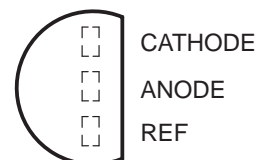


# TL430 ADJUSTABLE SHUNT REGULATORS

SLVS050D – JUNE 1976 – REVISED JANUARY 2005

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

LP PACKAGE  
(TOP VIEW)



## description/ordering information

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.

## ORDERING INFORMATION

TA	PACKAGE†	ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	TO-226 / TO-92 (LP)	Bulk of 1000	TL430CLP
		Reel of 2000	TL430CLPR
			TL430C

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

## symbol



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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.

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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)	140°C/W
Operating virtual junction temperature, $T_J$	150°C
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 51-7.

## recommended operating conditions

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

TL430C

## 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	$\Omega$
$V_n$ 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:
- 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:

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

**PARAMETER MEASUREMENT INFORMATION**

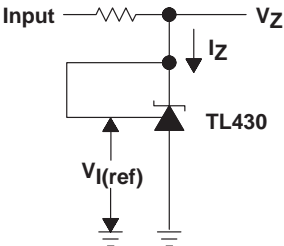
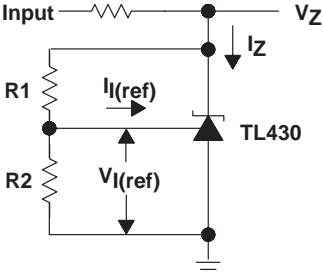


Figure 1. Test Circuit for  $V_Z = V_{I(ref)}$



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

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

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## TYPICAL CHARACTERISTICS

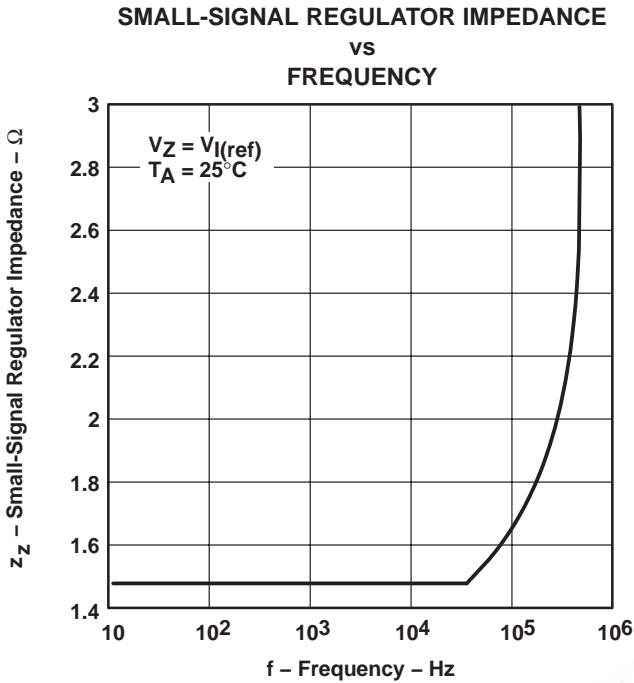


Figure 3

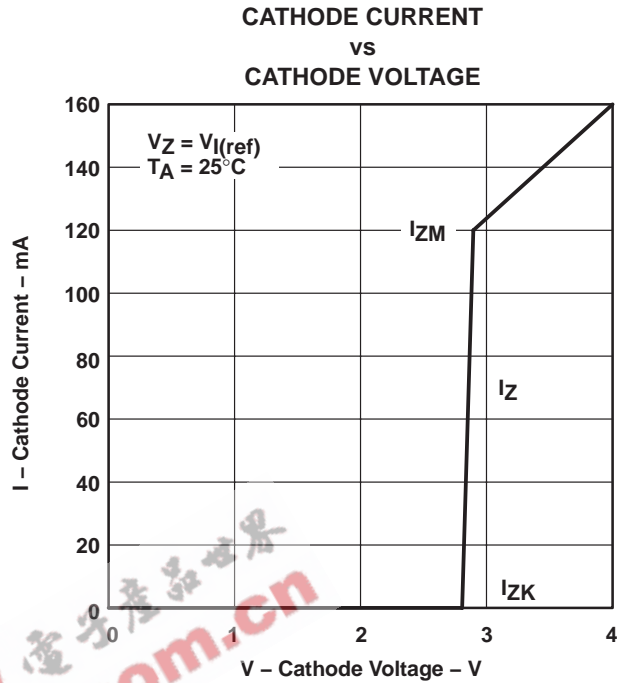
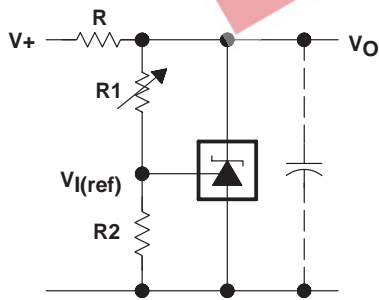


