

#### 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 250mΩ. 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  $1.24 + 1.4 = 2.64\text{V}$  minimum). See Figure 10.

The LX432 is offered in 3 and 5-pin 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 Linfinity's web site: <http://www.linfinity.com>.

#### KEY FEATURES

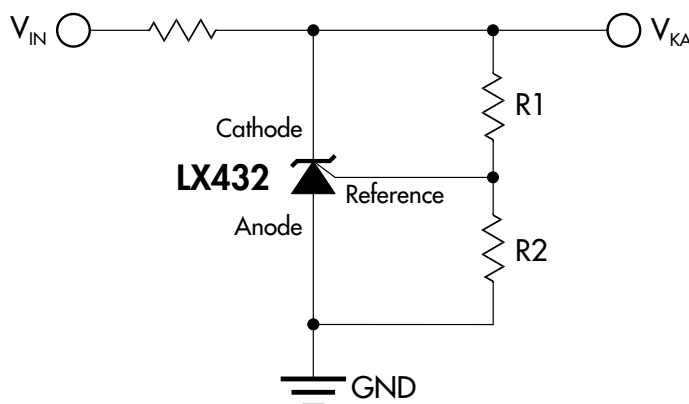
- Low Voltage Operation: 1.24V Reference
- Initial Voltage Reference Accuracy 1%
- Adjustable Output Voltage From  $V_{REF}$  To 20V
- Typical Output Dynamic Impedance Less Than 250mΩ
- Sink Current Capability 80μA To 20mA
- Direct Alternative To TLV431

#### APPLICATIONS

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

#### PRODUCT HIGHLIGHT

TYPICAL PROGRAMMABLE VOLTAGE  
REFERENCE CIRCUIT



#### PACKAGE ORDER INFORMATION

$T_A$ (°C)	SC Plastic SOT-23 3-pin	SE Plastic SOT-23 5-pin	LP Plastic TO-92 3-pin
0 to 70	LX432CSC	LX432CSE	LX432CLP
-40 to 85	LX432ISC	LX432ISE	LX432ILP

Note: All surface-mount packages are available in Tape & Reel.

Append the letter "T" to part number. (i.e. LX432CSET)

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	
Plastic (SC, SE & LP Packages)	150°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature	300°C

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 the specified terminal. Pin numbers refer to DIL packages only.

#### THERMAL DATA

##### SC PACKAGE:

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

##### SE PACKAGE:

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

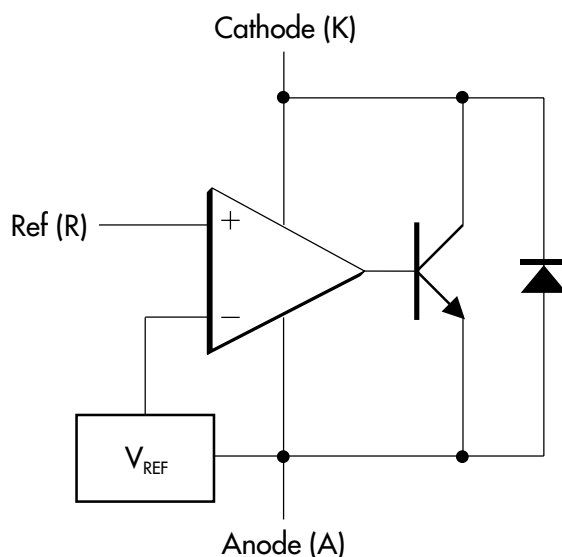
##### LP PACKAGE:

Thermal Resistance-Junction to Ambient, $\theta_{JA}$	156°C/W
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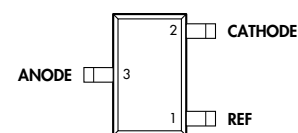
Junction Temperature Calculation:  $T_J = T_A + (P_D \times \theta_{JA})$ .

