

**DESCRIPTION**

The LX432 series are low-voltage precision adjustable shunt regulators with a reference voltage of 1.24V. The output voltage may be set to any value between 1.24V and 20V by two external resistors.

These devices offer low output impedance for improved load regulation – typical output impedance is 200mΩ. The LX432 series operates with an operating current as low as 80μA, making these devices suitable for portable and micropower applications.

Low voltage operation enables the LX432 to be used in the feedback loop of isolated low voltage power supplies. The minimum output voltage is determined by the LX432 output voltage plus the forward voltage drop of the opto-coupler LED (typically 1.24 + 1.4 = 2.64V minimum). See figure 12.

The LX432 is offered in 3 lead SOT-23 or TO-92 packages, and is a drop-in replacement for the TLV431 and SC431L devices.

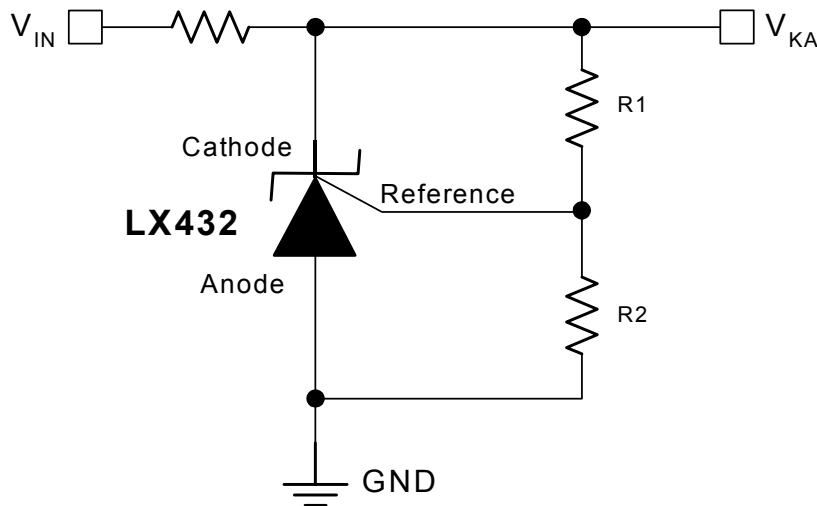
**IMPORTANT:** For the most current data, consult MICROSEMI's website: <http://www.microsemi.com>

**KEY FEATURES**

- Low Voltage Operation: 1.24V Reference
- Initial Voltage Reference Accuracy 1%
- Adjustable Output Voltage From VREF to 20V
- Typical Output Dynamic Impedance Less Than 250mΩ
- Sink Current Capability 80μA To 20mA
- Direct Alternative To TLV431

**APPLICATIONS**

- Low Voltage Adjustable Power Supplies
- Instrumentation
- Computers
- Portable Equipment

**PRODUCT HIGHLIGHT**

**PACKAGE ORDER INFO**

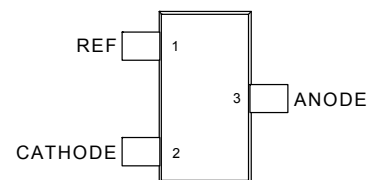
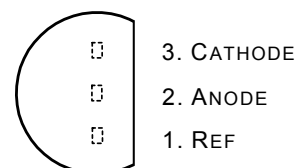
| T <sub>A</sub> (°C) | SC Package Marking | SC Plastic SOT-23 3-Pin                         | LP Plastic TO-92 3-Pin                          |
|---------------------|--------------------|-------------------------------------------------|-------------------------------------------------|
|                     |                    | RoHS Compliant / Pb-free<br>Transition DC: 0503 | RoHS Compliant / Pb-free<br>Transition DC: 0509 |
| 0 to 70             | 432C               | <b>LX432CSC</b>                                 | <b>LX432CLP</b>                                 |
| -40 to 85           | 432I               | <b>LX432ISC</b>                                 | <b>LX432ILP</b>                                 |

Note: Available in Tape & Reel. Append the letters "TR" to the part number. (i.e. LX432CSC-TR)  
TO-92 (LP) package also available in ammo-pack.

