

# TL432

## Description

The TL432 series ICs are low voltage three- terminal adjustable regulators with guaranteed thermal stability over a full operation range. These ICs feature sharp turn-on characteristics, low temperature coefficient and low output impedance, which make them ideal substitutes for Zener diodes in applications such as switching power supply, charger, motherboard and other adjustable regulators. The output voltage can be set to any value between 1.25V and 18V with two external resistors.

The TL432 precision reference is offered in two voltage. These ICs are available in 4 packages: TO-92, SOT-23, and SOT-89.

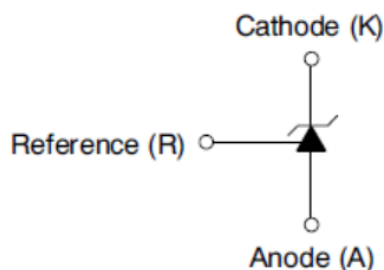
## Features

- Wide Programmable Precise Output Voltage from 1.25V to 18V
- High Stability under Capacitive Load
- Low Temperature Deviation: 3mV Typical
- Low Equivalent Full-Range Temperature Coefficient: 20PPM/ °C Typical
- Low Dynamic Output Resistance: 0.05Ω Typical
- High Sink Current Capacity from 0.1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125 °C

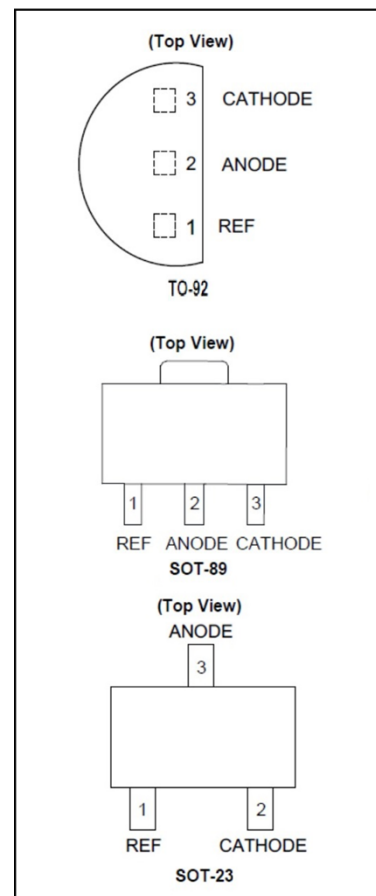
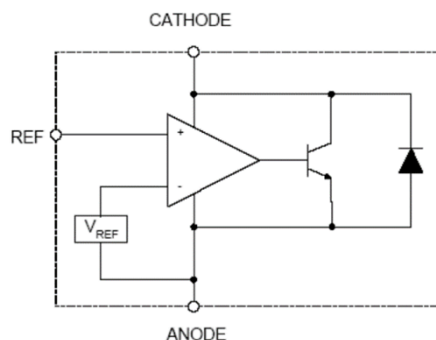
## Applications

- Graphic Card
- PC Motherboard
- Switching Power Supply
- Voltage Adapter
- Charger