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

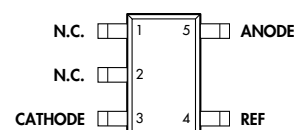
#### BLOCK DIAGRAM



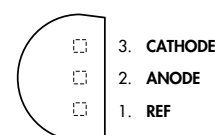
#### PACKAGE PIN OUTS



SC PACKAGE — 3-Pin  
(Top View)



SE PACKAGE — 5-Pin  
(Top View)



LP PACKAGE  
(Top View)

## LOW VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

### PRODUCTION DATA SHEET

#### ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, these specifications apply over the operating ambient temperatures for LX432C with  $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$ , and the LX432I with  $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ .)

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

Note 2. These parameters are guaranteed by design.

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

#### GRAPH / CURVE INDEX

##### Characteristic Curves

###### FIGURE #

1. Reference Voltage vs. Junction Temperature
2. Reference Current vs. Junction Temperature
3. Cathode Current vs. Cathode Voltage
4.  $\Delta V_{REF} / \Delta V_{KA}$  vs. Junction Temperature
5. Dynamic Impedance vs. Junction Temperature
6. Minimum Cathode Current For Regulation vs. Junction Temperature
7. Off-State Current vs. Junction Temperature
8. Equivalent Input Noise Voltage vs. Frequency

#### FIGURE INDEX

##### Parameter Measurement Information

###### FIGURE #

9. Test Circuit For  $V_{KA} = V_{REF}$
10. Test Circuit For  $V_{KA} > V_{REF}$
11. Test Circuit For  $I_{OFF}$

##### Typical Applications

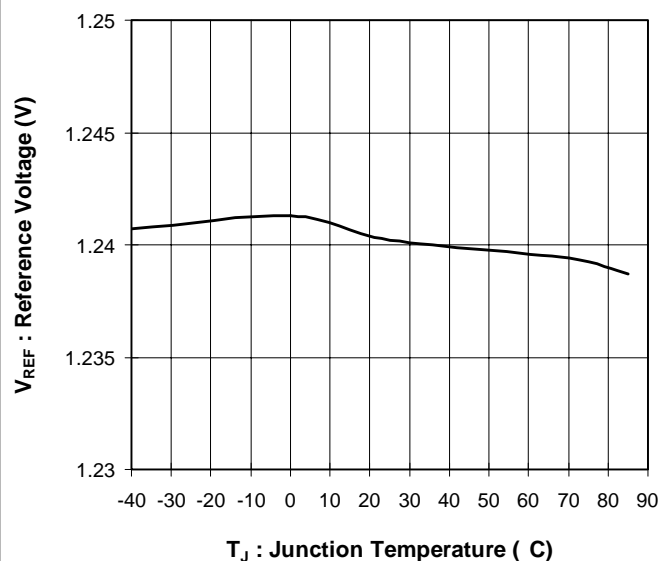
###### FIGURE #

12. Flyback With Isolation Using LX431 Or LX431A As Voltage Reference And Error Amplifier
13. LX432 In 3.3V To 2.7V Low Dropout Regulator Application

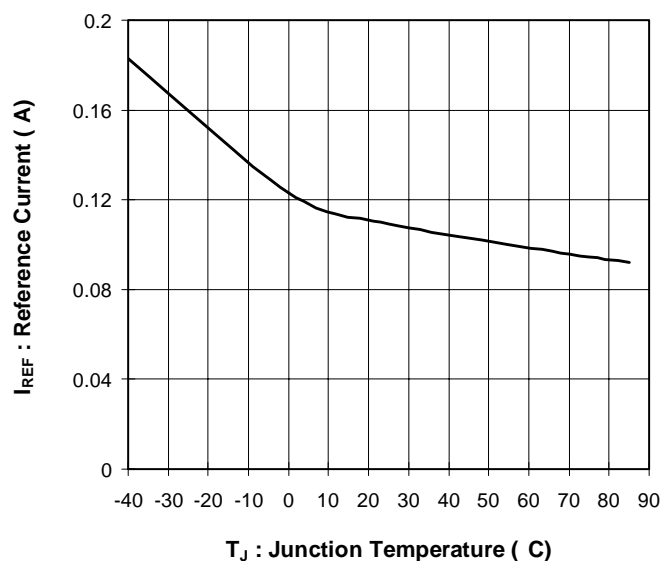
## LOW VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

