

## AS2164 - Quad voltage exponentially controlled amplifier (VCA)

### Features

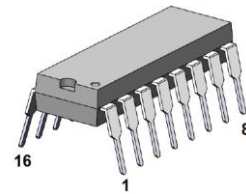
- protection from negative supply turned OFF
- four high performance VCAs in a single package
- no external trimming
- 120 dB gain range
- 0,07 dB gain matching (unity gain)
- class A or AB operation

### Applications

- Remote, Automatic, or Computer Volume Controls
- Automotive Volume/Balance/Faders
- Compressor/Limiters/Companors
- Noise Reduction Systems
- Automatic Gain Controls
- Voltage Controlled Filters
- Special Sound Processors

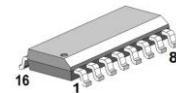
### AS2164

PDIP-16, 300mil, 2.54 mm



### AS2164D

SOIC-16, 150 Mil, 1.27 mm



### General Description

AS2164 contains four independent voltage controlled amplifiers (VCAs) in a single package. High performance (dynamic range 100 dB) provides excellent use of VCA's in gain control applications. Each VCA offers current inputs and outputs for maximum design flexibility, as well as a  $-33 \text{ mV/dB}$  ground control port. All channels are closely matched to within 0,07 dB at unity gain, and 0,24 dB at 40 dB of attenuation. A 120 dB gain range is possible.

A single resistor tailors operation between full Class A and AB modes.

AS2164 is internally protected in situations where negative supply is turned OFF.

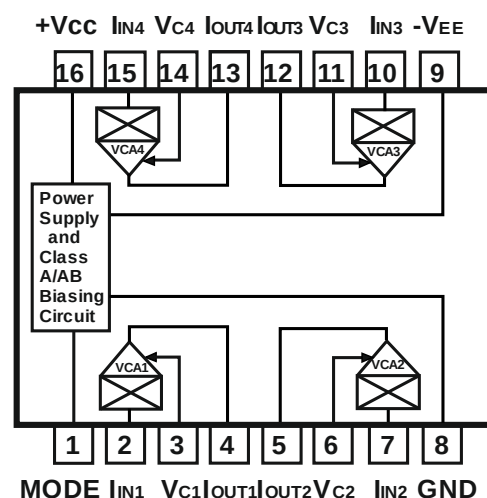
The AS2164 will operate over a wide supply voltage range of  $\pm 4 \text{ V}$  to  $\pm 18 \text{ V}$ .

| PART NUMBER | PACKAGE | BODY SIZE (NOM)        |
|-------------|---------|------------------------|
| AS2164      | PDIP-16 | 300mil, 2.54 mm pitch  |
| AS2164D     | SOIC-16 | 150 Mil, 1.27 mm pitch |

### Pin Information

| Pin No | Pin Name          | Description       |
|--------|-------------------|-------------------|
| 1      | MODE              | Mode select       |
| 2      | I <sub>IN1</sub>  | Input current 1   |
| 3      | V <sub>C1</sub>   | Control voltage 1 |
| 4      | I <sub>OUT1</sub> | Output current 1  |
| 5      | I <sub>OUT2</sub> | Output current 2  |
| 6      | V <sub>C2</sub>   | Control voltage 2 |
| 7      | I <sub>IN2</sub>  | Input current 2   |
| 8      | GND               | Ground            |
| 9      | V <sub>EE</sub>   | Negative supply   |
| 10     | I <sub>IN3</sub>  | Input current 3   |
| 11     | V <sub>C3</sub>   | Control voltage 3 |
| 12     | I <sub>OUT3</sub> | Output current 3  |
| 13     | I <sub>OUT4</sub> | Output current 4  |
| 14     | V <sub>C4</sub>   | Control voltage 4 |
| 15     | I <sub>IN4</sub>  | Input current 4   |
| 16     | V <sub>CC</sub>   | Positive supply   |

**Figure 1 Block and Connection Diagram**





### Absolute Maximum Ratings

Unless otherwise specified,  $T_A = 25^\circ\text{C}$

| Parameter                                 | Symbol             | Value      | Unit             |
|-------------------------------------------|--------------------|------------|------------------|
| Supply voltage                            | $V_{CC}, V_{EE}$   | +18, -18   | V                |
| Input, Output, Control Voltages           | $V_{IN}, V_O, V_C$ | V- ~ V+    | V                |
| Output Short Circuit Duration to GND      |                    | Indefinite | sec              |
| Storage Temperature Range                 | $T_{stg}$          | -65~+150   | $^\circ\text{C}$ |
| Operating Temperature Range               | $T_{opr}$          | -40~+85    | $^\circ\text{C}$ |
| Junction Temperature Range                | $T_j$              | -65~+150   | $^\circ\text{C}$ |
| Lead Temperature Range (Soldering 60 sec) |                    | +300       | $^\circ\text{C}$ |