## Symbol

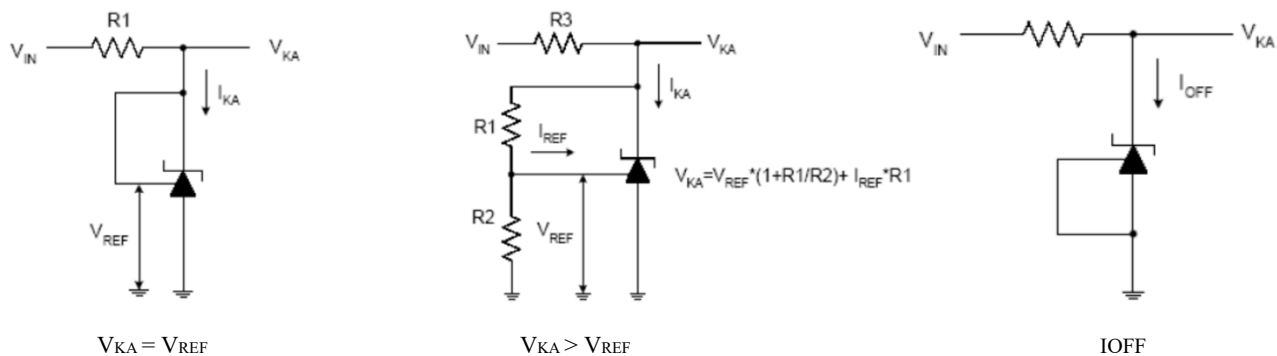


## Functional Block Diagram



Pin Assignments

## Test Circuit



## Absolute Maximum Ratings (Note 2)

| Symbol    | Parameter                          | Rating       |     | Unit |
|-----------|------------------------------------|--------------|-----|------|
| $V_{KA}$  | Cathode Voltage                    | 20           |     | V    |
| $I_{KA}$  | Cathode Current Range (Continuous) | -100 to 100  |     | mA   |
| $I_{REF}$ | Reference Input Current Range      | 10           |     | mA   |
| $P_D$     | Power Dissipation                  | Z, R Package | 770 | mW   |
|           |                                    | N, K Package | 370 |      |
| $T_J$     | Junction Temperature               | +150         |     | °C   |
| $T_{STG}$ | Storage Temperature Range          | -65 to +150  |     | °C   |

Note 2: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

## Recommended Operating Conditions

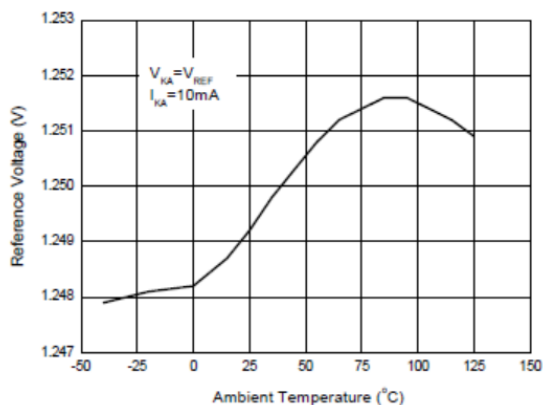
| Symbol   | Parameter                           | Min       | Max  | Unit |
|----------|-------------------------------------|-----------|------|------|
| $V_{KA}$ | Cathode Voltage                     | $V_{REF}$ | 18   | V    |
| $I_{KA}$ | Cathode Current                     | 0.1       | 100  | mA   |
| —        | Operating Ambient Temperature Range | -40       | +125 | °C   |

