

### Features

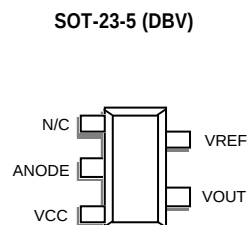
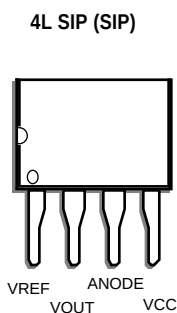
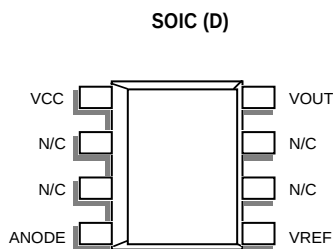
- Temperature-compensated: 50 ppm/°C
- Trimmed 0.5% typical bandgap reference
- High gain Internal amplifier with 100 mA capability
- Nominal temperature range extended to 105° C
- Low frequency dynamic output impedance: < 150 mΩ
- Low output noise

### Description

The AS535 is a three terminal adjustable shunt regulator utilizing an accurate 2.5V bandgap reference. The AS535 is functionally similar to an AS2431 except that the reference and amplifier operate off of a separate supply from the output, allowing very low output voltages (0.1V Typically)

Because of its robust bipolar technology, the AS535 handles a wide range of current, and holds off up to 18V so its use is not limited to low power, low voltage systems. Significant care has been taken to provide adequate AC bandwidth to allow the AS535 as an amplifier in control systems and power electronics. ASTEC also offers a 1.0% version of this part, the A535.

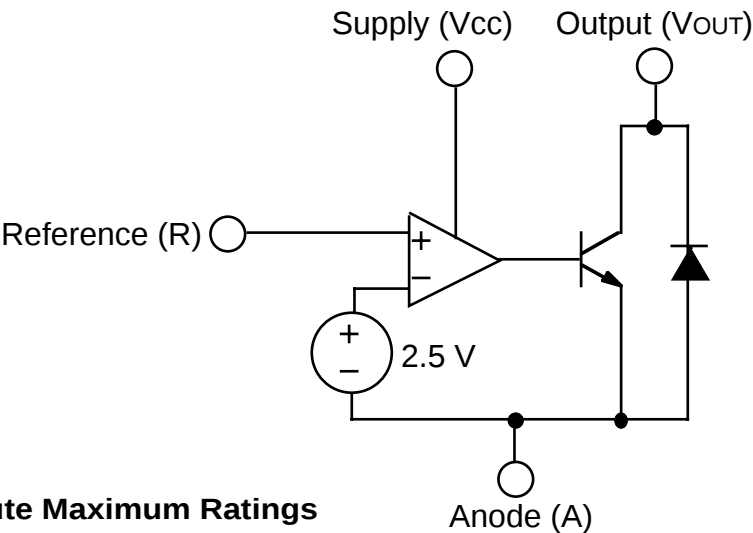
### Pin Configuration — Top view



### Ordering Information

| Description        | Temperature Range | 0.5%     | Order Codes | 1.0%    |
|--------------------|-------------------|----------|-------------|---------|
| 8-Pin Plastic SOIC | 0 to 105° C       | AS535D   |             | A535D   |
| 4-Pin Plastic SIP  | 0 to 105° C       | AS535SIP |             | A535SIP |
| SOT - 23 - 5       | 0 to 105° C       | AS535DBV |             | A535DBV |

Functional Block Diagram



Absolute Maximum Ratings

| Parameter                              | Symbol           | Rating      | Units |
|----------------------------------------|------------------|-------------|-------|
| Supply Voltage                         | VCC              | 18          | V     |
| Output Voltage                         | V <sub>OUT</sub> | 18          | V     |
| Anode-V <sub>OUT</sub> Forward Current | I <sub>AO</sub>  | 1           | A     |
| Operating Output Current               | I <sub>OUT</sub> | 100         | mA    |
| Reference Input Current                | I <sub>REF</sub> | 1           | mA    |
| Continuous Power at 25° C              | P <sub>D</sub>   |             |       |
| 8L SOIC                                |                  | 750         | mW    |
| 4L SIP                                 |                  | 1000        | mW    |
| SOT-23-5                               |                  | 200         | mW    |
| Junction Temperature                   | T <sub>J</sub>   | 150         | °C    |
| Storage Temperature                    | T <sub>STG</sub> | – 65 to 150 | °C    |
| Lead Temperature (Soldering 10 sec.)   | T <sub>L</sub>   | 300         | °C    |

Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Recommended Conditions

| Parameter      | Symbol           | Rating     | Unit |
|----------------|------------------|------------|------|
| Output Voltage | V <sub>OUT</sub> | -0.2 to 18 | V    |
| Output Current | I <sub>OUT</sub> | 10         | mA   |

