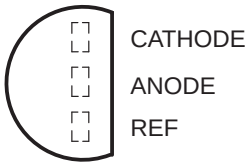
SLVS050D − JUNE 1976 − REVISED JANUARY 2005

- **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.

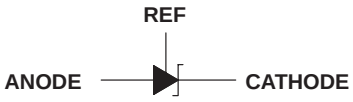
The TL430C is characterized for operation from 0°C to 70°C.

ORDERING INFORMATION

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

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

symbol



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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, θ_{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: 1. All voltage values are with respect to the anode terminal.
2. Maximum power dissipation is a function of $T_J(max)$, θ_{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.
3. 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	TL430C	0	70	°C

electrical characteristics over recommended operating conditions, T_A = 25°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 mA	2.5	2.75	3	V
$\alpha V_{I(ref)}$	Temperature coefficient of reference input voltage	1	$V_Z = V_{I(ref)}$, T_A = 0°C to 70°C	I_Z = 10 mA,		120		ppm/°C
$I_{I(ref)}$	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 4	100			
r_z	Differential regulator resistance (see Note 5)	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: 4. The average power dissipation, $V_Z \bullet I_Z \bullet$ duty cycle, must not exceed the maximum continuous rating in any 10-ms interval.
5. 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

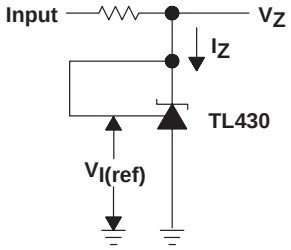
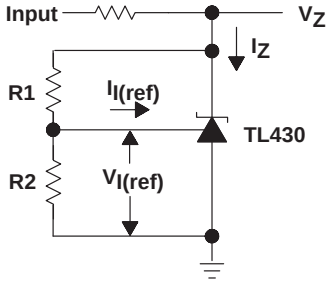


Figure 1. Test Circuit for $V_Z = V_{I(ref)}$



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

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

TYPICAL CHARACTERISTICS

SMALL-SIGNAL REGULATOR IMPEDANCE vs FREQUENCY

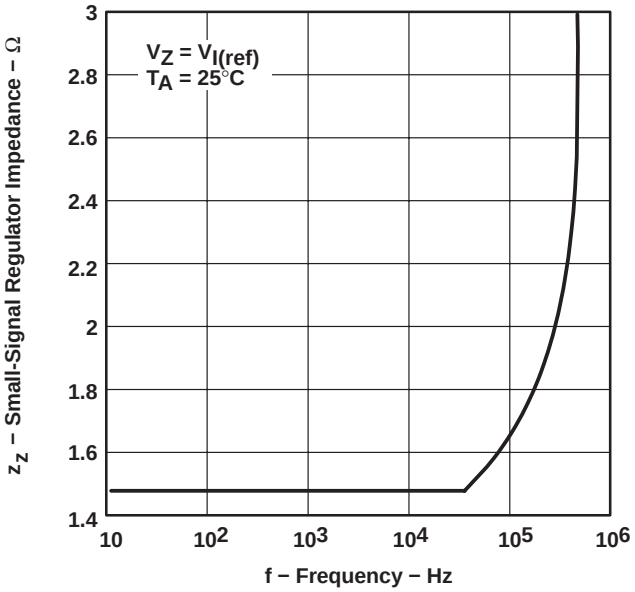


Figure 3

CATHODE CURRENT vs CATHODE VOLTAGE

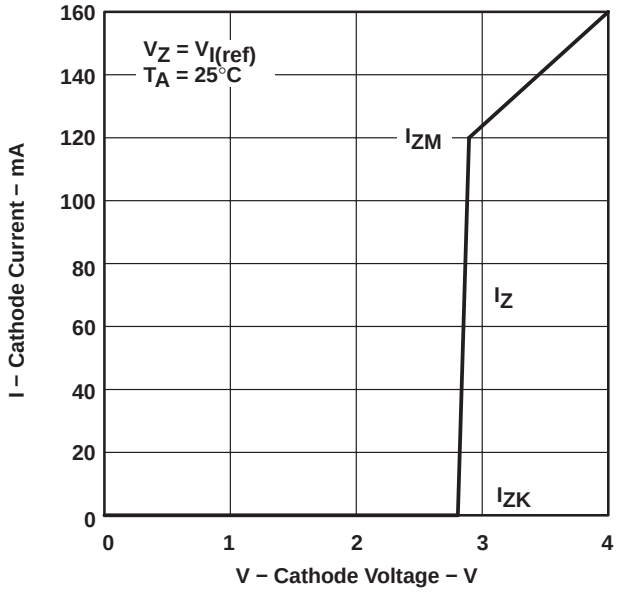
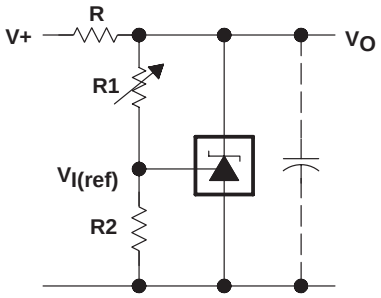