## Electrical Characteristics (Typical and limits apply for TA = +25 °C)

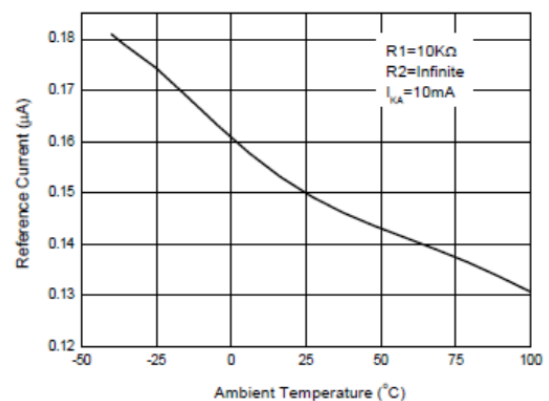
| Symbol                                 | Parameter                                                     |      | Test Circuit | Conditions                                                                       |               | Min   | Typ    | Max   | Unit         |
|----------------------------------------|---------------------------------------------------------------|------|--------------|----------------------------------------------------------------------------------|---------------|-------|--------|-------|--------------|
| $V_{REF}$                              | Reference Voltage                                             | 0.5% | 4            | $V_{KA} = V_{REF}, I_{KA} = 10mA$                                                |               | 1.244 | 1.250  | 1.256 | V            |
|                                        |                                                               | 1.0% |              |                                                                                  |               | 1.238 | 1.250  | 1.262 |              |
| $\Delta V_{REF}$                       | Deviation of Reference Voltage Over Full Temperature Range    |      | 4            | $V_{KA} = V_{REF}, I_{KA} = 10mA$                                                | 0 to +70°C    | –     | 2      | 10    | mV           |
|                                        |                                                               |      |              |                                                                                  | -40 to +85°C  | –     | 3      | 10    |              |
|                                        |                                                               |      |              |                                                                                  | -40 to +125°C | –     | 4      | 15    |              |
| $\frac{\Delta V_{REF}}{\Delta V_{KA}}$ | Ratio of Change in $V_{REF}$ to the Change in Cathode Voltage |      | 5            | $I_{KA} = 10mA, \Delta V_{KA}: V_{REF} \text{ to } 16V$                          |               | –     | -0.5   | -1.5  | mV/V         |
| $I_{REF}$                              | Reference Input Current                                       |      | 5            | $I_{KA} = 10mA, R1 = 10K\Omega, R2 = \infty$                                     |               | –     | 0.15   | 0.4   | $\mu A$      |
| $\Delta I_{REF}$                       | Deviation of Reference Current Over Full Temperature Range    |      | 5            | $I_{KA} = 10mA, R1 = 10K\Omega, R2 = \infty, T_A = -40 \text{ to } +125^\circ C$ |               | –     | 0.1    | 0.4   | $\mu A$      |
| $I_{KA}$ (Min)                         | Minimum Cathode Current for Regulation                        |      | 4            | $V_{KA} = V_{REF}$                                                               |               | –     | 55     | 80    | $\mu A$      |
| $I_{KA}$ (Off)                         | Off-state Cathode Current                                     |      | 6            | $V_{REF} = 0, V_{KA} = 18V$                                                      |               | –     | 0.04   | 0.10  | $\mu A$      |
|                                        |                                                               |      |              | $V_{KA} = 6V, V_{REF} = 0$                                                       |               | –     | 0.01   | 0.05  |              |
| $Z_{KA}$                               | Dynamic Impedance                                             |      | 4            | $V_{KA} = V_{REF}, I_{KA} = 1 \text{ to } 100mA, f \leq 1.0KHz$                  |               | –     | 0.05   | 0.15  | $\Omega$     |
| $\theta_{JC}$                          | Thermal Resistance (Junction to Case)                         |      | –            | SOT-23                                                                           |               | –     | 84.84  | –     | $^\circ C/W$ |
|                                        |                                                               |      |              | SOT-23-5                                                                         |               | –     | 84.84  | –     |              |
|                                        |                                                               |      |              | TO-92                                                                            |               | –     | 140.80 | –     |              |
|                                        |                                                               |      |              | SOT-89                                                                           |               | –     | 29.80  | –     |              |

## Performance Characteristics

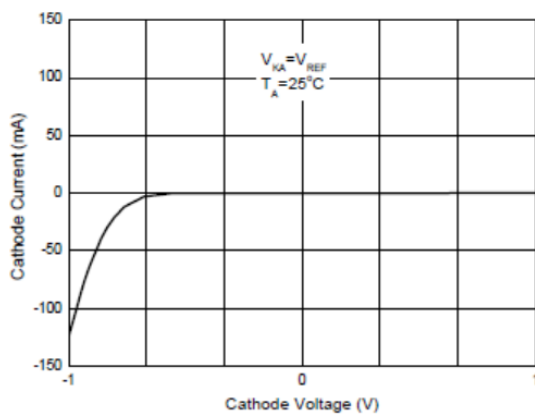
Reference Voltage vs. Ambient Temperature