### PRODUCTION DATA SHEET

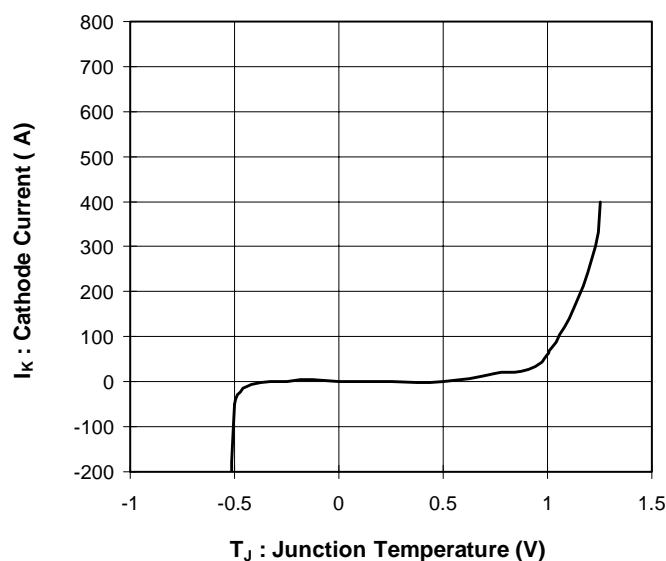
#### CHARACTERISTIC CURVES



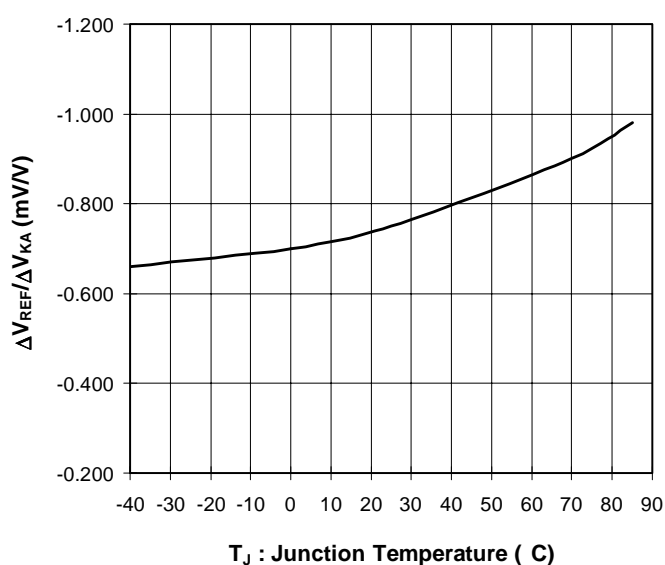
**FIGURE 1** — Reference Voltage vs. Junction Temperature