**ABSOLUTE MAXIMUM RATINGS (NOTE 1)**

|                                                                                             |                           |
|---------------------------------------------------------------------------------------------|---------------------------|
| Cathode to Anode Voltage ( $V_{KA}$ ).....                                                  | -0.3V to +20V             |
| Reference Input Current ( $I_{REF}$ ).....                                                  | -50 $\mu$ A to 10 $\mu$ A |
| Continuous Cathode Current ( $I_K$ ).....                                                   | -25mA to 25mA             |
| Operating Junction Temperature.....                                                         | 150°C                     |
| Storage Temperature.....                                                                    | -65°C to 150°C            |
| RoHS / Pb-free Peak Package Solder Reflow Temperature<br>(40 second maximum exposure) ..... | 260°C (+0,-5)             |

Note 1: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.

**PACKAGE PIN OUT**

**SC PACKAGE – 3-PIN**

**LP PACKAGE – 3-PIN**

RoHS / Pb-free 100% Matte Tin Lead Finish  
(All Views Top View)

**THERMAL DATA**
**SC 3-Pin Plastic Package**

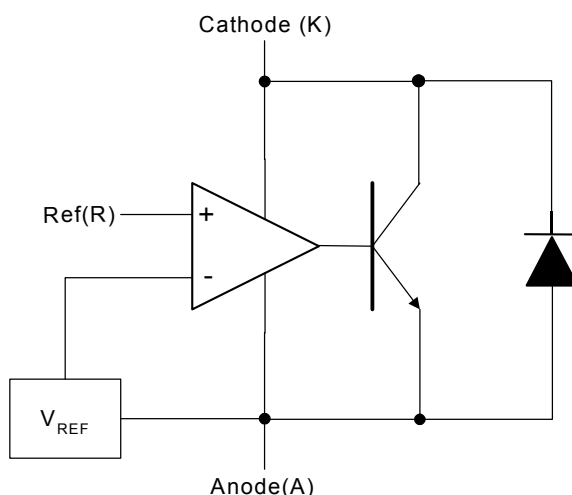
|                                                         |                  |         |
|---------------------------------------------------------|------------------|---------|
| Thermal Resistance – Junction to Ambient, $\theta_{JA}$ | (PC Mounted)     | 220°C/W |
|                                                         | (Non-PC Mounted) | 410°C/W |

**LP 3-Pin Plastic Package**

|                                                         |         |
|---------------------------------------------------------|---------|
| Thermal Resistance – Junction to Ambient, $\theta_{JA}$ | 156°C/W |
|---------------------------------------------------------|---------|

Junction Temperature Calculation:  $T_J = T_A + (P_D \times \theta_{JA})$ .

The  $\theta_{JA}$  numbers are guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.