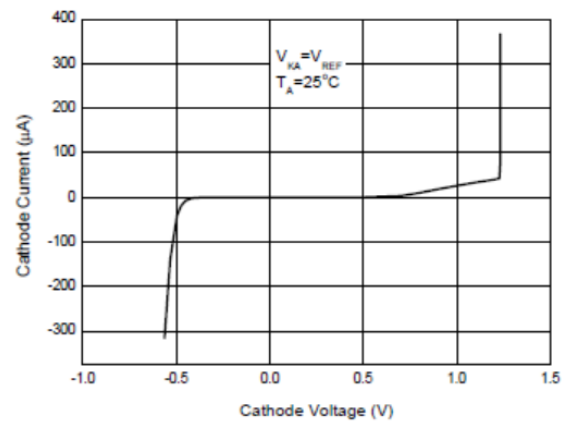
Reference Current vs. Ambient Temperature



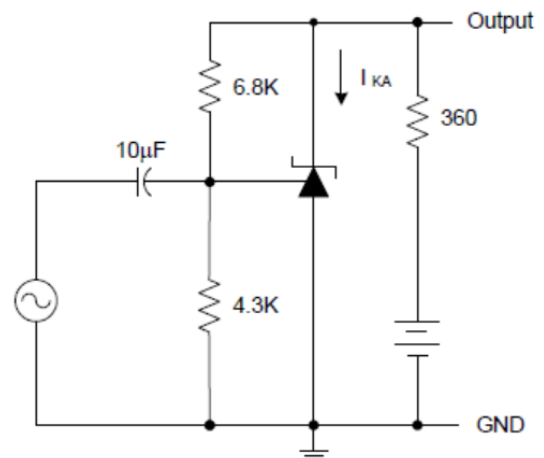
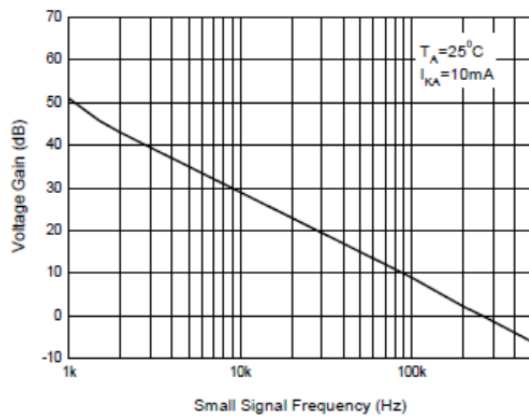
Cathode Current vs. Cathode Voltage



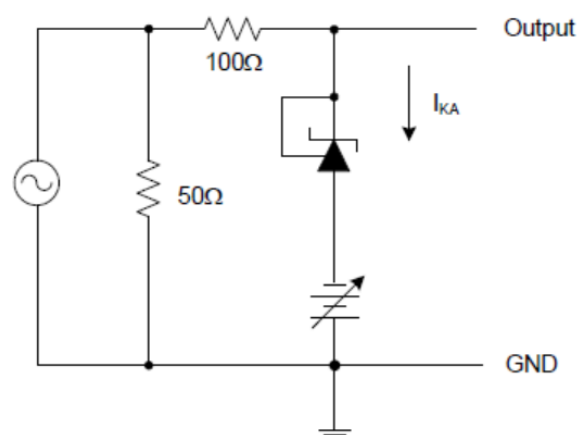
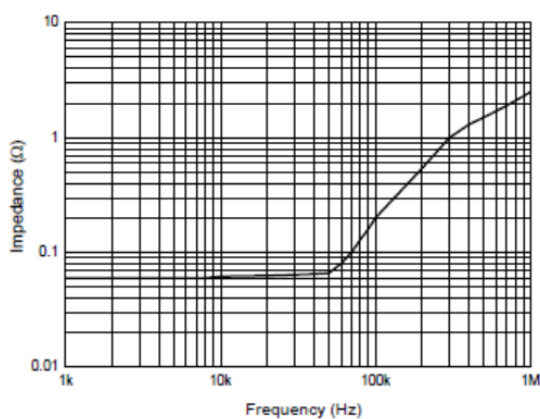
Cathode Current vs. Cathode Voltage