**FIGURE 2** — Reference Current vs. Junction Temperature

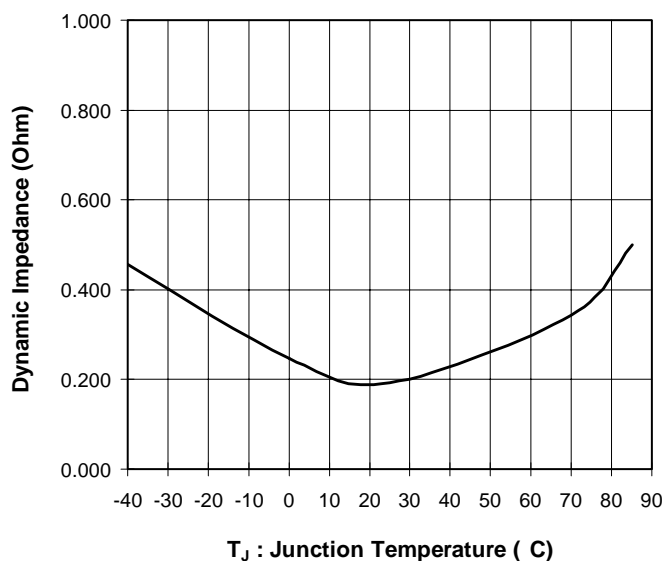


**FIGURE 3** — Cathode Current vs. Cathode Voltage

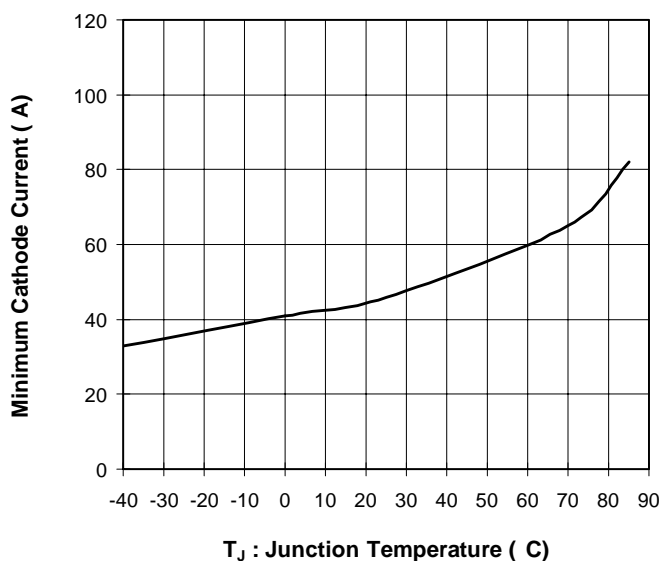


**FIGURE 4** —  $\Delta V_{REF} / \Delta V_{KA}$  vs. Junction Temperature

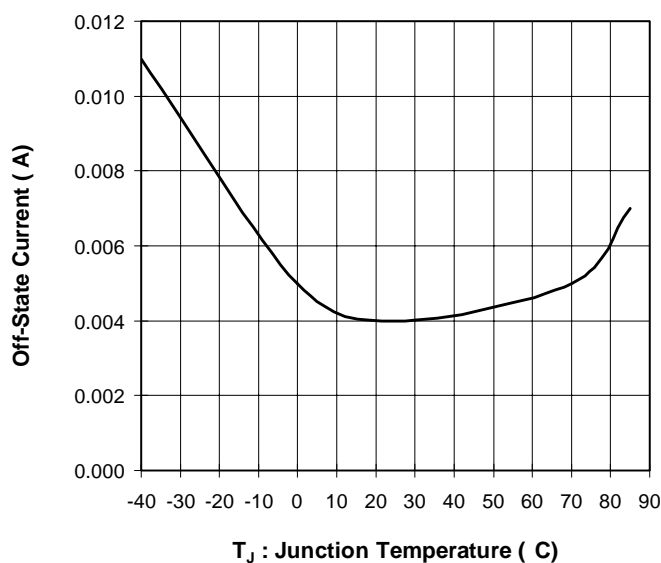
#### CHARACTERISTIC CURVES



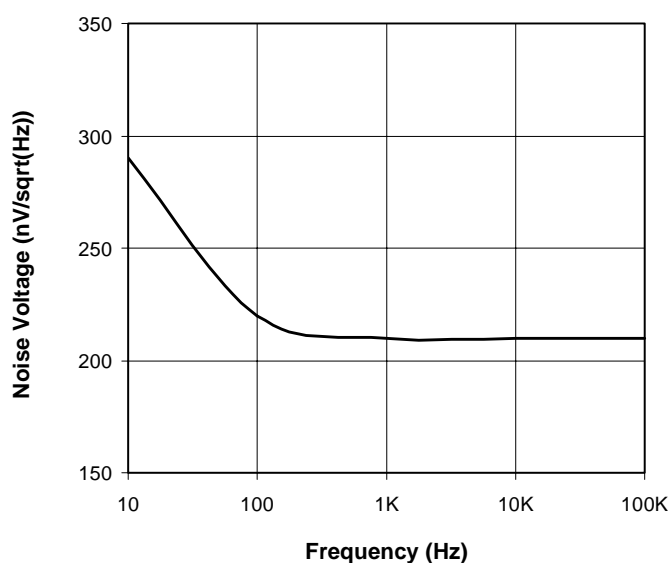
**FIGURE 5** — Dynamic Impedance vs. Junction Temperature