**BLOCK DIAGRAM**

**Figure 1 – Simplified Block Diagram**

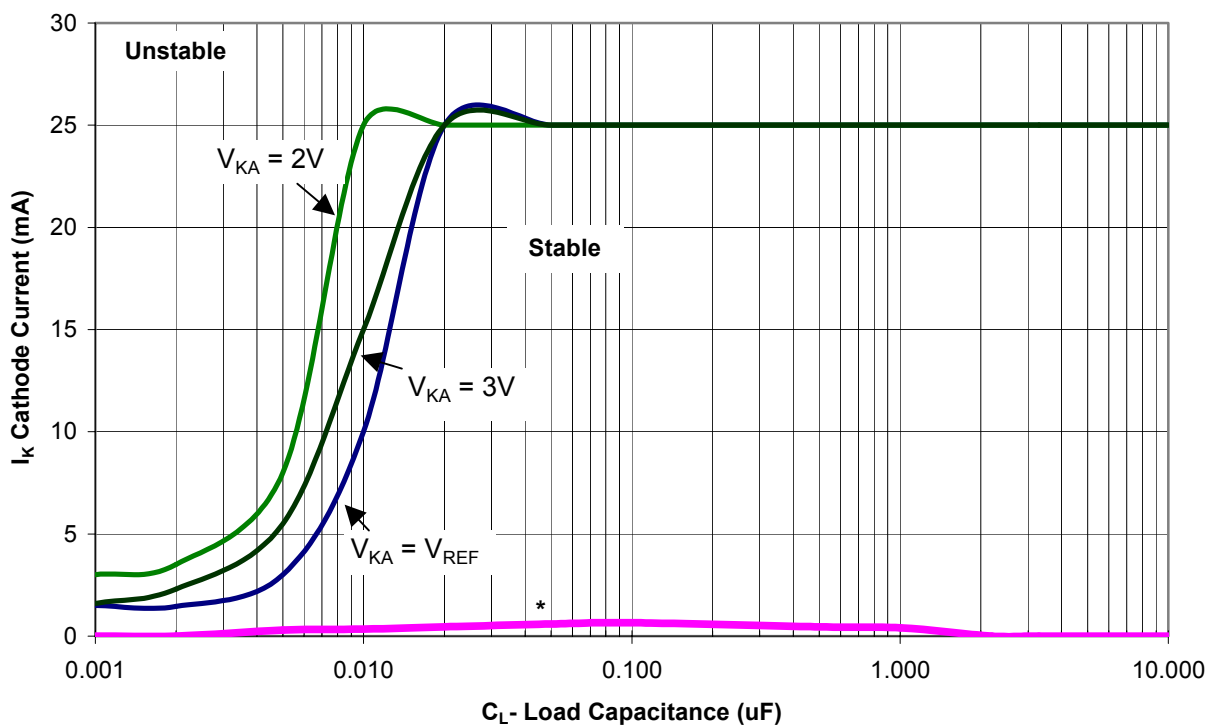
**ELECTRICAL CHARACTERISTICS**

Unless otherwise specified, the following specifications apply over the operating ambient temperature for the LX432C with  $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$  and the LX432I with  $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$  except where otherwise noted.

| Parameter                                                           | Symbol                                        | Test Conditions                                                                                                         | LX432 |       |       | Units         |
|---------------------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------|-------|-------|---------------|
|                                                                     |                                               |                                                                                                                         | Min   | Typ   | Max   |               |
| Reference Voltage                                                   | $V_{\text{REF}}$                              | $I_K = 10\text{mA}$ , $V_{KA} = V_{\text{REF}}$ , $T_A = 25^{\circ}\text{C}$                                            | 1.228 | 1.24  | 1.252 | V             |
| Reference Voltage Drift (note 2)                                    | $\Delta V_{\text{REF}}$                       | $I_K = 10\text{mA}$ , $V_{KA} = V_{\text{REF}}$ , $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$                  |       | 3     | 12    | mV            |
|                                                                     |                                               | $I_K = 10\text{mA}$ , $V_{KA} = V_{\text{REF}}$ , $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$                |       | 4     | 20    | mV            |
| Ratio of $V_{\text{REF}}$ Change In Cathode Voltage Change (note 3) | $\frac{\Delta V_{\text{REF}}}{\Delta V_{KA}}$ | $I_K = 10\text{mA}$ , $V_{KA} = V_{\text{REF}}$ to 16V, $T_A = 25^{\circ}\text{C}$                                      |       | -1    | -2.7  | mV/V          |
| Reference Terminal Current                                          | $I_{\text{REF}}$                              | $I_K = 10\text{mA}$ , $V_{KA} = V_{\text{REF}}$ , $T_A = 25^{\circ}\text{C}$ , $R1=10\text{k}\Omega$ , $R2=\text{Open}$ |       | 0.1   | 0.5   | $\mu\text{A}$ |
| Reference Current Drift (note 2)                                    | $\Delta I_{\text{REF}}$                       | $I_K = 10\text{mA}$ , $V_{KA} = V_{\text{REF}}$ , $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$                  |       | 0.05  | 0.3   | $\mu\text{A}$ |
|                                                                     |                                               | $I_K = 10\text{mA}$ , $V_{KA} = V_{\text{REF}}$ , $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$                |       | 0.1   | 0.4   | $\mu\text{A}$ |
| Minimum Cathode Current For Regulation                              | $I_{K(\text{MIN})}$                           | $V_{KA} = V_{\text{REF}}$ , $T_A = 25^{\circ}\text{C}$                                                                  |       | 55    | 80    | $\mu\text{A}$ |
| Dynamic Impedance                                                   | $Z_{KA}$                                      | $I_K = 0.1\text{mA}$ to 15mA, $V_{KA} = V_{\text{REF}}$ , $T_A = 25^{\circ}\text{C}$                                    |       | 0.2   | 0.4   | $\Omega$      |
| Off-State Cathode Current                                           | $I_{\text{OFF}}$                              | $V_{KA} = 16\text{V}$ , $T_A = 25^{\circ}\text{C}$                                                                      |       | 0.004 |       | $\mu\text{A}$ |

Note 2: These parameters are guaranteed by design.

Note 3:  $\frac{\Delta V_{\text{REF}}}{\Delta V_{KA}}$  Ratio of change in reference input voltage to the change in cathode voltage

**CHARACTERISTIC CURVES****STABILITY BOUNDARY CONDITION†****Figure 2 – Stability**

\* Unstable below 700 $\mu A$  as indicated

† The unstable areas indicate loading conditions that may cause the device to oscillate.