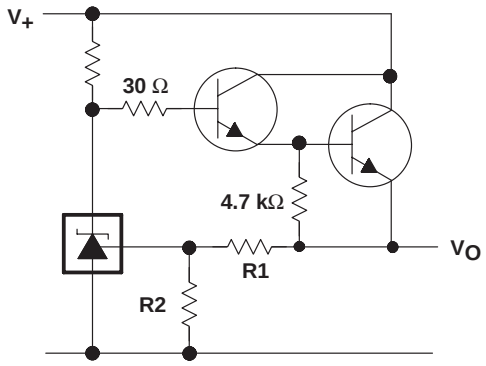
Figure 4

APPLICATION INFORMATION



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

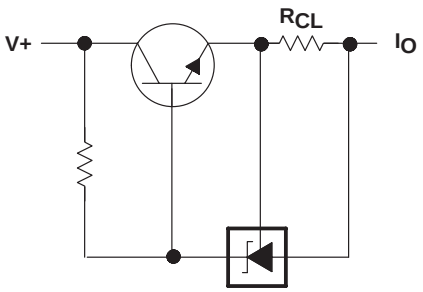
Figure 5. Shunt Regulator



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

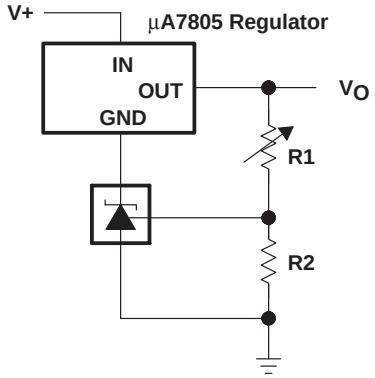
Figure 6. Series Regulator

APPLICATION INFORMATION



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

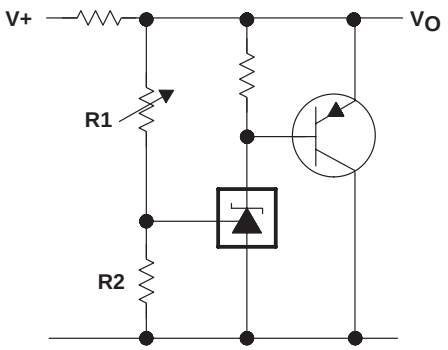
Figure 7. Current Limiter



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

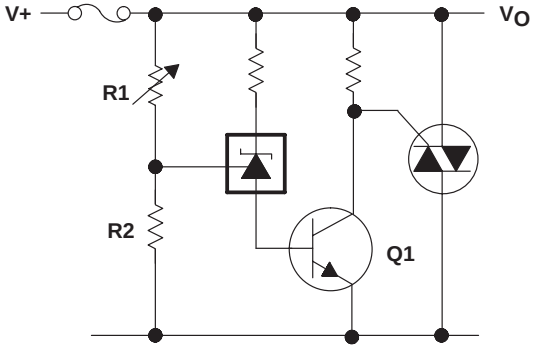
$$\text{Min } V_O = V_{I(ref)} + 5\,V$$

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



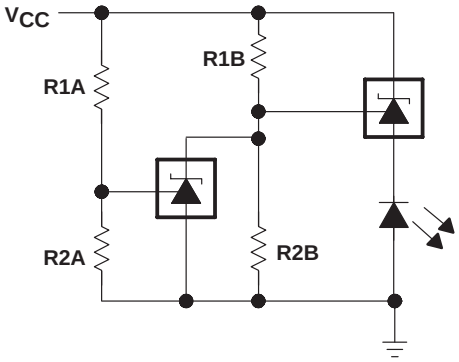
$$V_O \approx \left(1 + \frac{R1}{R2}\right) V_{I(ref)}$$

