

# TL430 ADJUSTABLE SHUNT REGULATORS

SLVS050B – JUNE 1976 – REVISED JULY 1999

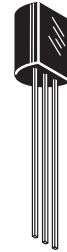
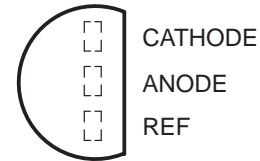
- Temperature Compensated
- Programmable Output Voltage
- Low Output Resistance
- Low Output Noise
- Sink Capability up to 100 mA

## description

The TL430 is a 3-terminal adjustable shunt regulator, featuring excellent temperature stability, wide operating current range, and low output noise. The output voltage can be set by two external resistors to any desired value between 3 V and 30 V. The TL430 can replace zener diodes in many applications, providing improved performance.

The TL430C is characterized for operation from 0°C to 70°C.

LP PACKAGE  
(TOP VIEW)



## symbol



AVAILABLE OPTIONS

T <sub>A</sub>	PACKAGED DEVICES	CHIP FORM (Y)
	PLASTIC (LP)	
0°C to 70°C	TL430CLP	TL430Y

The LP package is available taped and reeled. Add R suffix to device type (e.g., TL430CLPR). Chip forms are tested at 25°C.



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

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# TL430

## ADJUSTABLE SHUNT REGULATORS

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### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Regulator voltage (see Note 1)	30 V
Continuous regulator current	150 mA
Package thermal impedance, $\theta_{JA}$ (see Notes 2 and 3):	156°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C
Storage temperature range, $T_{stg}$	–65°C to 150°C

† Stresses beyond 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-rated conditions for extended periods may affect device reliability.

- NOTES:
- All voltage values are with respect to the anode terminal.
  - Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\max) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can impact reliability.
  - The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.

### recommended operating conditions

	MIN	MAX	UNIT
Regulator voltage, $V_Z$	$V_{ref}$	30	V
Regulator current, $I_Z$	2	100	mA
Operating free-air temperature range, $T_A$	TL430C		0 70 °C

### electrical characteristics over recommended operating conditions, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST FIGURE	TEST CONDITIONS	TL430C			UNIT
			MIN	TYP	MAX	
$V_{I(ref)}$ Reference input voltage	1	$V_Z = V_{I(ref)}$ , $I_Z = 10\text{ mA}$	2.5	2.75	3	V
$\alpha V_{I(ref)}$ Temperature coefficient of reference input voltage	1	$V_Z = V_{I(ref)}$ , $I_Z = 10\text{ mA}$ , $T_A = 0^\circ\text{C}$ to $70^\circ\text{C}$	120			ppm/°C
$I_{I(ref)}$ Reference input current	2	$I_Z = 10\text{ mA}$ , $R_1 = 10\text{ k}\Omega$ , $R_2 = \infty$	3 10			$\mu\text{A}$
$I_{ZK}$ Regulator current near lower knee of regulation range	1	$V_Z = V_{I(ref)}$	0.5 2			mA
$I_{ZK}$ Regulator current at maximum limit of regulation range	1	$V_Z = V_{I(ref)}$	50			mA
	2	$V_Z = 5\text{ V}$ to $30\text{ V}$ , See Note 4	100			
$r_z$ Differential regulator resistance (see Note 5)	1	$V_Z = V_{I(ref)}$ , $\Delta I_Z = (52 - 2)\text{ mA}$	1.5 3			W
$V_n$ Noise voltage	2	$f = 0.1\text{ Hz}$ to $10\text{ Hz}$	$V_Z = 3\text{ V}$			$\mu\text{V}$
			$V_Z = 12\text{ V}$			
			$V_Z = 30\text{ V}$			

- NOTES:
- The average power dissipation,  $V_Z \cdot I_Z \cdot \text{duty cycle}$ , must not exceed the maximum continuous rating in any 10-ms interval.
  - The regulator resistance for  $V_Z > V_{I(ref)}$ ,  $r_z$ , is given by:

$$r_z' = r_z \left( 1 + \frac{R_1}{R_2} \right)$$



electrical characteristics over recommended operating conditions,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

PARAMETER	TEST FIGURE	TEST CONDITIONS	TL430Y			UNIT
			MIN	TYP	MAX	
$V_{I(\text{ref})}$ Reference input voltage	1	$V_Z = V_{I(\text{ref})}$ , $I_Z = 10 \text{ mA}$	2.5	2.75	3	V
$I_{I(\text{ref})}$ Reference input current	2	$I_Z = 10 \text{ mA}$ , $R_1 = 10 \text{ k}\Omega$ , $R_2 = \infty$		3	10	$\mu\text{A}$
$I_{ZK}$ Regulator current near lower knee of regulation range	1	$V_Z = V_{I(\text{ref})}$		0.5	2	mA
$I_{ZK}$ Regulator current at maximum limit of regulation range	1	$V_Z = V_{I(\text{ref})}$		50		mA
	2	$V_Z = 5 \text{ V to } 30 \text{ V}$ , See Note 4		100		
$r_z$ Differential regulator resistance (see Note 5)	1	$V_Z = V_{I(\text{ref})}$ , ... $\Delta I_Z = (52 - 2) \text{ mA}$		1.5	3	$\Omega$
$V_n$ Noise voltage	2	$f = 0.1 \text{ Hz to } 10 \text{ Hz}$	$V_Z = 3 \text{ V}$		50	$\mu\text{V}$
			$V_Z = 12 \text{ V}$		200	
			$V_Z = 30 \text{ V}$		650	