#### CHARACTERISTIC CURVES

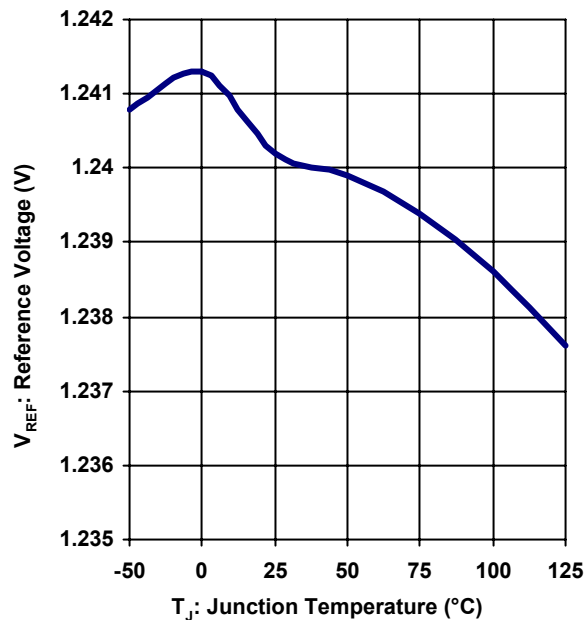


Figure 3 – Reference Voltage vs. Junction Temperature

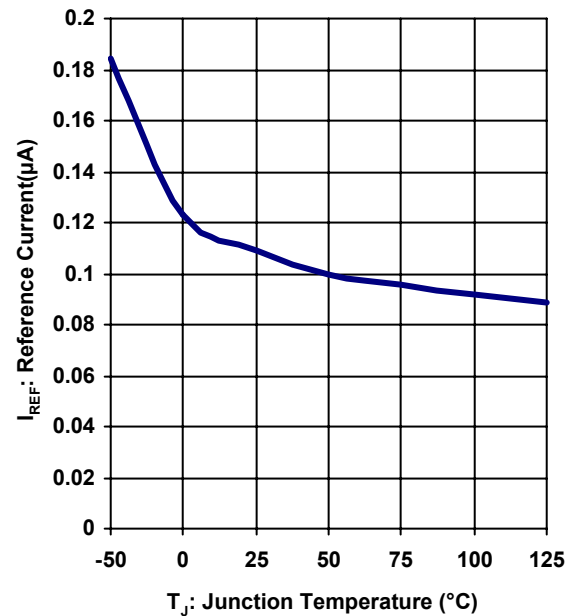


Figure 4 – Reference Current vs. Junction Temperature

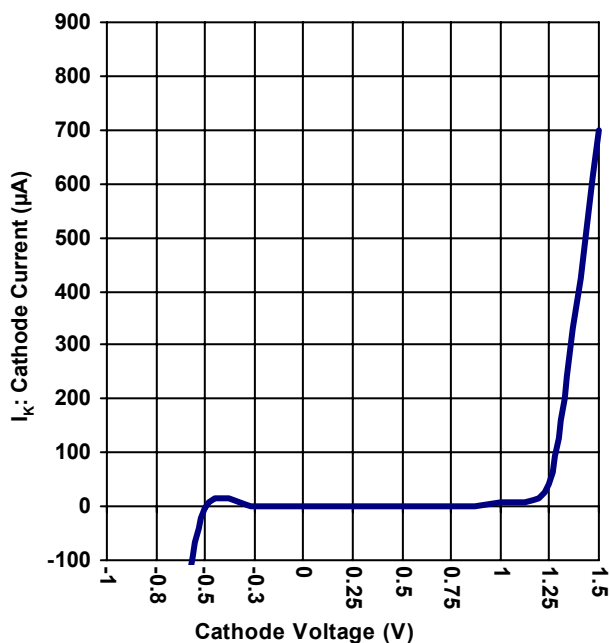