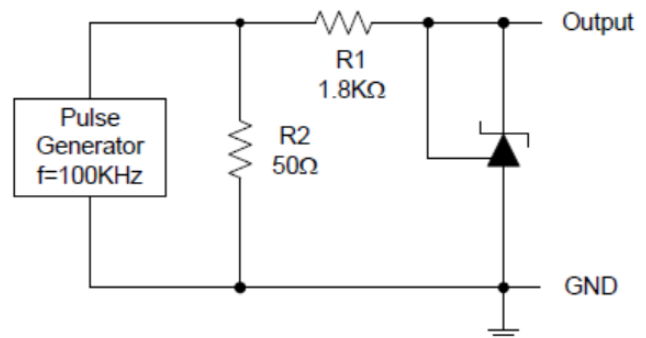
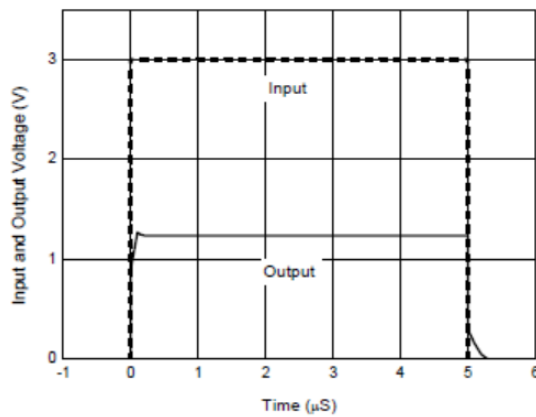
Small Signal Voltage Gain vs. Frequency



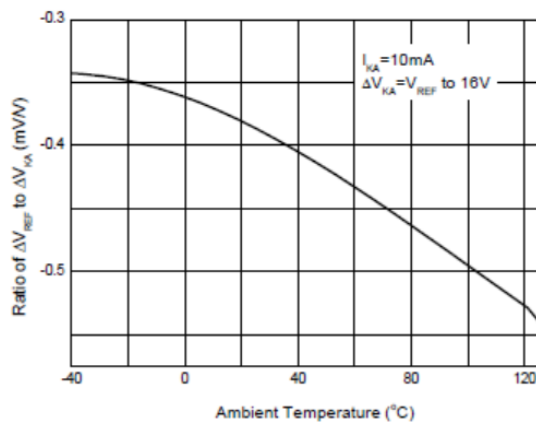
Dynamic Impedance vs. Frequency



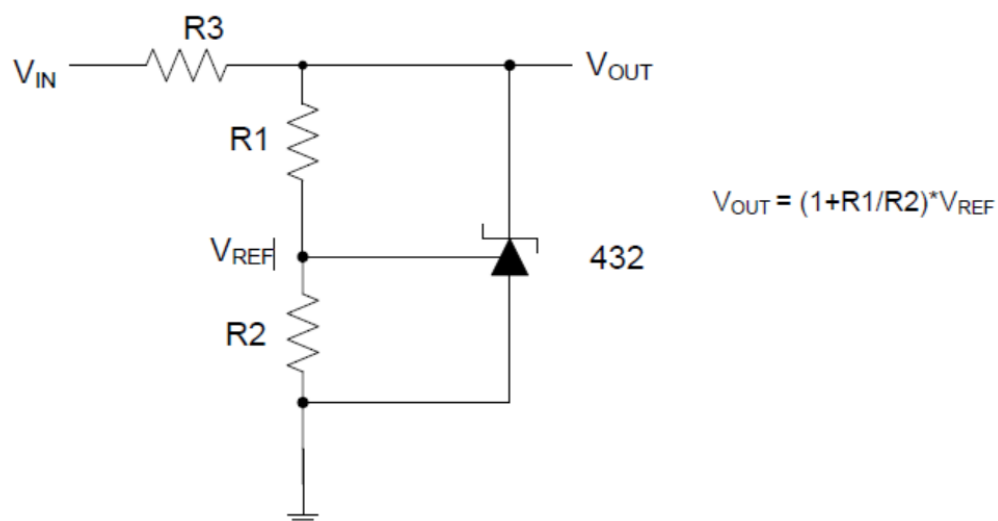
### Pulse Response of Input and Output Voltage