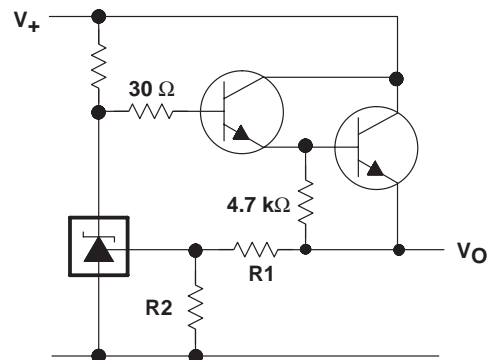
Figure 4

## APPLICATION INFORMATION



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

Figure 5. Shunt Regulator



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

Figure 6. Series Regulator

APPLICATION INFORMATION

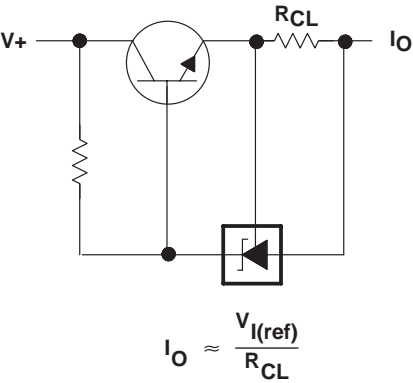
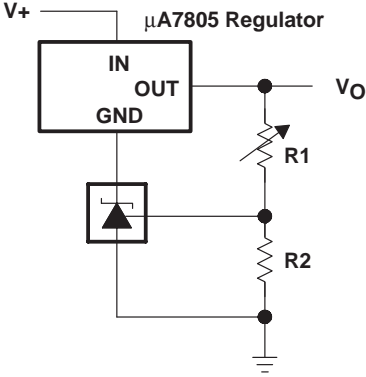


Figure 7. Current Limiter



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

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

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

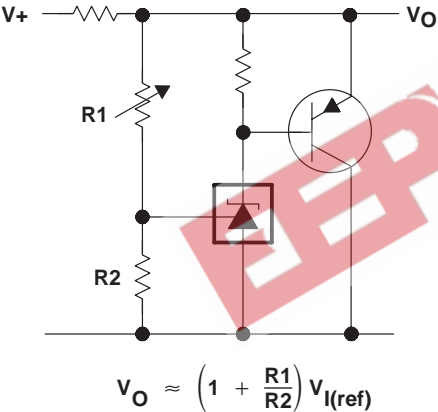


Figure 9. Higher-Current Applications

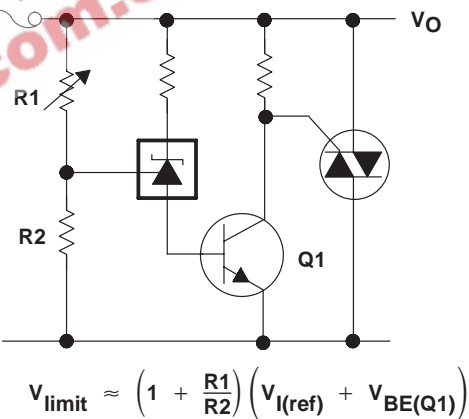
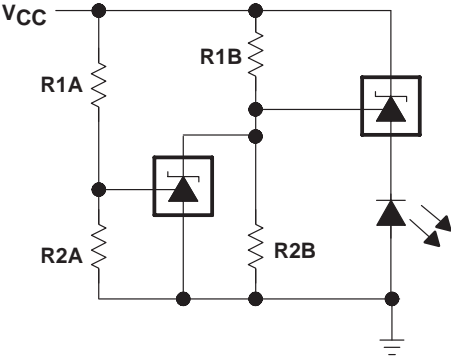


