

LM329 Precision Reference

Check for Samples: [LM329](#)

FEATURES

- 0.6 mA to 15 mA Operating Current
- 0.8Ω Dynamic Impedance at Any Current
- Available With Temperature Coefficient of 0.01%/°C
- 7μV Wideband Noise
- 5% Initial Tolerance
- 0.002% Long Term Stability
- Low Cost
- Subsurface Zener

DESCRIPTION

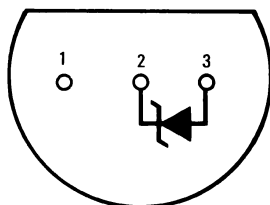
The LM329 is a precision multi-current temperature-compensated 6.9V zener reference with dynamic impedance a factor of 10 to 100 less than discrete diodes. Constructed in a single silicon chip, the LM329 uses active circuitry to buffer the internal zener allowing the device to operate over a 0.5 mA to 15 mA range with virtually no change in performance. The LM329 is available with a temperature coefficients of 0.01%/°C. This reference also has excellent long term stability and low noise.

A new subsurface breakdown zener used in the LM329 gives lower noise and better long-term stability than conventional IC zeners. Further the zener and temperature compensating transistor are made by a planar process so they are immune to problems that plague ordinary zeners. For example, there is virtually no voltage shift in zener voltage due to temperature cycling and the device is insensitive to stress on the leads.

The LM329 can be used in place of conventional zeners with improved performance. The low dynamic impedance simplifies biasing and the wide operating current allows the replacement of many zener types.

The LM329 for operation over 0°C to 70°C is available in a TO-92 epoxy package.

Connection Diagram



**Figure 1. Bottom View
Plastic Package (TO-92)
See Package LP**

Typical Application

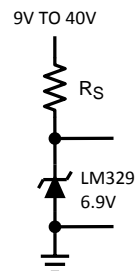


Figure 2. Simple Reference



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These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings⁽¹⁾

Reverse Breakdown Current	30 mA
Forward Current	2 mA
Operating Temperature Range	
LM329	0°C to +70°C
Storage Temperature Range	-55°C to +150°C
Soldering Information	
TO-92 package: 10 sec.	260°C

- (1) "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits.

Electrical Characteristics⁽¹⁾

Parameter	Conditions	Min	Typ	Max	Units
Reverse Breakdown Voltage	$T_A = 25^\circ\text{C}$, $0.6\text{ mA} \leq I_R \leq 15\text{ mA}$	6.6	6.9	7.25	V
Reverse Breakdown Change $T_A = 25^\circ\text{C}$, with Current ⁽²⁾	$0.6\text{ mA} \leq I_R \leq 15\text{ mA}$		9	20	mV
Reverse Dynamic Impedance ⁽²⁾	$T_A = 25^\circ\text{C}$, $I_R = 1\text{ mA}$		0.8	2	Ω
RMS Noise	$T_A = 25^\circ\text{C}$, $10\text{ Hz} \leq F \leq 10\text{ kHz}$		7	100	μV
Long Term Stability (1000 hours)	$T_A = 45^\circ\text{C} \pm 0.1^\circ\text{C}$, $I_R = 1\text{ mA} \pm 0.3\%$		20		ppm
Temperature Coefficient	$I_R = 1\text{ mA}$		50	100	ppm/°C
Change In Reverse Breakdown Temperature Coefficient	$1\text{ mA} \leq I_R \leq 15\text{ mA}$		1		ppm/°C
Reverse Breakdown Change with Current	$1\text{ mA} \leq I_R \leq 15\text{ mA}$		12		mV
Reverse Dynamic Impedance	$1\text{ mA} \leq I_R \leq 15\text{ mA}$		1		Ω

- (1) These specifications apply for $0^\circ\text{C} \leq T_A \leq +70^\circ\text{C}$ for the LM329 unless otherwise specified. The maximum junction temperature for a LM329 is 100°C . For operating at elevated temperature. The TO-92 package, the derating is based on 180°C/W junction to ambient with 0.4" leads from a PC board and 160°C/W junction to ambient with 0.125" lead length to a PC board.
- (2) These changes are tested on a pulsed basis with a low duty-cycle. For changes versus temperature, compute in terms of tempco.

