | Typ. | Max. | Unit       |
|---------------------------------------|-------------|------------|------|------|------|------------|
| Sum Gain Resistors                    | $R_1 + R_2$ |            | 20   | 100  | 200  | k $\Omega$ |
| Sum Reference Adjustment Resistors    | $R_3 + R_4$ |            | 20   | 100  | 200  | k $\Omega$ |
| Stabilisation Capacitance @ $V_{REF}$ | $C_1$       |            | 1.9  | 2.2  | 5.0  | $\mu F$    |

## BLOCK DIAGRAM AND PINOUT AM461

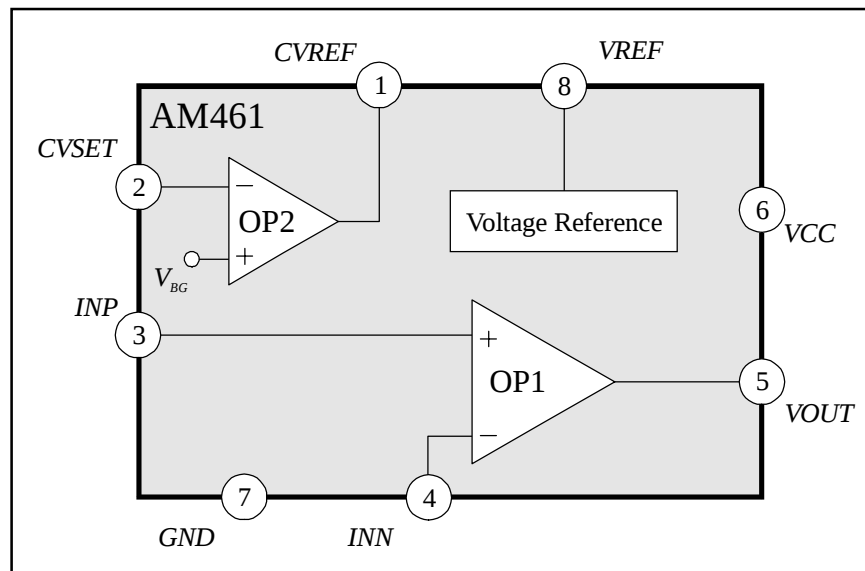


Figure 2: Block diagram AM461

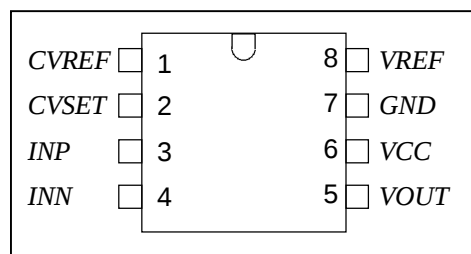


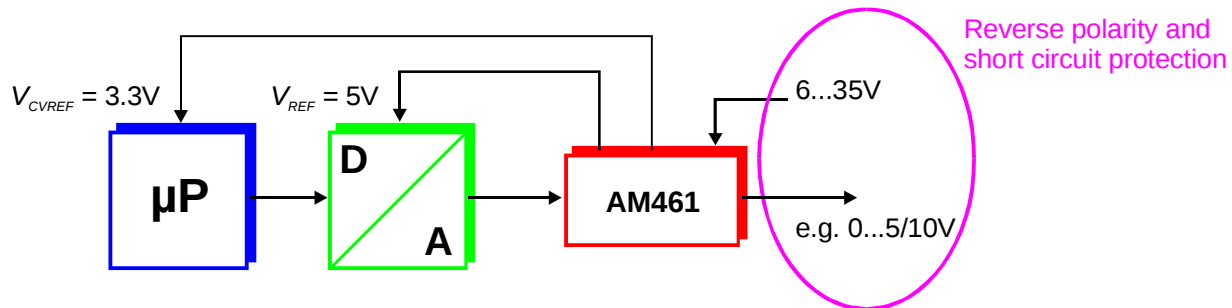
Figure 3: Pinout AM461

| PIN | NAME  | DESIGNATION              |
|-----|-------|--------------------------|
| 1   | CVREF | Output OP2               |
| 2   | CVSET | Input OP2                |
| 3   | INP   | Positive input OP1       |
| 4   | INN   | Negative input OP1       |
| 5   | VOUT  | Voltage output           |
| 6   | VCC   | Supply voltage           |
| 7   | GND   | IC ground                |
| 8   | VREF  | Output voltage reference |

Table1: Pinout AM461

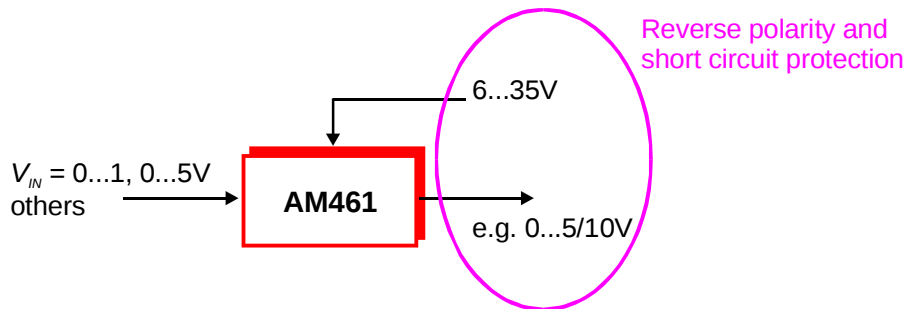
## PRINCIPLE APPLICATION EXAMPLES

- Application as processor interface



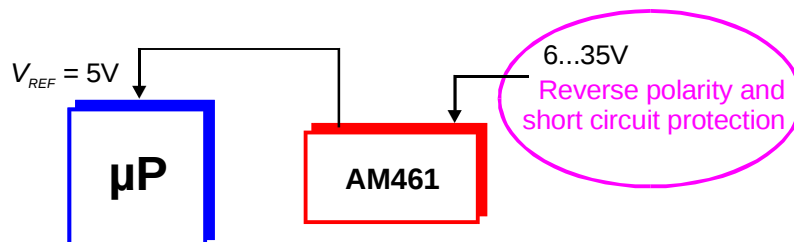
**Figure 4:** Application as processor interface

- Application as amplifier IC and impedance converter



**Figure 5:** Application as amplifier IC and impedance converter

- Application as voltage regulator and protection IC for controllers



**Figure 6:** Application as voltage regulator and protection IC for controllers

## **DELIVERY**

The AM461 amplifier and protection IC is available in

- DIP08, SO08

## **ADDITIONAL LITERATURE**

- [1] Concept of Frame ASICs: <http://www.Frame-ASIC.com/>
- [2] Analog Microelectronics' Homepage: <http://www.analogmicro.info/>

## **NOTES**

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