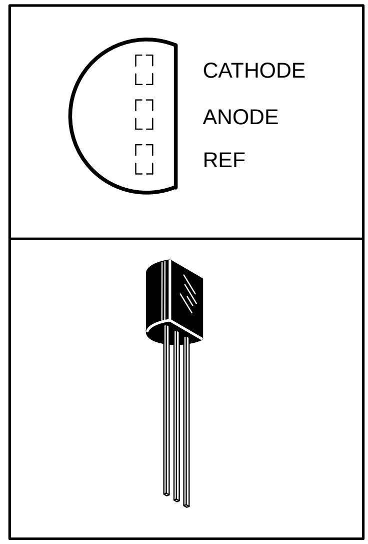
SLVS050A – JUNE 1976 – REVISED AUGUST 1995

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

LP PACKAGE
(TOP VIEW)

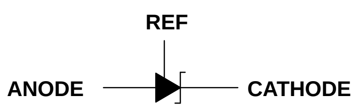


description

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.

symbol



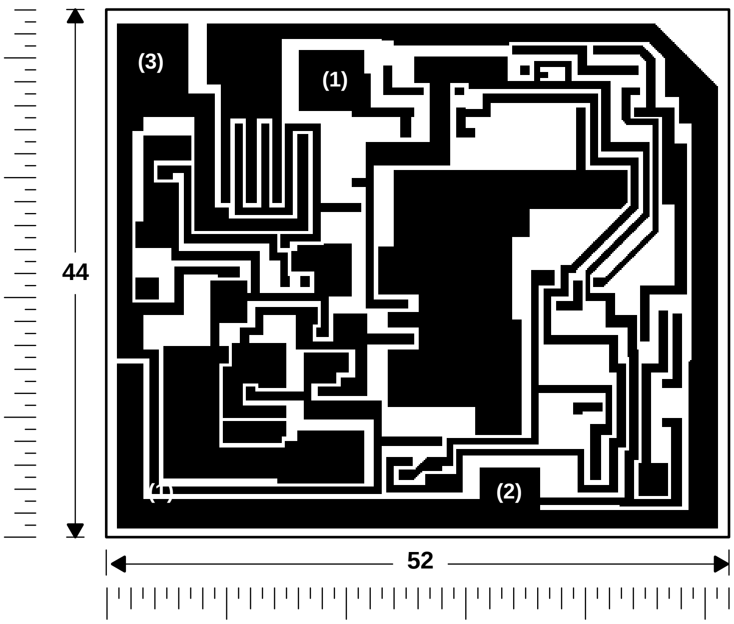
AVAILABLE OPTIONS

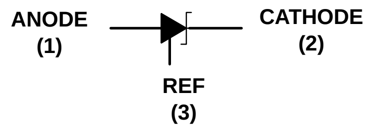
T_A	PACKAGED DEVICES† PLASTIC (LP)	CHIP FORM (Y)
0°C to 70°C	TL430CLP	TL430Y
–40°C to 85°C	TL430ILP	—

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.

BONDING PAD ASSIGNMENTS





CHIP THICKNESS:
15 MILS TYPICAL

BONDING PADS:
4 × 4 MILS MINIMUM

$T_J$max = 150°C

TOLERANCES ARE ±10%.

ALL DIMENSIONS ARE IN MILS.

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°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 mW/°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	70	°C
	TL430I	–40	85	

electrical characteristics over recommended operating conditions, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST FIGURE	TEST CONDITIONS		TL430C MIN	TL430C TYP	TL430C MAX	TL430I MIN	TL430I TYP	TL430I MAX	UNIT
$V_{I(ref)}$	Reference input voltage	1	$V_Z = V_{I(ref)}$,	I_Z = 10 mA	2.5	2.75	3	2.6	2.75	2.9	V
$\alpha V_{I(ref)}$	Temperature coefficient of reference input voltage	1	$V_Z = V_{I(ref)}$, T_A = full range†	I_Z = 10 mA,		120			120	200	ppm/°C
$I_{I(ref)}$	Reference input current	2	I_Z = 10 mA, R2 = ∞	R1 = 10 kΩ,		3	10		3	10	µA
I_{ZK}	Regulator current near lower knee of regulation range	1	$V_Z = V_{I(ref)}$			0.5	2		0.5	2	mA
I_{ZK}	Regulator current at maximum limit of regulation range	1	$V_Z = V_{I(ref)}$		50			50			mA
		2	V_Z = 5 V to 30 V,	See Note 3	100			100			
r_z	Differential regulator resistance (see Note 4)	1	$V_Z = V_{I(ref)}$, ΔI_Z = (52 – 2) mA			1.5	3		1.5	3	Ω
V_n	Noise voltage	2	f = 0.1 Hz to 10 Hz	V_Z = 3 V		50			50		µV
				V_Z = 12 V		200			200		
				V_Z = 30 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, $V_Z \bullet I_Z \bullet$ duty cycle, must not exceed the maximum continuous rating in any 10-ms interval.