Typical Applications

Figure 3. Low Cost 0–25V Regulator

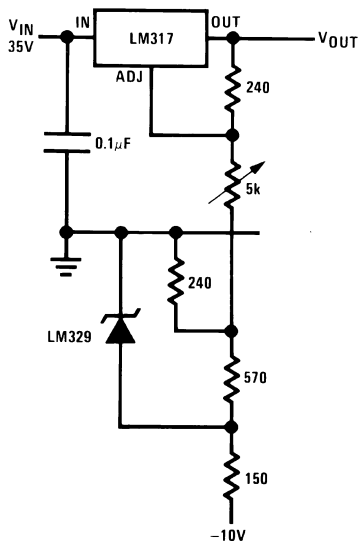


Figure 4. Adjustable Bipolar Output Reference

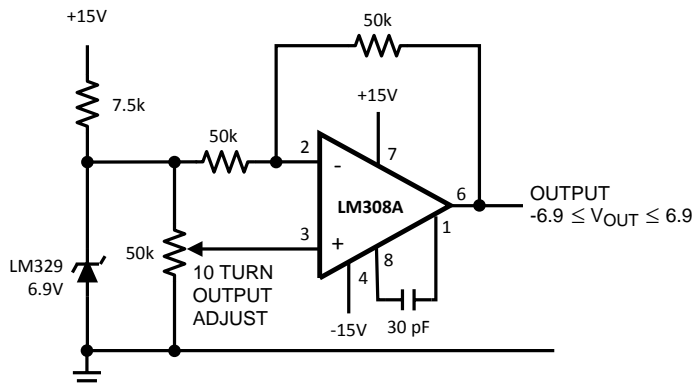


Figure 5. 0V to 20V Power Reference

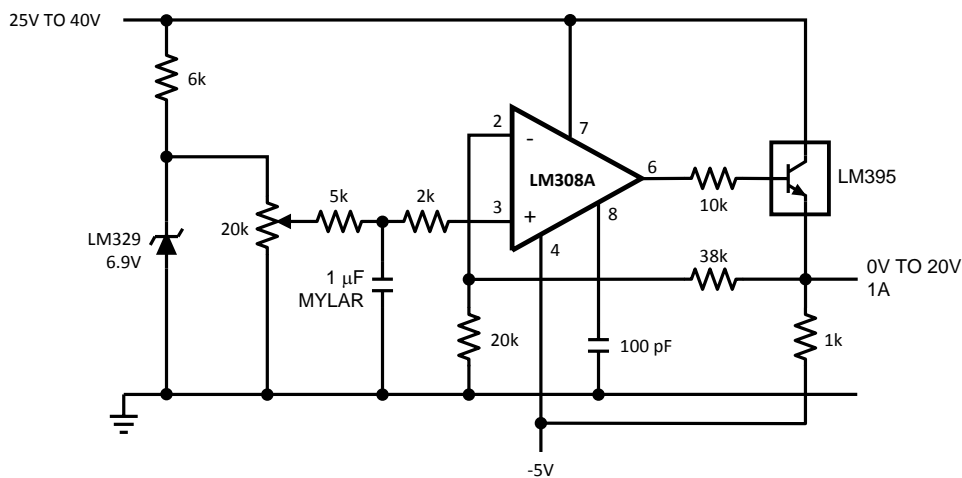


Figure 6. External Reference for Temperature Transducer