**FIGURE 6** — Minimum Cathode Current for Regulation vs. Junction Temperature



**FIGURE 7** — Off-State Current vs. Junction Temperature

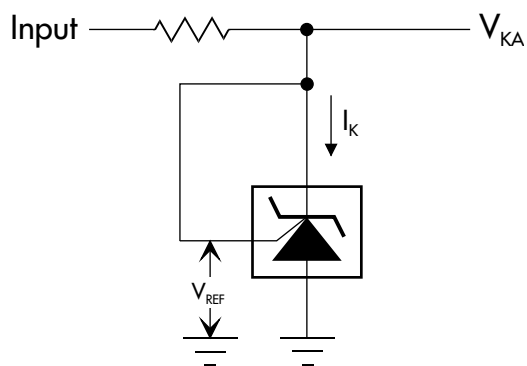


**FIGURE 8** — Equivalent Input Noise Voltage vs. Frequency

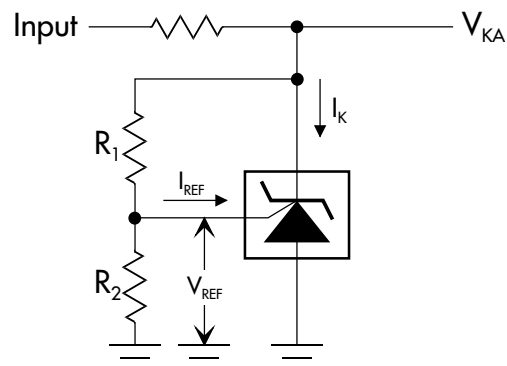
## LOW VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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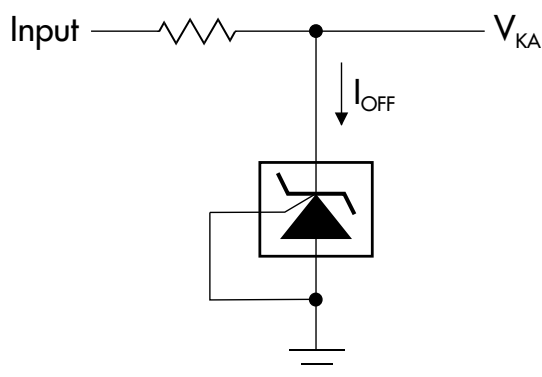
#### PARAMETER MEASUREMENT INFORMATION