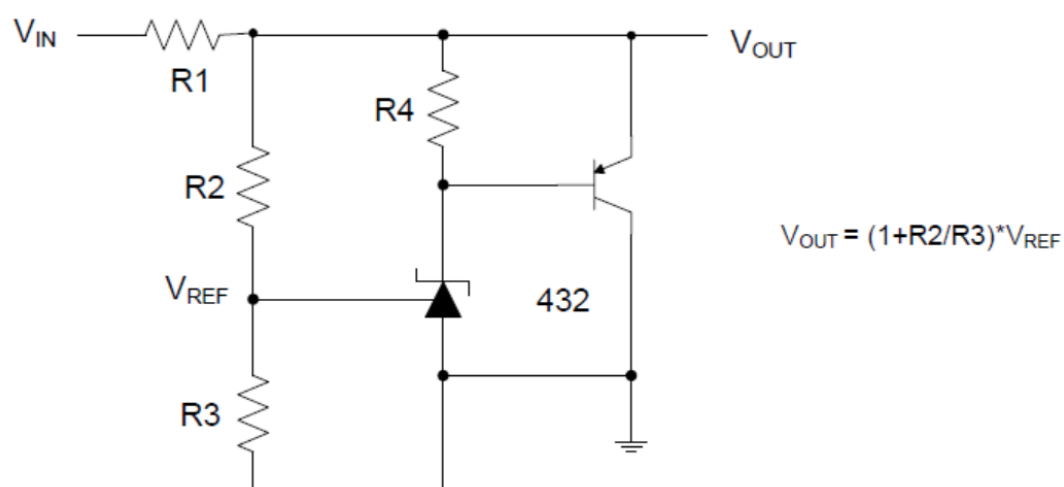
### Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage vs. Ambient Temperature