### Electrical Characteristics

$V_{CC} = +15\text{ V}$ ,  $V_{EE} = -15\text{ V}$ ,  $A_V = 0\text{ dB}$ ,  $0\text{ dB}\mu = 0,775\text{ V rms}$ ,  $V_{IN} = 0\text{ dB}\mu$ ,  $R_{IN} = R_{OUT} = 30\text{ k}\Omega$ ,  $f = 1\text{ kHz}$ ,  
 $-40^\circ\text{C} < T_A < +85^\circ\text{C}$  using Typical Application Circuit (Class AB), unless otherwise noted.

Typical specifications apply at  $T_A = +25^\circ\text{C}$ .

| Parameter                             | Symbol           | Conditions                                           | Min     | Typ       | Max      | Units                 |
|---------------------------------------|------------------|------------------------------------------------------|---------|-----------|----------|-----------------------|
| <b>POWER SUPPLY</b>                   |                  |                                                      |         |           |          |                       |
| Supply Voltage Range                  | $V_{CC}, V_{EE}$ |                                                      | $\pm 4$ |           | $\pm 18$ | V                     |
| Supply Current                        | $I_S$            | Class AB                                             |         | 7,5       | 8,9      | mA                    |
| Power Supply Rejection Ratio          | PSRR             | 60Hz                                                 |         | 90        |          | dB                    |
| <b>AUDIO SIGNAL PATHS</b>             |                  |                                                      |         |           |          |                       |
| Noise                                 | $V_{NO}$         | $V_{IN} = \text{GND}$ , 20 kHz Bandwidth             |         | -94       |          | dB $\mu$              |
| Headroom                              | HR               | Clip point=1%THD+N                                   |         | 22        |          | dB $\mu$              |
| Total Harmonic Distortion             | THD              | 2nd and 3rd Harmonics Only                           |         |           |          |                       |
|                                       |                  | $A_V = 0\text{ dB}$ , Class A                        |         | 0,03      | 0,1      | %                     |
|                                       |                  | $A_V = \pm 20\text{ dB}$ , Class A <sup>1</sup>      |         | 0,15      |          | %                     |
|                                       |                  | $A_V = 0\text{ dB}$ , Class AB                       |         | 0,16      | 1        | %                     |
|                                       |                  | $A_V = \pm 20\text{ dB}$ , Class AB <sup>1</sup>     |         | 0,3       |          | %                     |
| Channel Separation                    | Sep              |                                                      |         | -110      |          | dB                    |
| Unity Gain Bandwidth                  | GB               | $C_F = 10\text{ pF}$                                 |         | 500       |          | kHz                   |
| Slew Rate                             | SR               | $C_F = 10\text{ pF}$                                 |         | 0,7       |          | mA/ $\mu\text{s}$     |
| Input Bias Current                    | $I_{IB}$         |                                                      |         | $\pm 10$  |          | nA                    |
| Output Offset Current                 | $I_{OO}$         | $V_{IN} = 0$                                         |         | $\pm 60$  |          | nA                    |
| Output Compliance                     | $V_{OC}$         |                                                      |         | $\pm 100$ |          | mV                    |
| <b>CONTROL PORTS</b>                  |                  |                                                      |         |           |          |                       |
| Input Impedance                       | $R_{IN}$         |                                                      |         | 10,5      |          | k $\Omega$            |
| Gain Constant                         | $G_C$            | After 60 seconds operation                           |         | -33       |          | mV/dB                 |
| Gain Constant Temperature Coefficient | $TCG_C$          |                                                      |         | -3300     |          | ppm/ $^\circ\text{C}$ |
| Control Feedthrough                   | $V_{CF}$         | $A_V = 0\text{ dB}$ to -40dB Gain Range <sup>2</sup> | -8,5    | 1,5       | 8,5      | mV                    |
| Gain Matching, Channel-to-Channel     | $G_M$            | $A_V = 0\text{ dB}$                                  |         | 0,07      |          | dB                    |
|                                       |                  | $A_V = -40\text{ dB}$                                |         | 0,24      |          | dB                    |
| Maximum Attenuation                   | $G_A$            |                                                      | -90     | -110      |          | dB                    |
| Maximum Gain                          | $G_{MAX}$        |                                                      | 17      | +22       | 23       | dB                    |

### NOTES

<sup>1</sup> -10 dB $\mu$  input @ 20 dB gain; +10 dB $\mu$  input @ -20 dB gain.

<sup>2</sup> +25 $^\circ\text{C}$  to +85 $^\circ\text{C}$ .

Specifications subject to change without notice.