Typical Thermal Resistances

| Package  | θ <sub>JA</sub> | θ <sub>JC</sub> | Typical Derating |
|----------|-----------------|-----------------|------------------|
| SOIC     | 175° C/W        | 45° C/W         | 5.7 mW/°C        |
| SIP      | 95° C/W         | 50° C/W         | 10.5 mW/°C       |
| SOT-23-5 | 575° C/W        | 150° C/W        | 1.7 mW/°C        |

## Electrical Characteristics

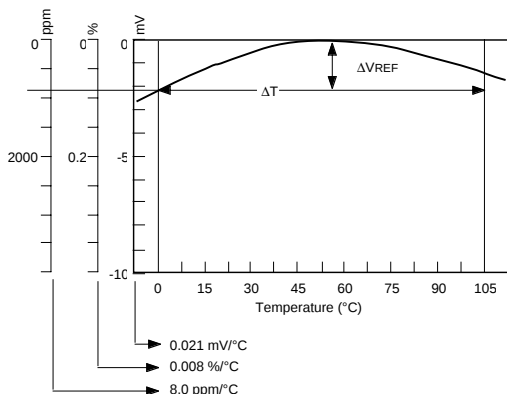
Electrical characteristics are guaranteed over the full junction temperature range (0-105 °C). Ambient temperature must be derated based upon power dissipation and package thermal characteristics. Unless otherwise stated, test conditions are:  $V_{OUT} = V_{REF}$ ,  $V_{CC} = 5V$  and  $I_{OUT} = 1 \text{ mA}$ .

| Parameter                      | Symbol           | Test Condition                                  | A535 (1.0 %) |       |       | AS535 (0.5 %) |       |       | Units         |
|--------------------------------|------------------|-------------------------------------------------|--------------|-------|-------|---------------|-------|-------|---------------|
|                                |                  |                                                 | Min          | Typ   | Max   | Min           | Typ   | Max   |               |
| Supply Voltage                 | VCC              |                                                 | 4            |       | 15    | 4             |       | 15    | V             |
| Supply Current                 | ICC              |                                                 |              | 0.5   | 1     |               | 0.5   | 1     | mA            |
| Reference Voltage              | $V_{REF}$        | $T_J = 25^\circ \text{C}$                       | 2.475        | 2.500 | 2.525 | 2.488         | 2.500 | 2.513 | V             |
| Line Regulation                | $\Delta V_{OUT}$ | $V_{CC} = 4 \text{ to } 15 \text{ V}$           |              | -1    | -10   |               | -1    | -10   | mV            |
| Load Regulation                | $\Delta V_{OUT}$ | $I_{OUT} = 1 \text{ to } 100 \text{ mA}$        |              | 1     | 50    |               | 1     | 50    | mV            |
| Temperature Deviation          | $\Delta V_{OUT}$ | $0 < T_J < 105^\circ \text{C}$                  |              | 3     | 10    |               | 3     | 8     | mV            |
| Reference Input Current        | $I_{REF}$        |                                                 |              | 0.1   | 0.4   |               | 0.1   | 0.4   | $\mu\text{A}$ |
| Amplifier open loop gain       | $A_v$            |                                                 | 70           | 80    |       | 70            | 80    |       | dB            |
| Amplifier Unity gain frequency | $F_1$            | $C_{LOAD} < 1\text{nF}$                         | 1            | 2     |       | 1             | 2     |       | MHz           |
| Output Saturation Voltage      | $V_{SAT}$        | $I_{OUT} = 100\text{mA}$                        |              |       | 0.4   |               |       | 0.4   | V             |
| Off State Leakage              | $I_{LEAK}$       | $V_{REF} = 0 \text{ V}, V_{OUT} = 15 \text{ V}$ |              | 0.04  | 500   |               | 0.04  | 500   | nA            |

\*Temperature deviation is defined as the maximum deviation of the reference over the given temperature range and does not imply an incremental deviation at any given temperature.

## Typical Performance Curves

\*Calculating Average Temperature Coefficient (TC)



$$\bullet \text{ TC in mV}/^\circ\text{C} = \frac{\Delta V_{REF}}{\Delta T_A} \quad (\text{mV})$$

$$\bullet \text{ TC in } \%/^\circ\text{C} = \frac{\left( \frac{\Delta V_{REF}}{V_{REF} \text{ at } 25^\circ\text{C}} \right) \times 100}{\Delta T_A}$$

$$\bullet \text{ TC in ppm}/^\circ\text{C} = \frac{\left( \frac{\Delta V_{REF}}{V_{REF} \text{ at } 25^\circ\text{C}} \right) \times 10^6}{\Delta T_A}$$