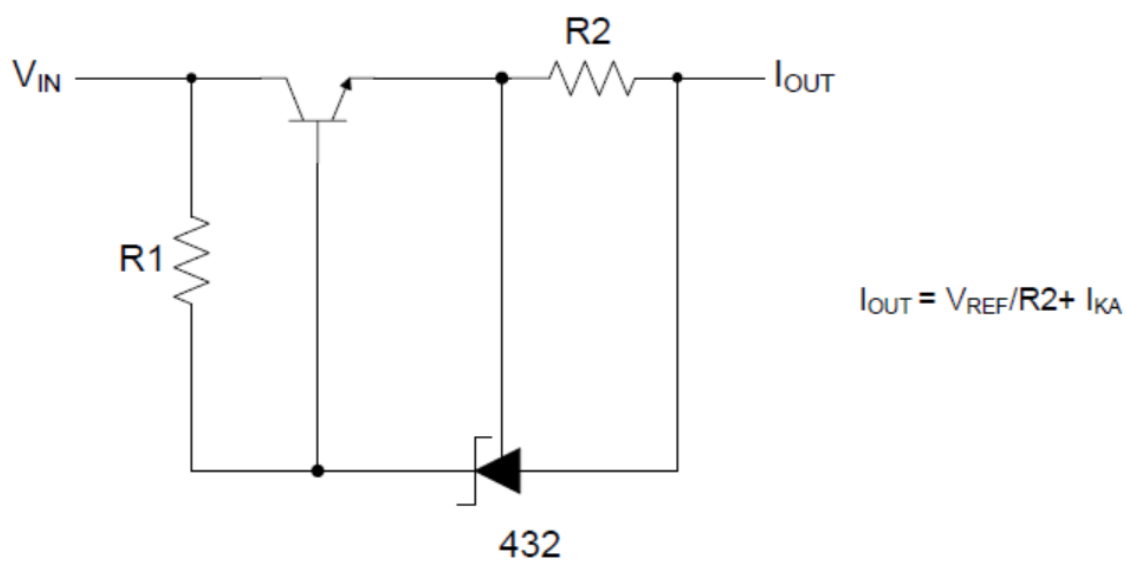
### Typical Applications Circuit



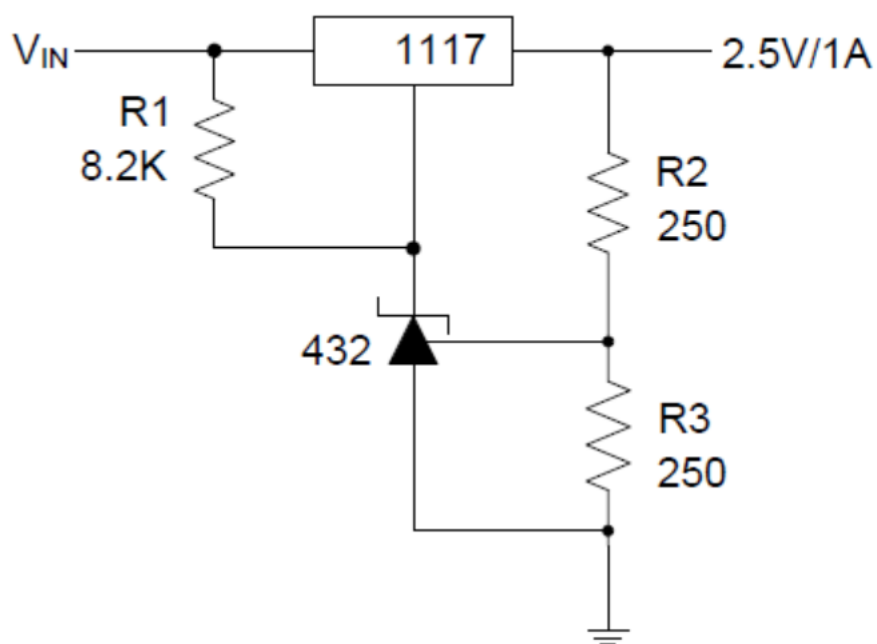
Shunt Regulator



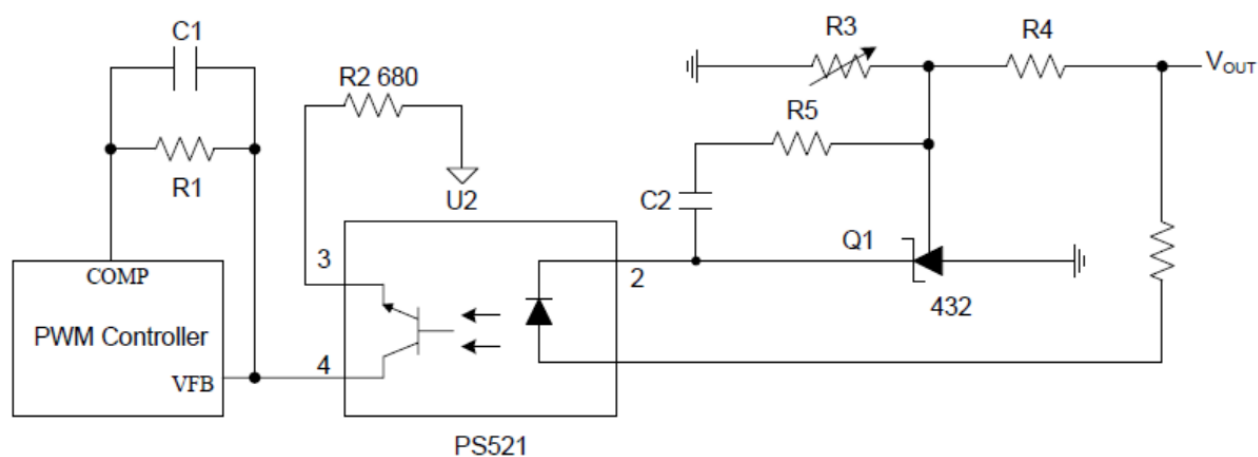
High Current Shunt Regulator



Current Source or Current Limit



Precision 2.5V/1A Regulator



PWM Converter with Reference