Figure 2 Typical Application and Test Circuit

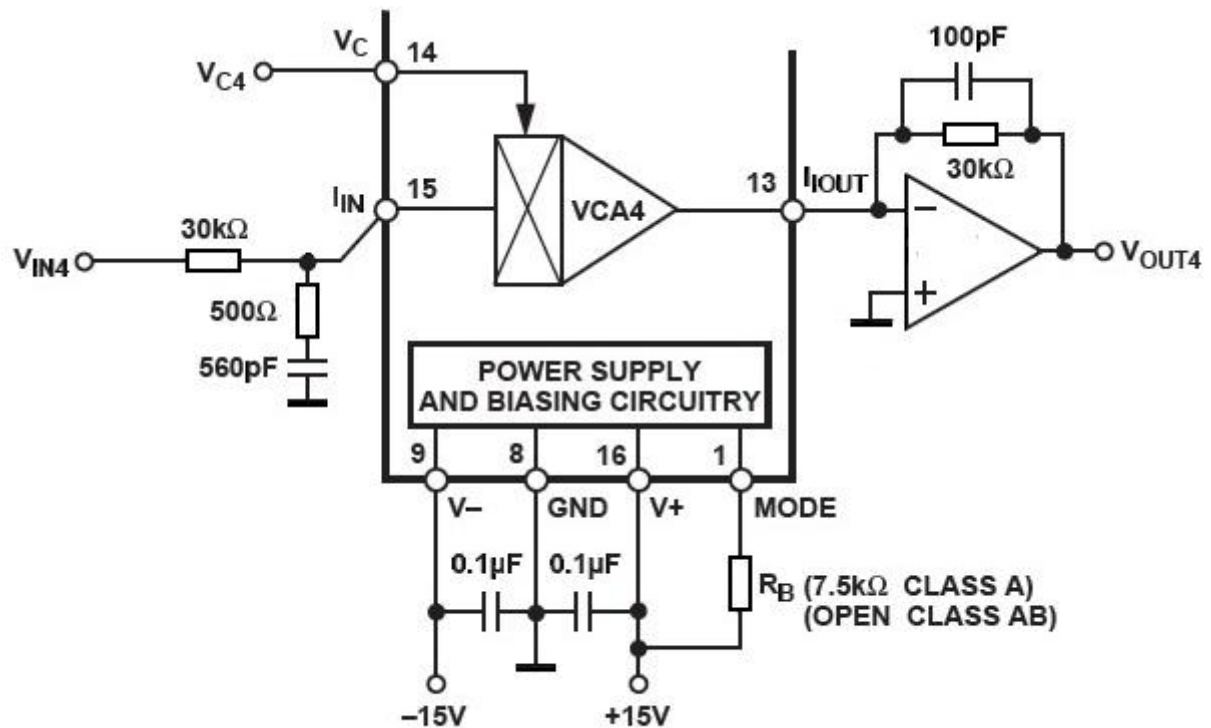
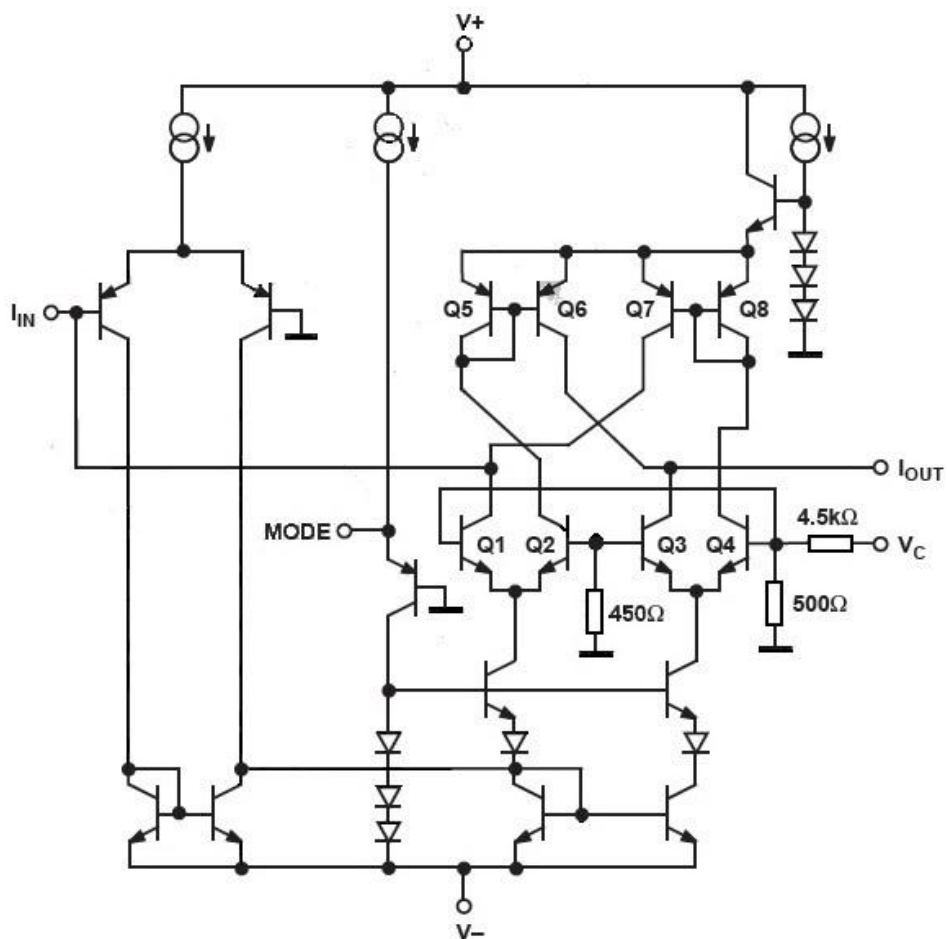


