

TL430C, TL430I, TL430Y ADJUSTABLE SHUNT REGULATORS

SLVS050A – JUNE 1976 – REVISED AUGUST 1995

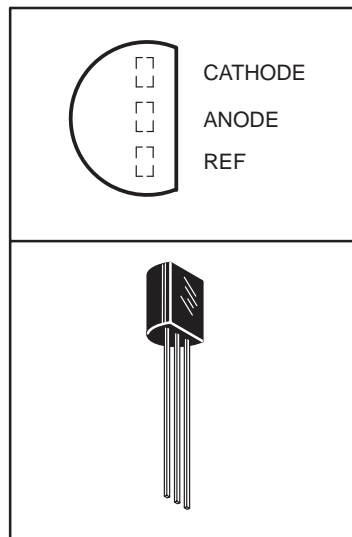
- Temperature Compensated
- Programmable Output Voltage
- Low Output Resistance
- Low Output Noise
- Sink Capability to 100 mA

description

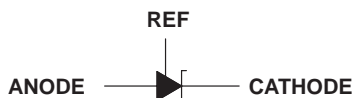
The TL430 is a 3-terminal adjustable shunt regulator featuring excellent temperature stability, wide operating current range, and low output noise. The output voltage may be set by two external resistors to any desired value between 3 V and 30 V. The TL430 can replace zener diodes in many applications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

The TL430C is characterized for operation from 0°C to 70°C. The TL430I is characterized for operation from –40°C to 85°C.

LP PACKAGE
(TOP VIEW)



symbol



AVAILABLE OPTIONS

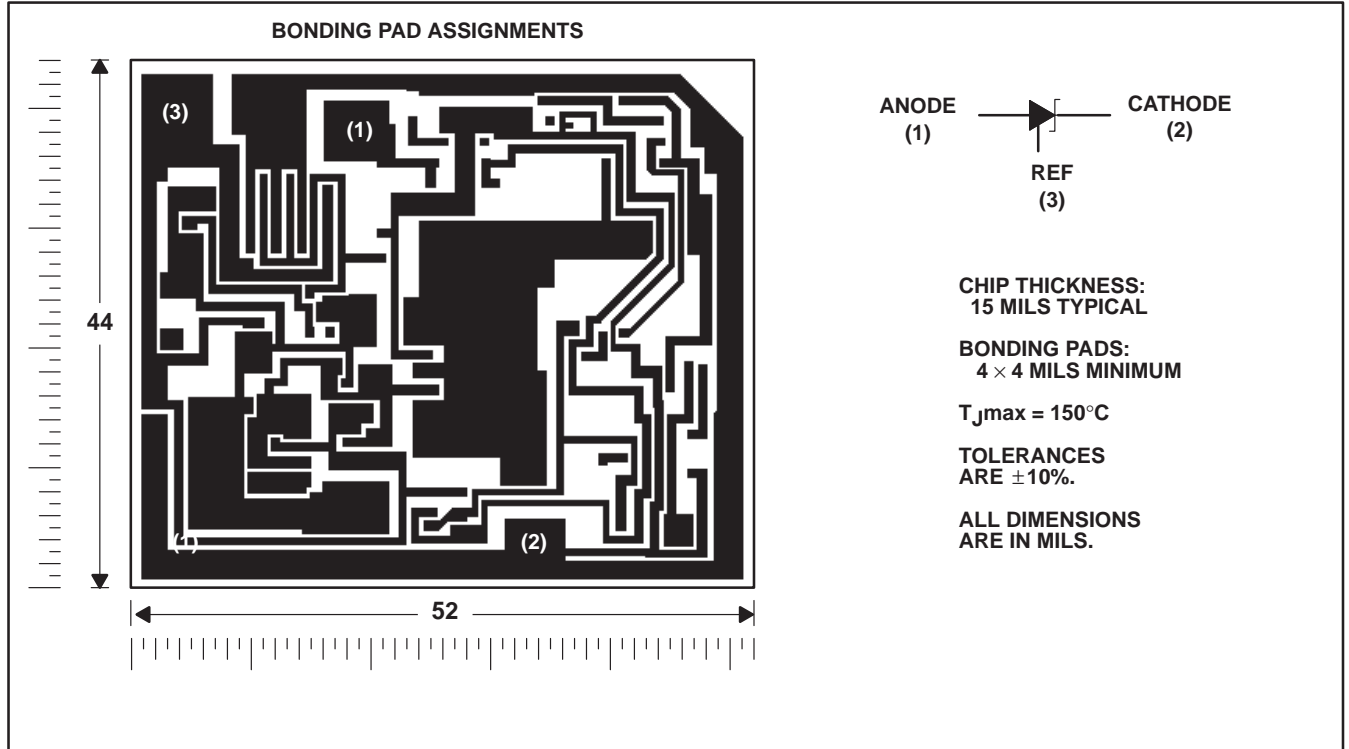
T _A	PACKAGED DEVICES†	CHIP FORM (Y)
	PLASTIC (LP)	
0°C to 70°C	TL430CLP	TL430Y
–40°C to 85°C	TL430ILP	—