NOTES: 4. The average power dissipation,  $V_Z \cdot I_Z \cdot \text{duty cycle}$ , must not exceed the maximum continuous rating in any 10-ms interval.  
5. The regulator resistance for  $V_Z > V_{I(\text{ref})}$ ,  $r_z$ , is given by:

$$r_z' = r_z \left( 1 + \frac{R_1}{R_2} \right)$$

### PARAMETER MEASUREMENT INFORMATION

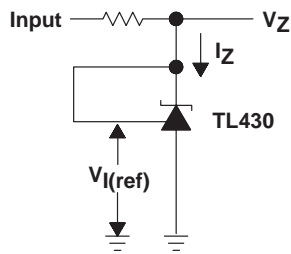
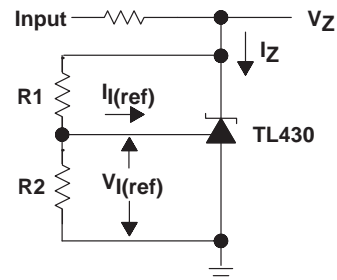


Figure 1. Test Circuit for  $V_Z = V_{I(\text{ref})}$



$$V_Z = V_{I(\text{ref})} \left( 1 + \frac{R_1}{R_2} \right) + I_{I(\text{ref})} \times R_1$$

Figure 2. Test Circuit for  $V_Z > V_{I(\text{ref})}$

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## TYPICAL CHARACTERISTICS

**SMALL-SIGNAL REGULATOR IMPEDANCE  
vs  
FREQUENCY**

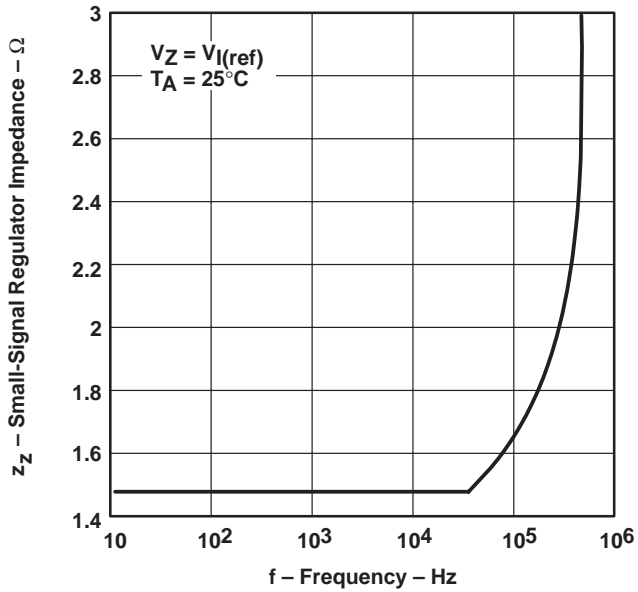


Figure 3

**CATHODE CURRENT  
vs  
CATHODE VOLTAGE**

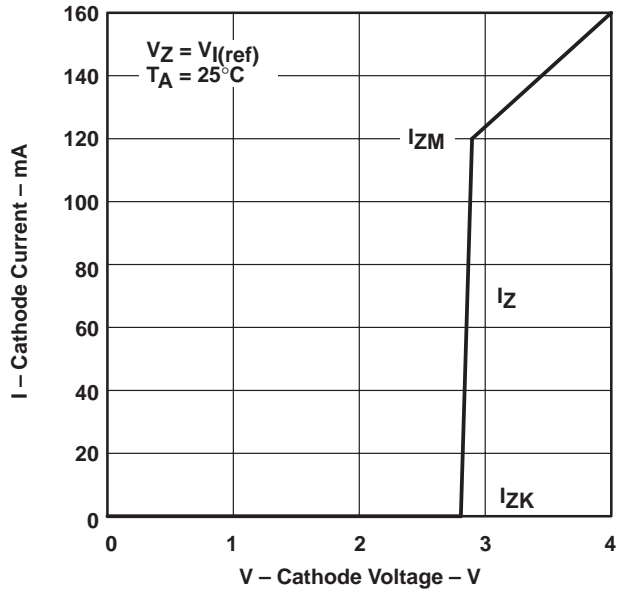
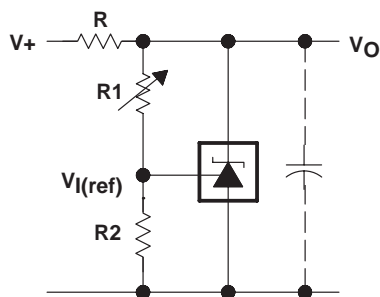