**FIGURE 9** — Test Circuit For  $V_{KA} = V_{REF}$



**FIGURE 10** — Test Circuit For  $V_{KA} > V_{REF}$



**FIGURE 11** — Test Circuit For  $I_{OFF}$

#### TYPICAL APPLICATION

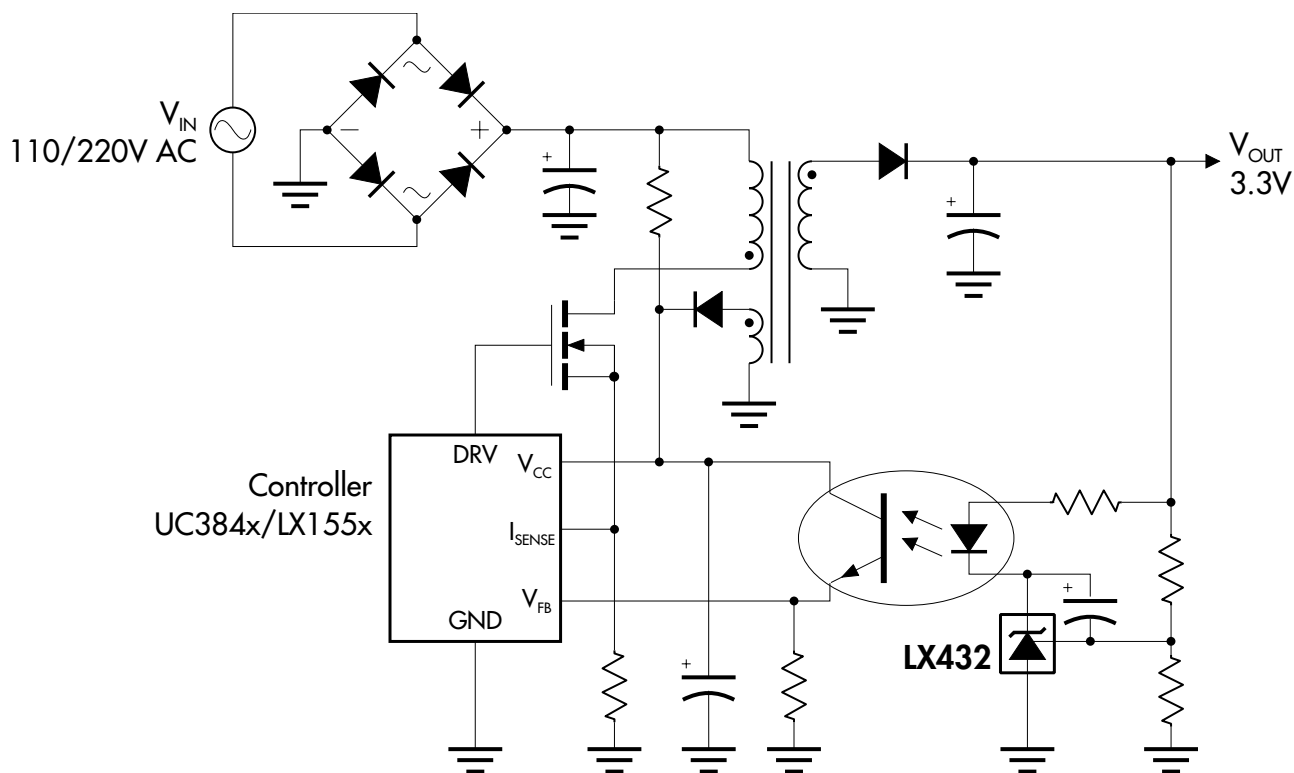


FIGURE 12 — LX432 In A Power Supply Isolated Feedback Application

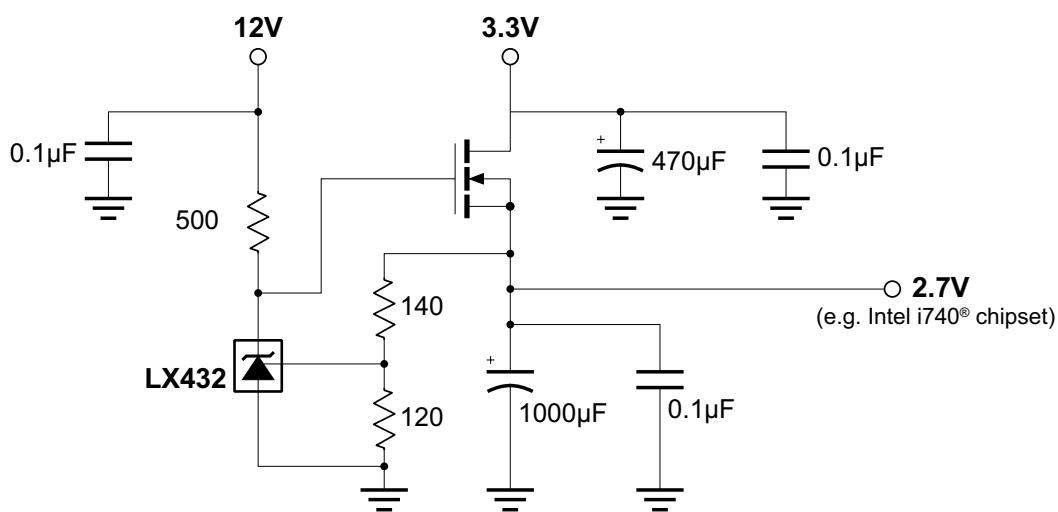


FIGURE 13 — LX432 In 3.3V To 2.7V Low Dropout Regulator Application

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