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TL430Y chip information

This chip, when properly assembled, displays characteristics similar to the TL430C. Thermal compression or ultrasonic bonding may be used on the doped aluminum bonding pads. The chip may be mounted with conductive epoxy or a gold-silicon preform.



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

Regulator voltage (see Note 1)	30 V
Continuous regulator current	150 mA
Continuous total power dissipation at (or below) $T_A = 25^{\circ}\text{C}$ (see Note 2)	775 mW
Operating free-air temperature range, T_A : TL430C	0°C to 70°C
TL430I	-40°C to 85°C
Storage temperature range, T_{stg}	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°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: 1. All voltage values are with respect to the anode terminal.
2. For operation above 25°C free-air temperature, derate at $6.2 \text{ mW}/^{\circ}\text{C}$.

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	$^{\circ}\text{C}$
	TL430I	-40	

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

PARAMETER	TEST FIGURE	TEST CONDITIONS	TL430C			TL430I			UNIT
			MIN	TYP	MAX	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	2.6	2.75	2.9	V
$\alpha V_{I(\text{ref})}$ Temperature coefficient of reference input voltage	1	$V_Z = V_{I(\text{ref})}$, $I_Z = 10\text{ mA}$, $T_A = \text{full range}^\dagger$	120			120 200			ppm/ $^\circ\text{C}$
$I_{I(\text{ref})}$ Reference input current	2	$I_Z = 10\text{ mA}$, $R_1 = 10\text{ k}\Omega$, $R_2 = \infty$	3 10			3 10			μA
I_{ZK} Regulator current near lower knee of regulation range	1	$V_Z = V_{I(\text{ref})}$	0.5 2			0.5 2			mA
I_{ZK} Regulator current at maximum limit of regulation range	1	$V_Z = V_{I(\text{ref})}$	50			50			mA
	2	$V_Z = 5\text{ V to }30\text{ V}$, See Note 3	100			100			
r_z Differential regulator resistance (see Note 4)	1	$V_Z = V_{I(\text{ref})}$, $\Delta I_Z = (52 - 2)\text{ mA}$	1.5 3			1.5 3			Ω
V_n Noise voltage	2	$f = 0.1\text{ Hz to }10\text{ Hz}$	$V_Z = 3\text{ V}$	50		50		μV	
			$V_Z = 12\text{ V}$	200		200			
			$V_Z = 30\text{ V}$	650		650			

† Full temperature range is 0°C to 70°C for the TL430C and -40°C to 85°C for the TL430I.

- NOTES: 3. 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.
4. The regulator resistance for $V_Z > V_{I(\text{ref})}$, r_z , is given by:

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

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			μA
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 3	100			
r_z Differential regulator resistance (see Note 4)	1	$V_Z = V_{I(\text{ref})}$, $\Delta I_Z = (52 - 2)\text{ mA}$	1.5 3			Ω
V_n Noise voltage	2	$f = 0.1\text{ Hz to }10\text{ Hz}$	$V_Z = 3\text{ V}$	50		μV
			$V_Z = 12\text{ V}$	200		
			$V_Z = 30\text{ V}$	650		

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PARAMETER MEASUREMENT INFORMATION