Figure 9. Higher-Current Applications



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

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

PACKAGING INFORMATION

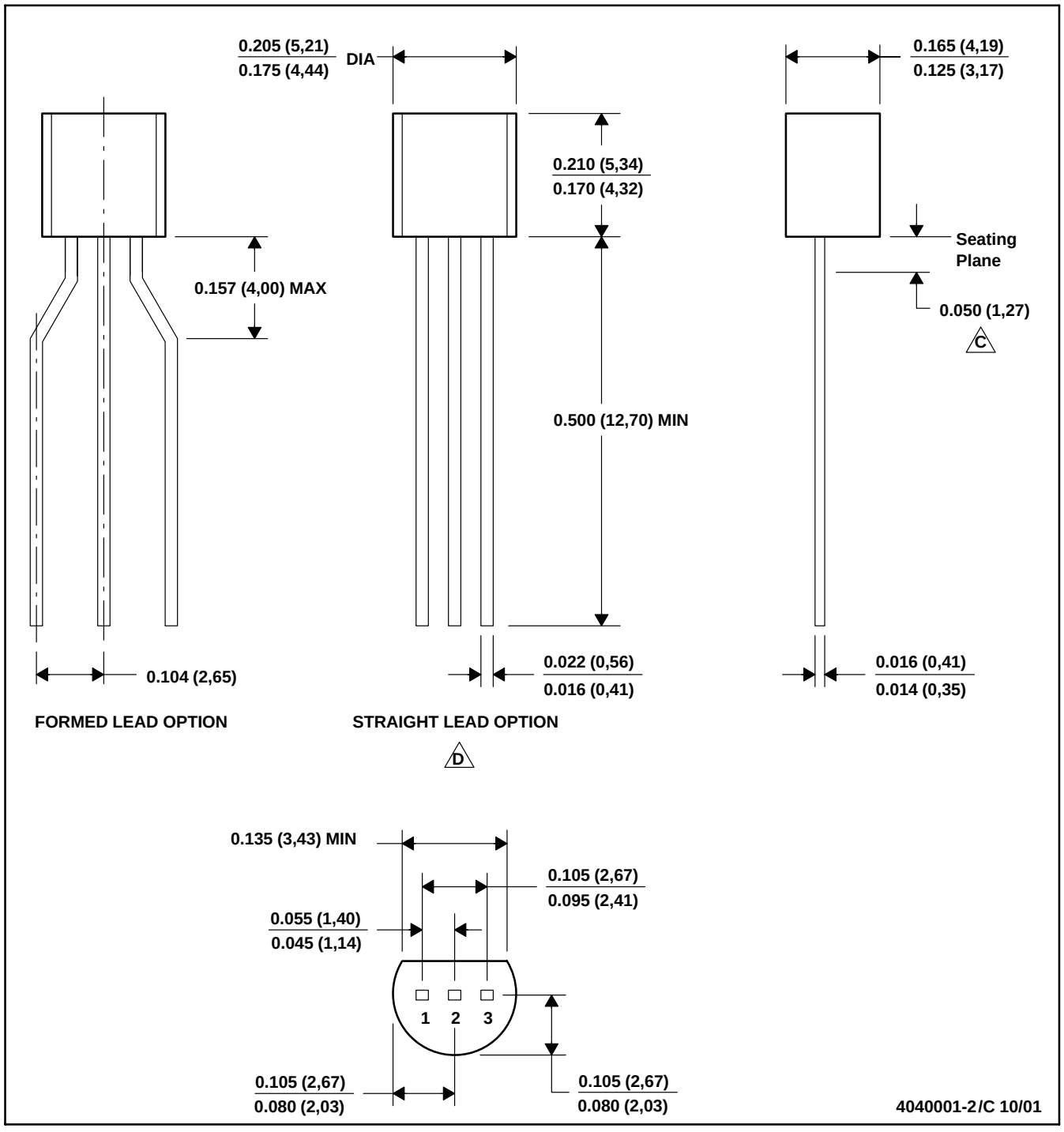
Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
TL430CLP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type
TL430CLPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type
TL430CLPR	ACTIVE	TO-92	LP	3	2000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

(1) 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.