Figure 5 – Cathode Current vs. Cathode Voltage

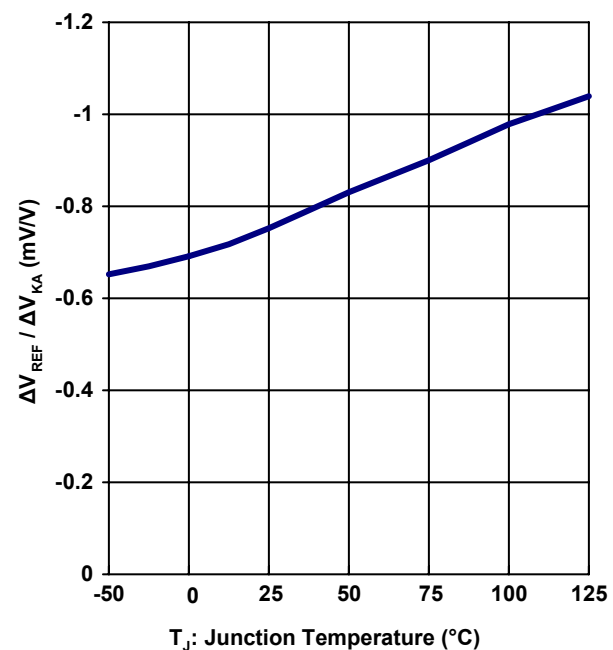
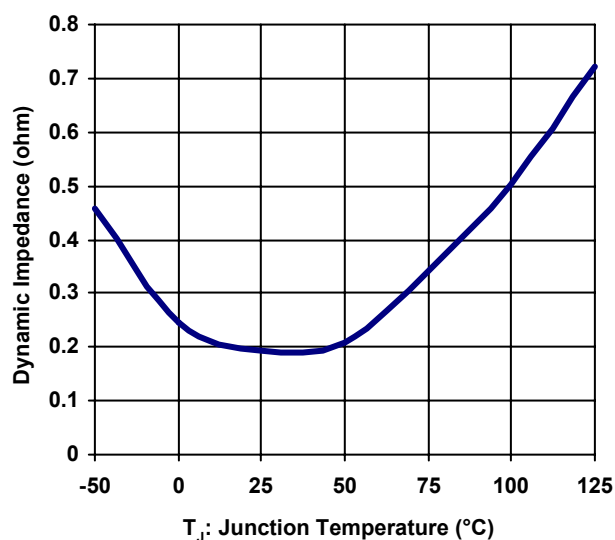
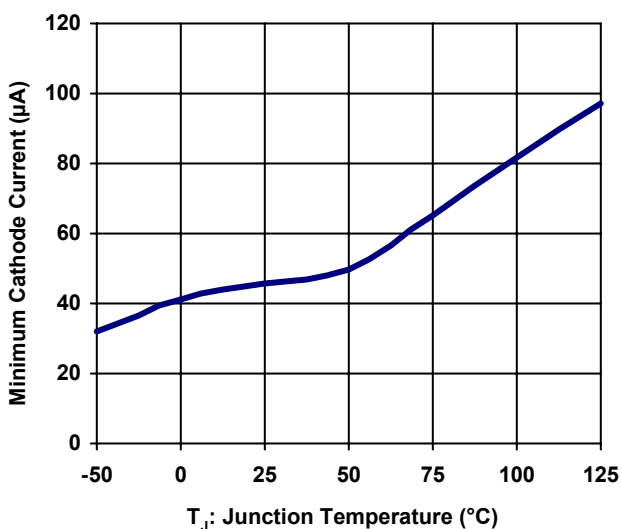
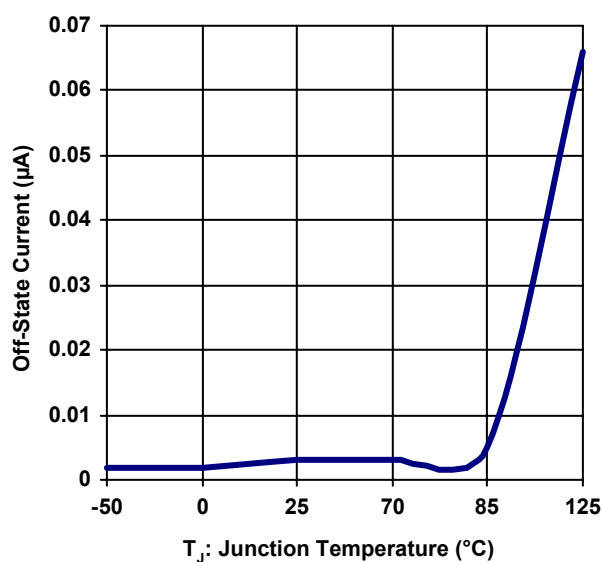
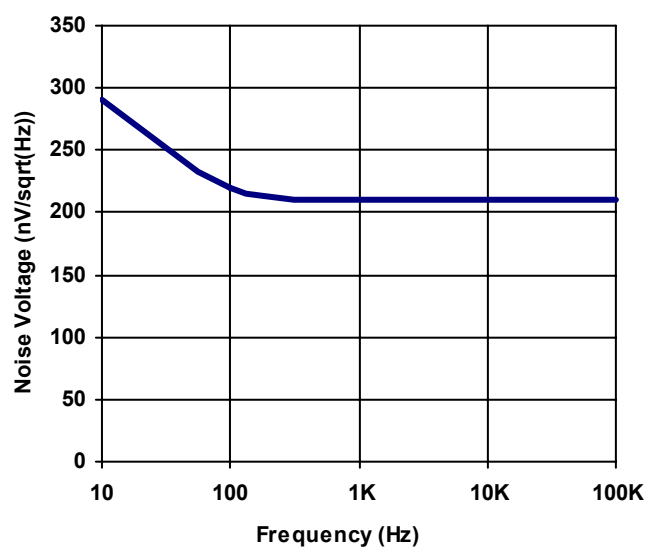