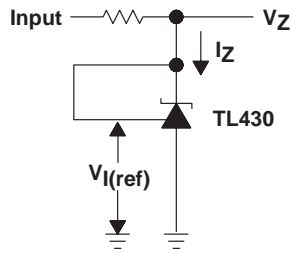
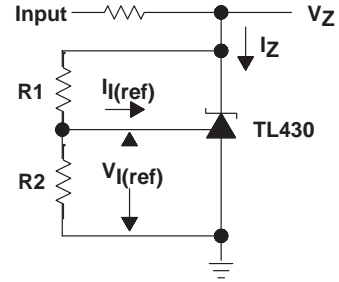


Figure 1. Test Circuit for $V_Z = V_{I(ref)}$



$$V_Z = V_{I(ref)} \left(1 + \frac{R1}{R2} \right) + I_{I(ref)} \times R1$$

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

TYPICAL CHARACTERISTICS

SMALL-SIGNAL REGULATOR IMPEDANCE
vs
FREQUENCY

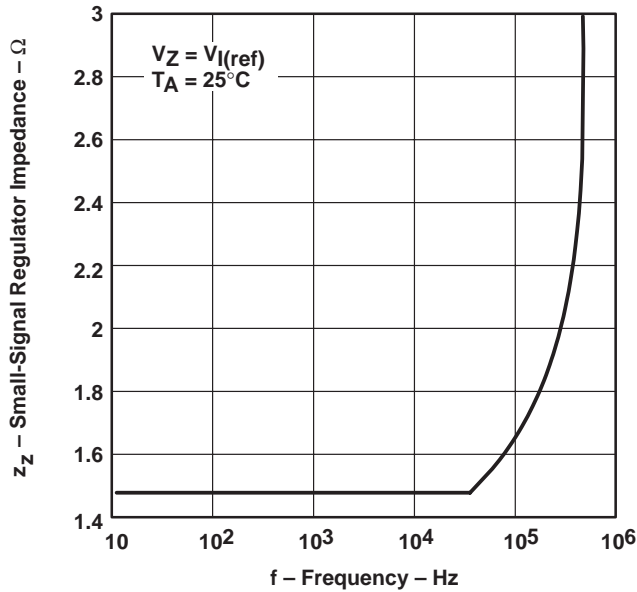


Figure 3

CATHODE CURRENT
vs
CATHODE VOLTAGE

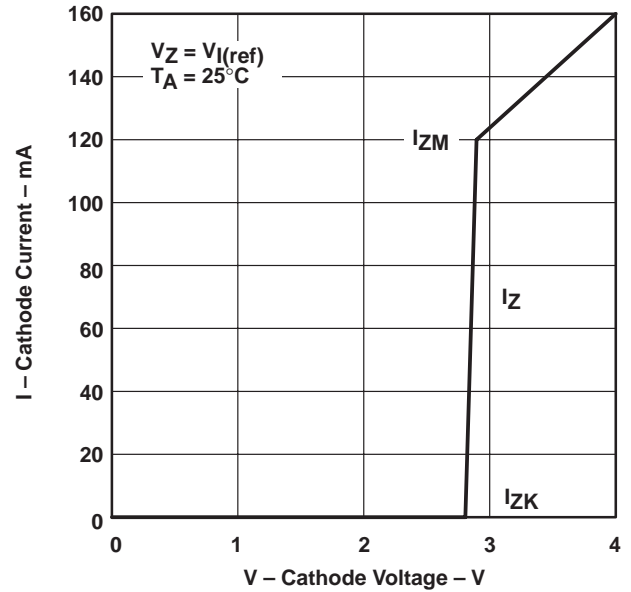
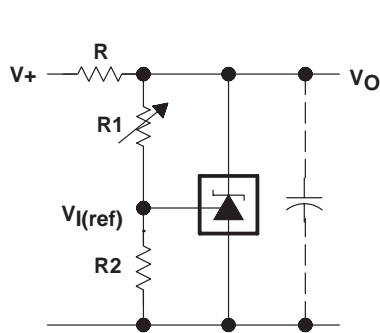