Figure 3 Simplified Schematic (One Channel)

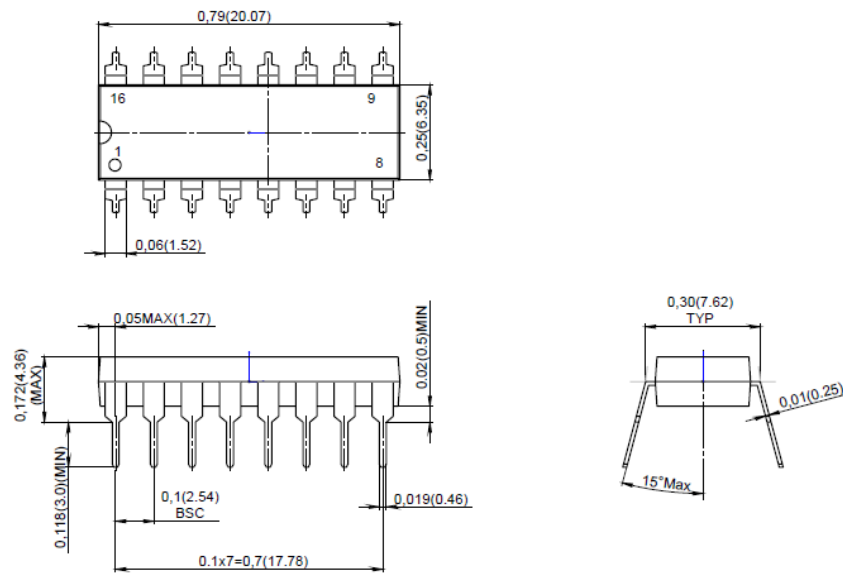




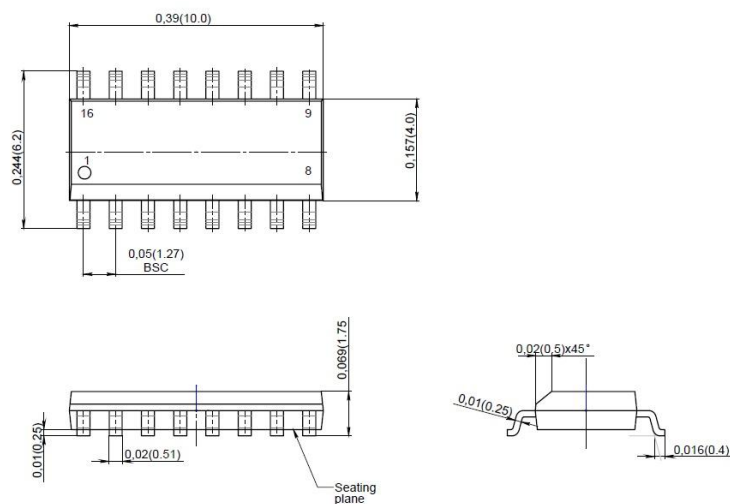
| Device type | Package                 |
|-------------|-------------------------|
| AS2164      | PDIP-16 (300 Mil, 2.54) |
| AS2164D     | SOIC-16 (150 Mil, 1.27) |

### Package Information

Units: inch (mm)  
**PDIP-16 (300 Mil)**



### SOIC-16 (150 mil)



### Revision history

| Date        | Revision | Changes                                     |
|-------------|----------|---------------------------------------------|
| 26-Mar-2019 | 1        | Preliminary version 1                       |
| 12-Aug-2019 | 2        | Changes in Specifications                   |
| 28-Oct-2019 | 3        | SOIC-16 – new package                       |
| 10-Dec-2020 | 4        | Minor changes in Electrical Characteristics |