(2) 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)

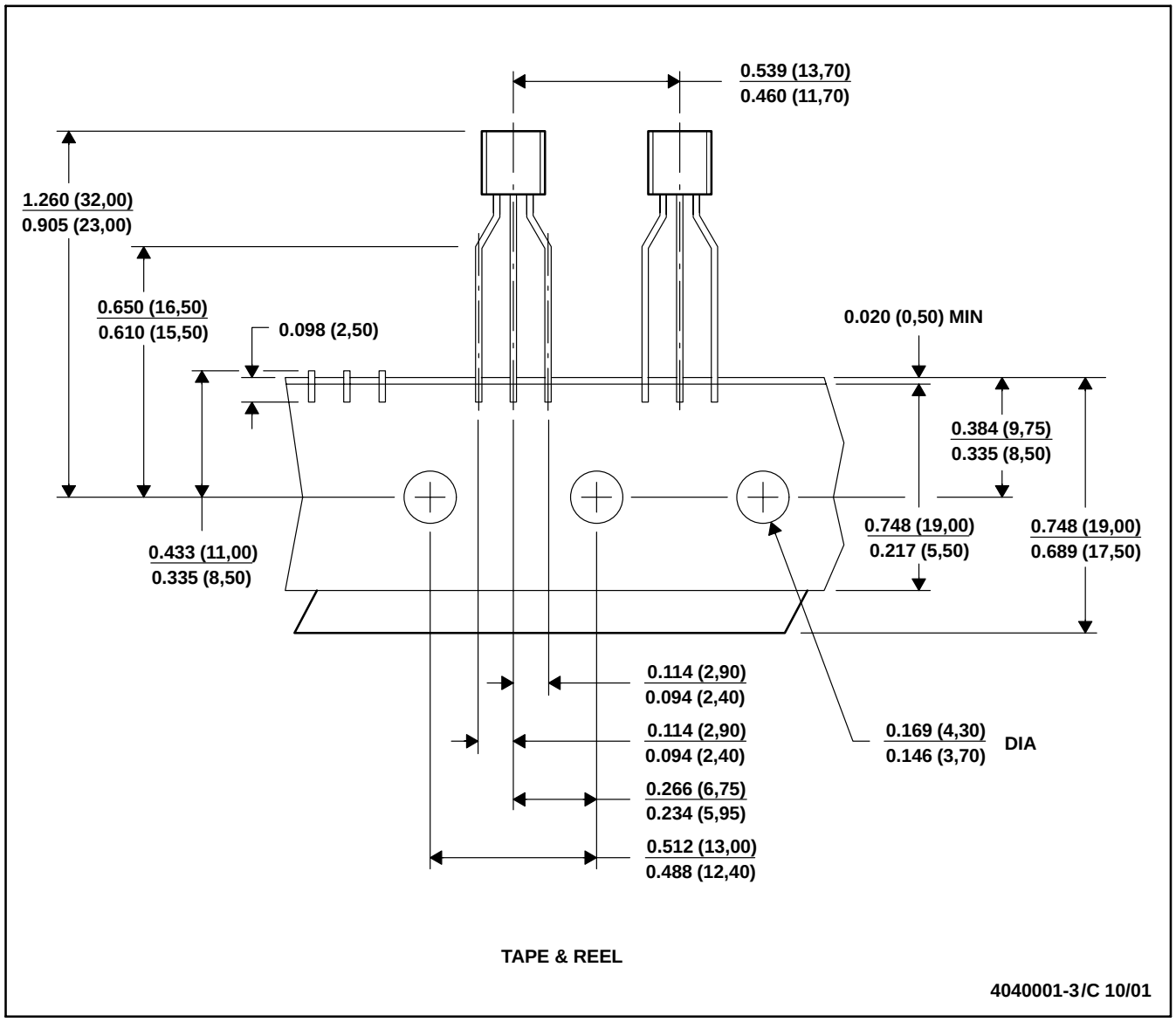
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

LP (O-PBCY-W3) **PLASTIC CYLINDRICAL PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area
D. FAlls within JEDEC TO -226 Variation AA (TO-226 replaces TO-92)
E. Shipping Method:
Straight lead option available in bulk pack only.
Formed lead option available in tape & reel or ammo pack.

LP (O-PBCY-W3) **PLASTIC CYLINDRICAL PACKAGE**



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

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