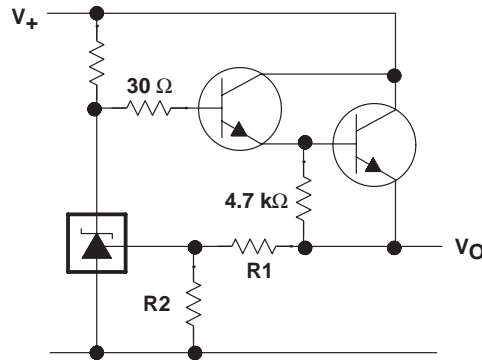
Figure 4

APPLICATION INFORMATION



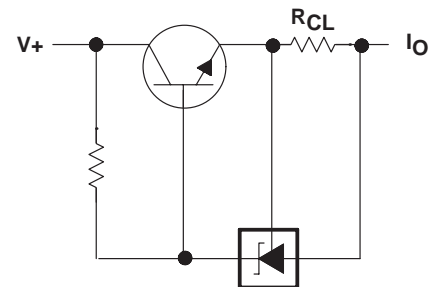
$$V_O \approx \left(1 + \frac{R1}{R2}\right) V_{I(ref)}$$

Figure 5. Shunt Regulator



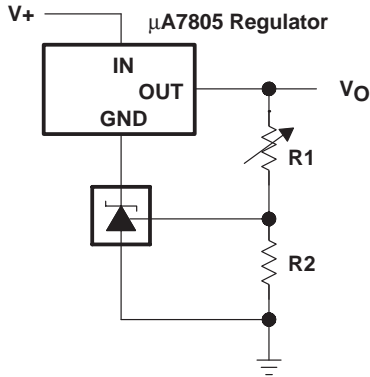
$$V_O \approx \left(1 + \frac{R1}{R2}\right) V_{I(ref)}$$

Figure 6. Series Regulator



$$I_O \approx \frac{V_{I(ref)}}{R_{CL}}$$

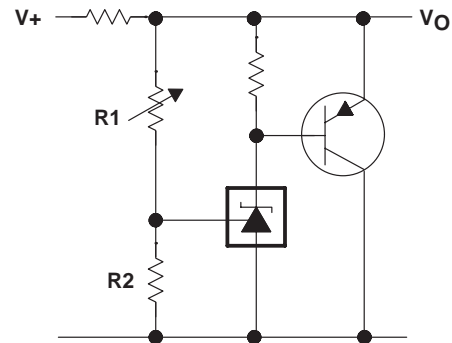
Figure 7. Current Limiter



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

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

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



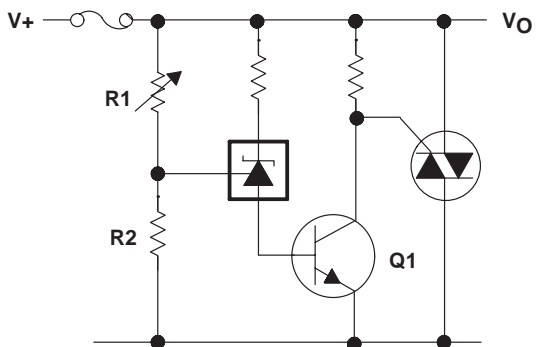
$$V_O \approx \left(1 + \frac{R1}{R2}\right) V_{I(ref)}$$

Figure 9. Higher-Current Applications

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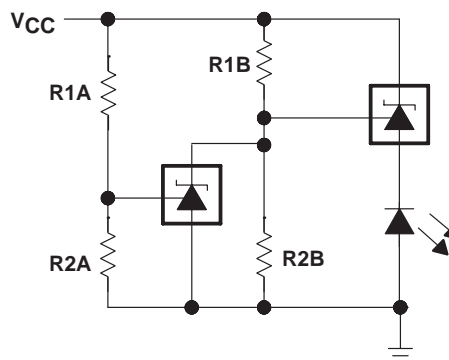
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APPLICATION INFORMATION



$$V_{\text{limit}} \approx \left(1 + \frac{R1}{R2}\right) \left(V_{I(\text{ref})} + V_{BE(Q1)}\right)$$

Figure 10. Crowbar



$$\text{Low limit} \approx V_{I(\text{ref})} \left(1 + \frac{R1B}{R2B}\right) + V_D$$

$$\text{High limit} \approx V_{I(\text{ref})} \left(1 + \frac{R1A}{R2A}\right)$$

Figure 11. V_{CC} Monitor

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