Figure 10. Crowbar



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

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

Figure 11. VCC Monitor

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
TL430CLP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type
TL430CLPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type
TL430CLPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type
TL430CLPRE3	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type
TL430ILP	OBSOLETE	TO-92	LP	3		TBD	Call TI	Call TI

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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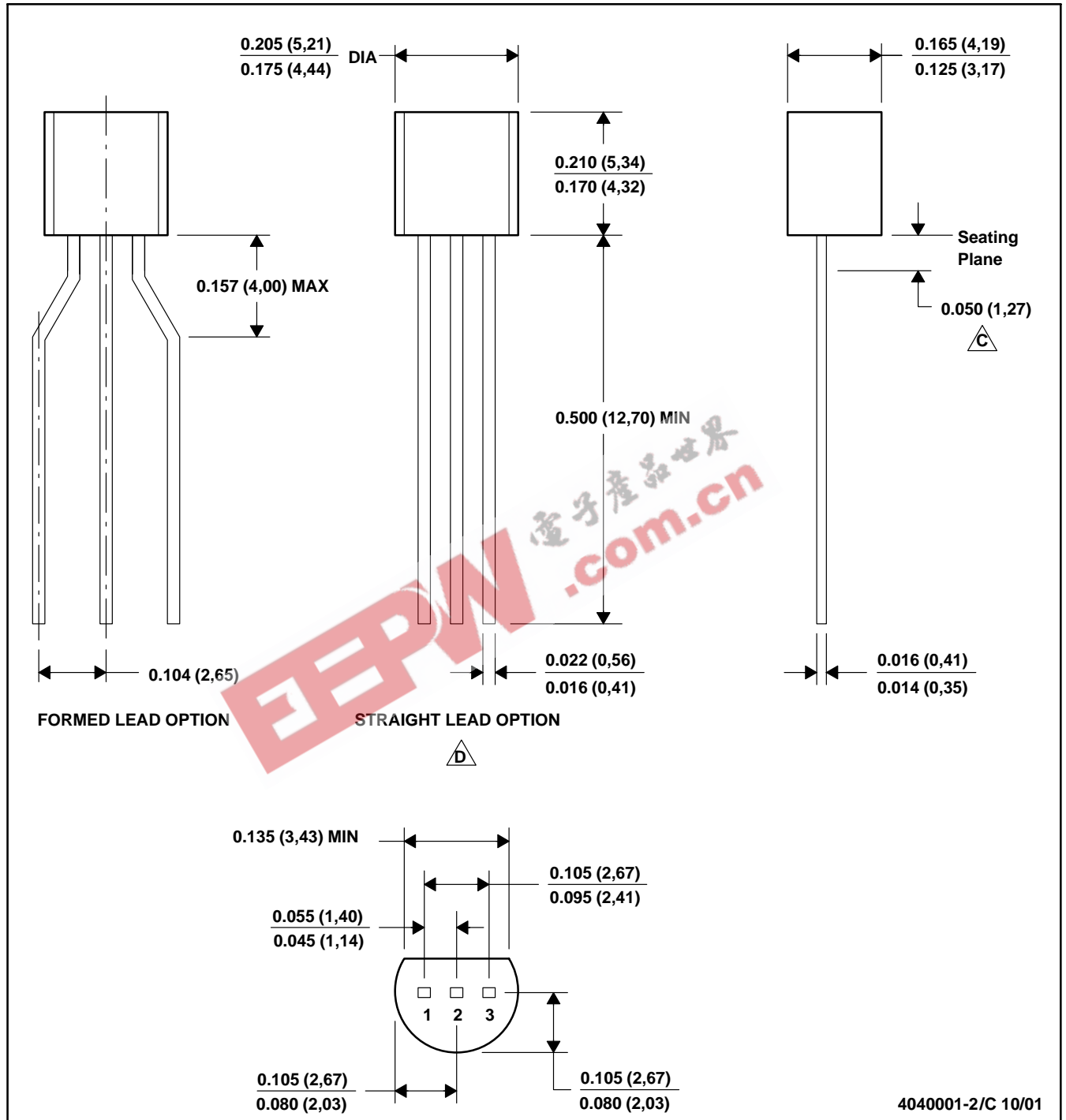
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MSOT002A – OCTOBER 1994 – REVISED NOVEMBER 2001