Figure 6 –  $\Delta V_{REF} / \Delta V_{KA}$  vs. Junction Temperature

**CHARACTERISTIC CURVES**

**Figure 7** – Dynamic Impedance vs. Junction Temperature

**Figure 8** – Minimum Cathode Current for Regulation vs. Junction Temperature

**Figure 9** – Off-State Current vs. Junction Temperature

**Figure 10** – Equivalent Input Noise Voltage vs. Frequency



#### PARAMETER MEASUREMENT INFORMATION

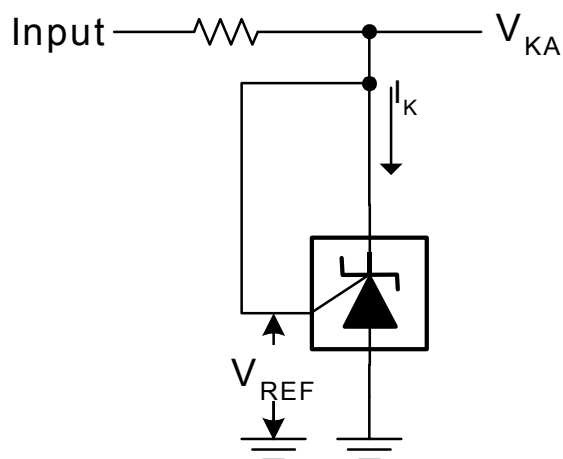


Figure 11 – Test Circuit For  $V_{KA} = V_{REF}$

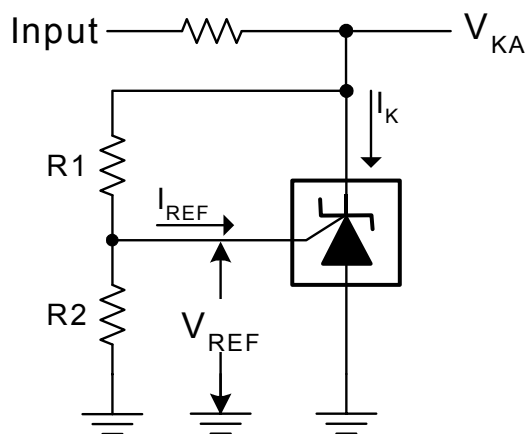


Figure 12 – Test Circuit For  $V_{KA} > V_{REF}$

$$V_O = V_{KA} = V_{REF} \times \left(1 + \frac{R1}{R2}\right) + I_{REF} \times R1$$