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

$$r_z' = r_z \left(1 + \frac{R1}{R2}\right)$$

electrical characteristics over recommended operating conditions, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST FIGURE	TEST CONDITIONS		TL430Y MIN	TL430Y TYP	TL430Y MAX	UNIT
$V_{I(ref)}$	Reference input voltage	1	$V_Z = V_{I(ref)}$,	I_Z = 10 mA	2.5	2.75	3	V
$I_{I(ref)}$	Reference input current	2	I_Z = 10 mA, R2 = ∞	R1 = 10 kΩ,		3	10	µA
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 V to 30 V,	See Note 3	100			
r_z	Differential regulator resistance (see Note 4)	1	$V_Z = V_{I(ref)}$, ... ΔI_Z = (52 – 2) mA			1.5	3	Ω
V_n	Noise voltage	2	f = 0.1 Hz to 10 Hz	V_Z = 3 V		50		µV
				V_Z = 12 V		200		
				V_Z = 30 V		650		

NOTES: 3. The average power dissipation, $V_Z \bullet I_Z \bullet$ duty cycle, must not exceed the maximum continuous rating in any 10-ms interval.

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

$$r_z' = r_z \left(1 + \frac{R1}{R2}\right)$$

PARAMETER MEASUREMENT INFORMATION

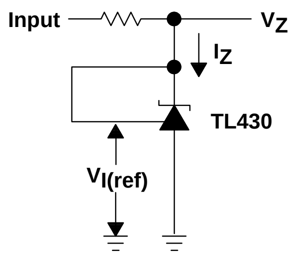
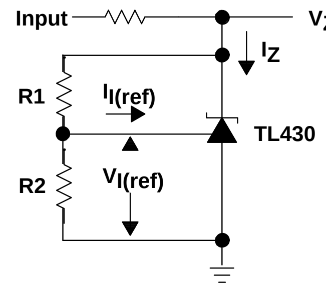


Figure 1. Test Circuit for $V_Z = V_{I(ref)}$



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

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

TYPICAL CHARACTERISTICS

SMALL-SIGNAL REGULATOR IMPEDANCE vs FREQUENCY

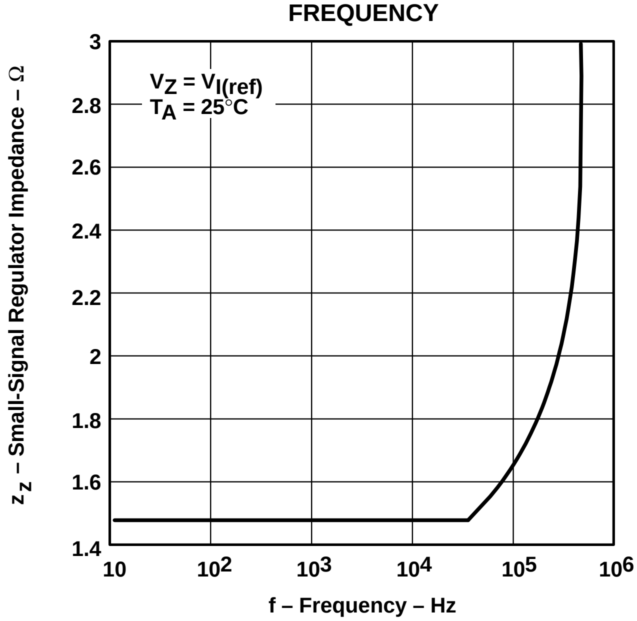


Figure 3

CATHODE CURRENT vs CATHODE VOLTAGE

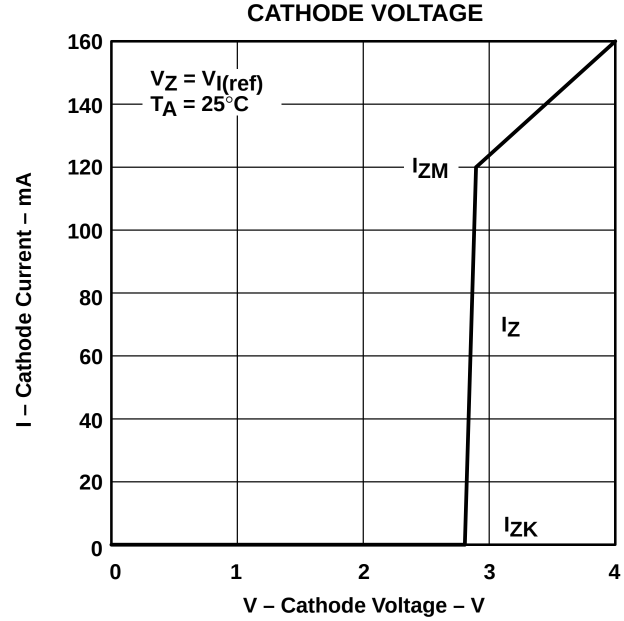
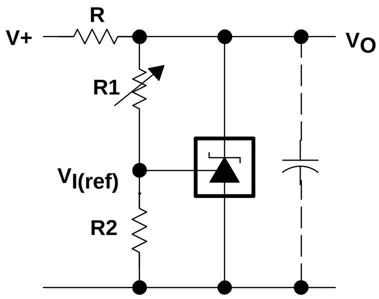