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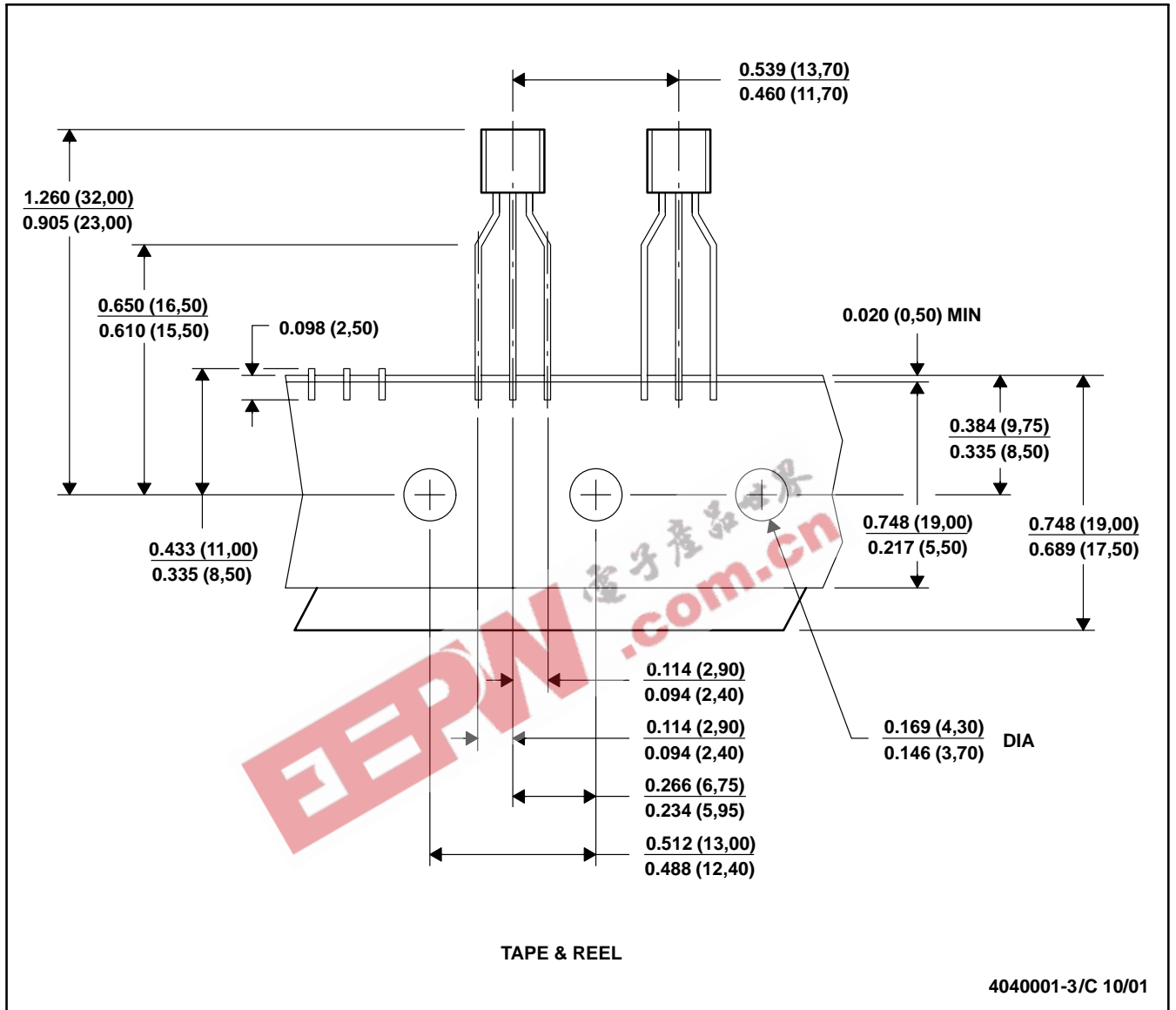
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# MECHANICAL DATA

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LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Tape and Reel information for the Format Lead Option package.



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