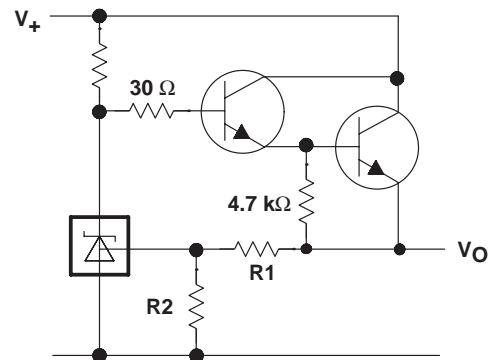
Figure 4

## APPLICATION INFORMATION



$$V_O \approx \left(1 + \frac{R1}{R2}\right) V_{I(ref)}$$

Figure 5. Shunt Regulator



$$V_O \approx \left(1 + \frac{R1}{R2}\right) V_{I(ref)}$$

Figure 6. Series Regulator

APPLICATION INFORMATION

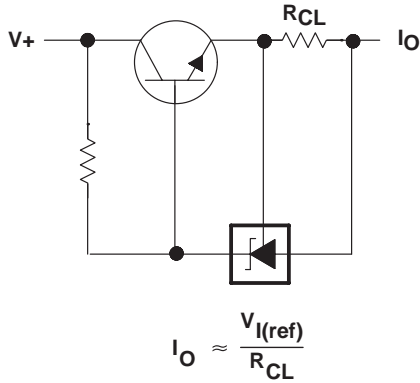
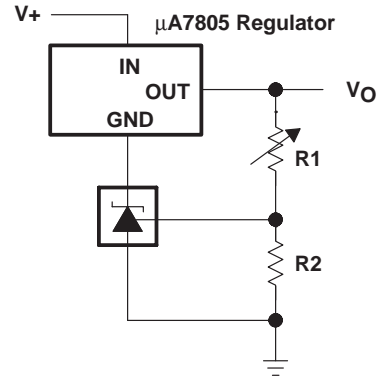


Figure 7. Current Limiter



$$V_O = \left(1 + \frac{R_1}{R_2}\right) V_{I(\text{ref})}$$

$$\text{Min } V_O = V_{I(\text{ref})} + 5V$$

Figure 8. Output Control of a 3-Terminal Fixed Regulator

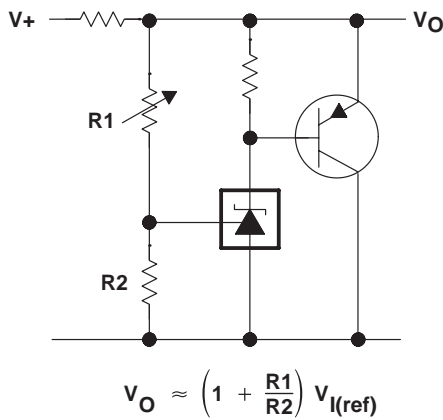


Figure 9. Higher-Current Applications

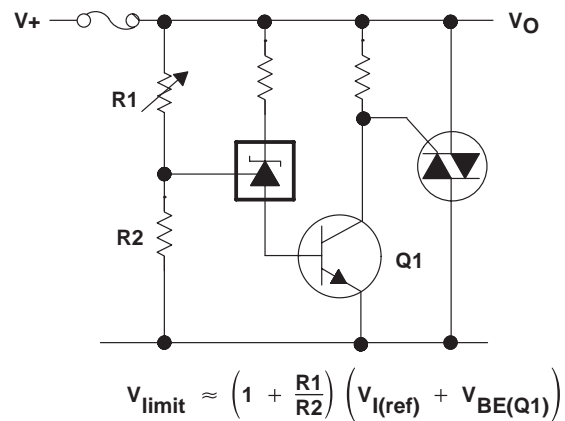


Figure 10. Crowbar

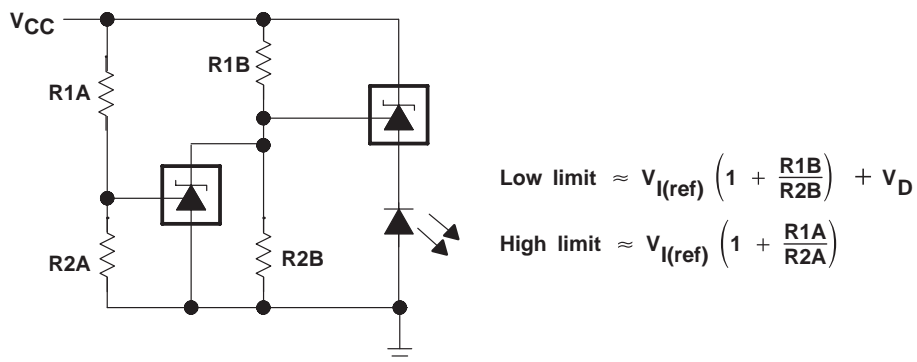


Figure 11. V<sub>CC</sub> Monitor

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