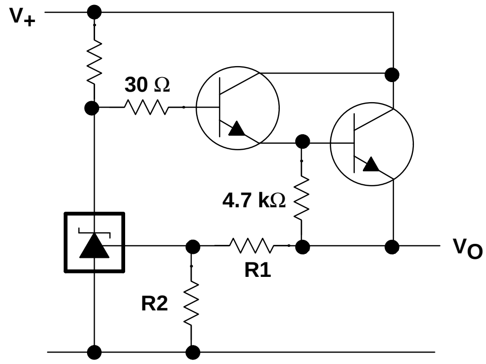
Figure 4

APPLICATION INFORMATION



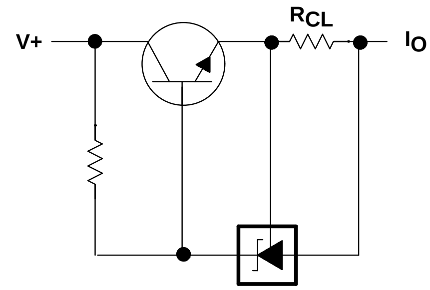
$$V_O \approx \left(1 + \frac{R1}{R2}\right) V_{I(ref)}$$

Figure 5. Shunt Regulator



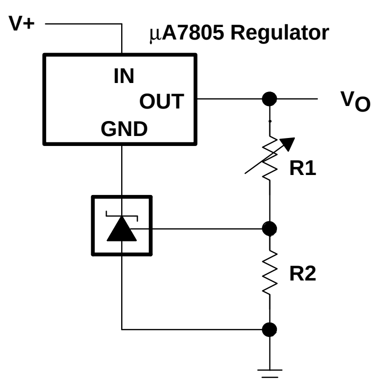
$$V_O \approx \left(1 + \frac{R1}{R2}\right) V_{I(ref)}$$

Figure 6. Series Regulator



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

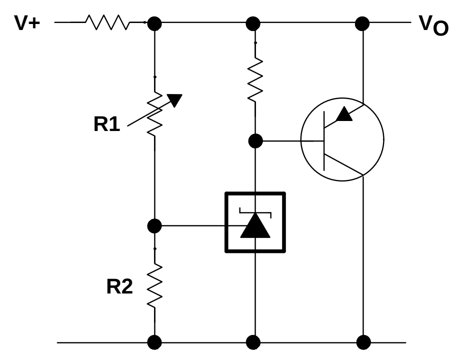
Figure 7. Current Limiter



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

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

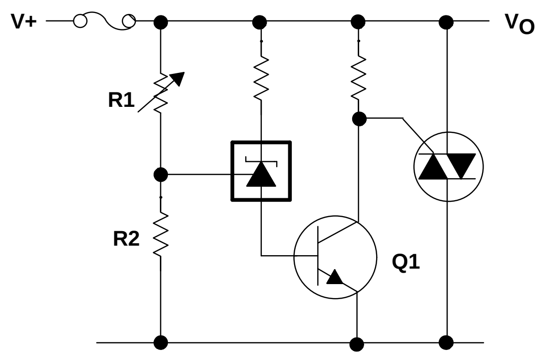
Figure 8. Output Control of a 3-Terminal Fixed Regulator



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

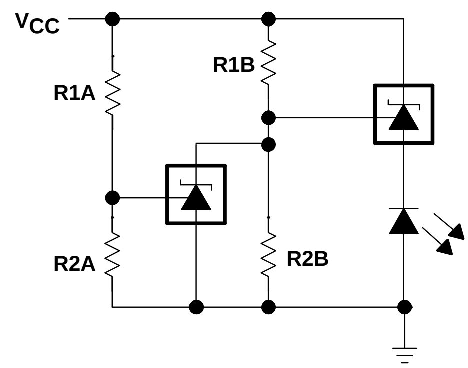
Figure 9. Higher-Current Applications

APPLICATION INFORMATION



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

Figure 10. Crowbar



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

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

Figure 11. V_{CC} Monitor