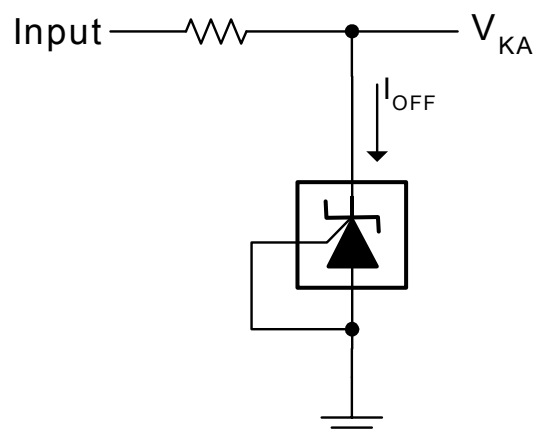


Figure 13 – Test Circuit For  $I_{OFF}$



#### TYPICAL APPLICATION

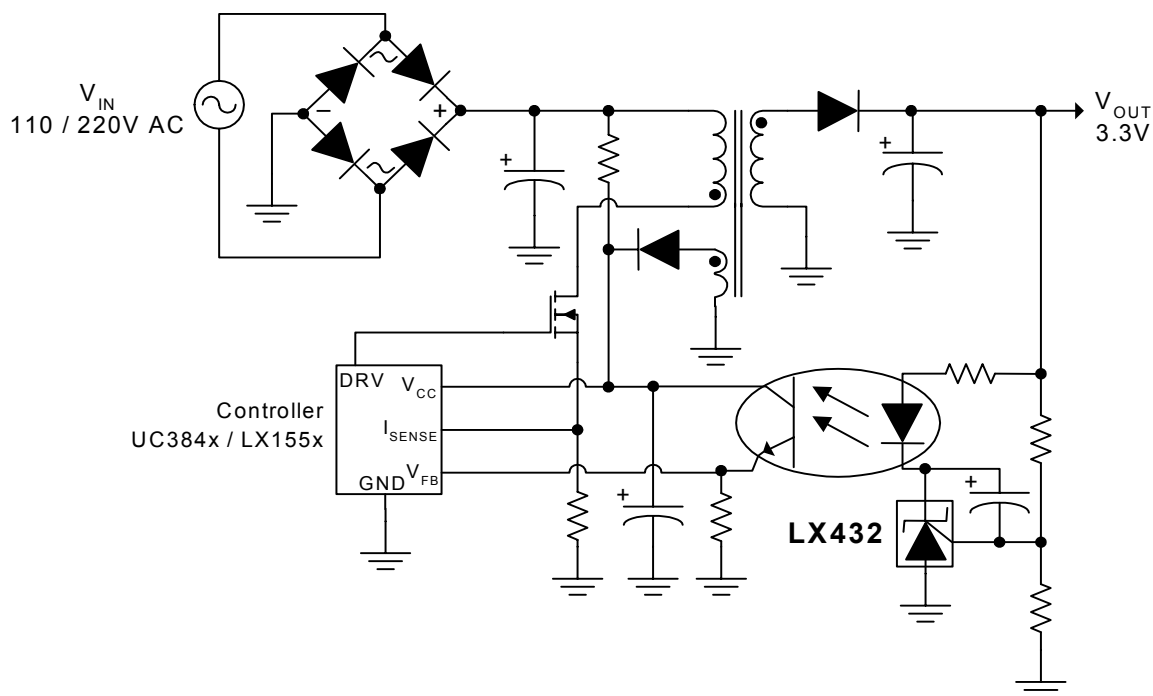


Figure 12 – LX432 In A Power Supply Isolated Feedback Application

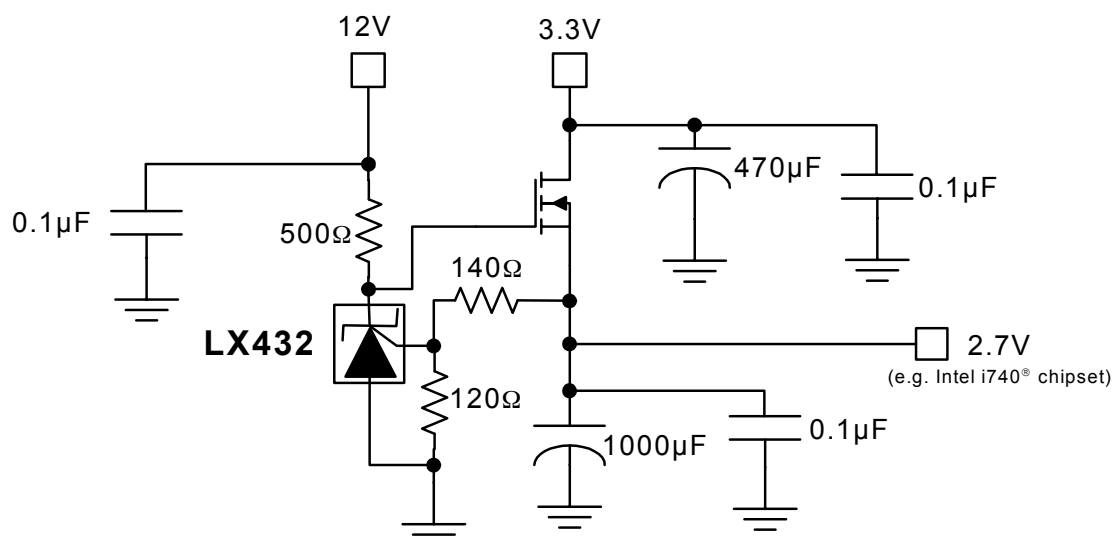
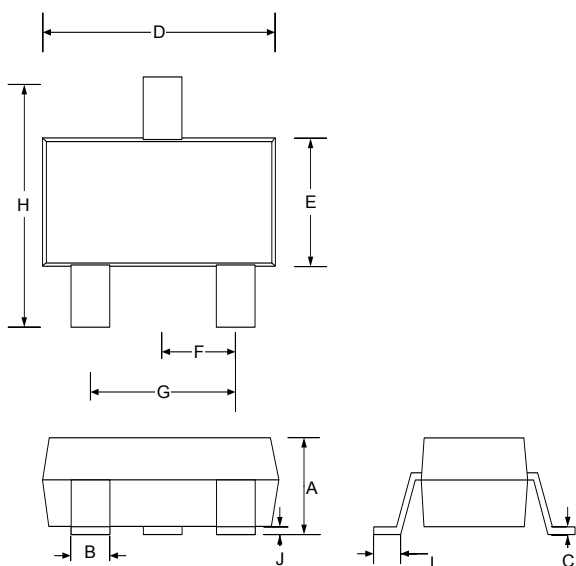


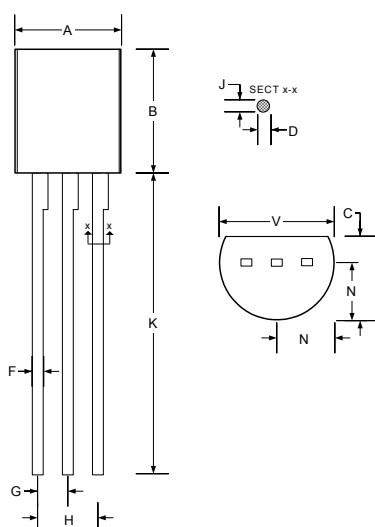
Figure 13 – LX432 in a 3.3V to 2.7V Low Dropout Regulator Application

**PACKAGE DIMENSIONS**
**SC 3-Pin Plastic SOT-23**


| Dim | MILLIMETERS |      | INCHES |        |
|-----|-------------|------|--------|--------|
|     | MIN         | MAX  | MIN    | MAX    |
| A   | 0.89        | 1.12 | 0.035  | 0.044  |
| B   | 0.37        | 0.51 | 0.015  | 0.020  |
| C   | 0.085       | 0.18 | 0.003  | 0.007  |
| D   | 2.80        | 3.04 | 0.110  | 0.120  |
| E   | 1.20        | 1.40 | 0.047  | 0.055  |
| F   | 0.89        | 1.09 | 0.035  | 0.043  |
| G   | 1.78        | 2.05 | 0.070  | 0.080  |
| H   | 2.10        | 2.64 | 0.083  | 0.104  |
| I   | 0.35        | 0.55 | 0.014  | 0.022  |
| J   | 0.013       | 0.10 | 0.0005 | 0.0039 |

**Note:**

1. Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm(.006") on any side. Lead dimension shall not include solder coverage.

**LP 3-Pin Plastic TO-92**


| Dim | MILLIMETERS |      | INCHES |       |
|-----|-------------|------|--------|-------|
|     | MIN         | MAX  | MIN    | MAX   |
| A   | 4.45        | 5.20 | 0.175  | 0.205 |
| B   | 4.32        | 5.33 | 0.170  | 0.210 |
| C   | 3.18        | 4.19 | 0.125  | 0.165 |
| D   | 0.41        | 0.55 | 0.016  | 0.022 |
| E   | 0.41        | 0.48 | 0.016  | 0.019 |
| F   | 1.15        | 1.39 | 0.045  | 0.055 |
| G   | 2.42        | 2.66 | 0.095  | 0.105 |
| H   | 0.39        | 0.50 | 0.015  | 0.020 |
| I   | 12.70       | -    | 0.500  | -     |
| J   | 2.05        | 2.66 | 0.080  | 0.105 |
| K   | 3.43        | -    | 0.135  | -     |

**Note:**

1. Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm(.006") on any side. Lead dimension shall not include solder coverage.



**Microsemi**<sup>®</sup>

**LX432**

**Low Voltage Adjustable Precision Shunt Regulator**

**PRODUCTION DATA SHEET**

**NOTES**

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