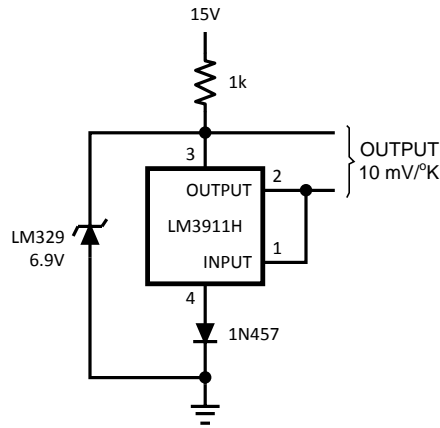


Figure 7. Positive Current Source

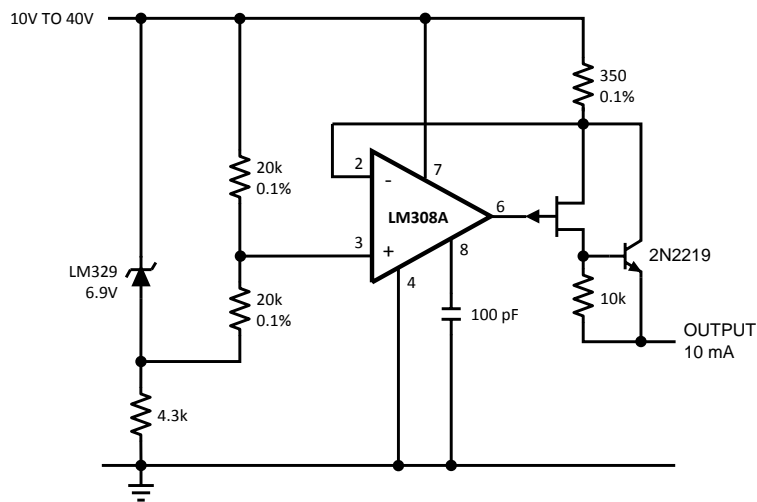
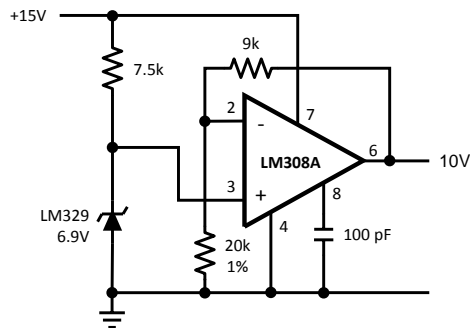
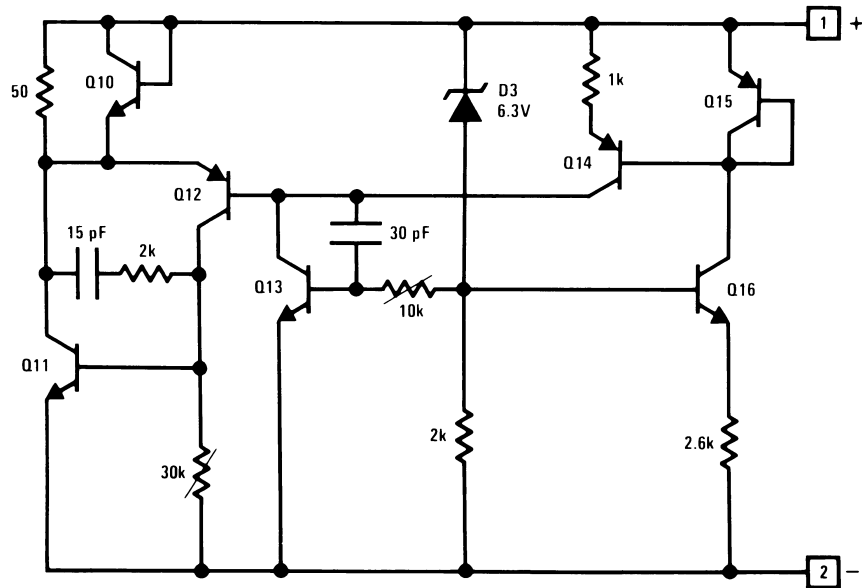


Figure 8. Buffered Reference with Single Supply



Schematic Diagram



Typical Performance Characteristics

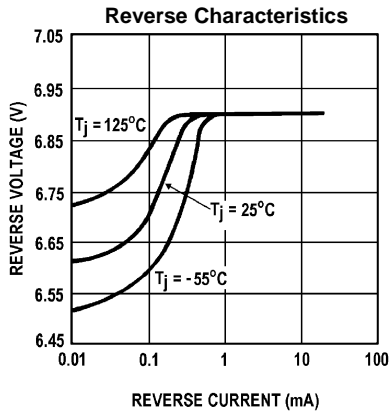


Figure 9.

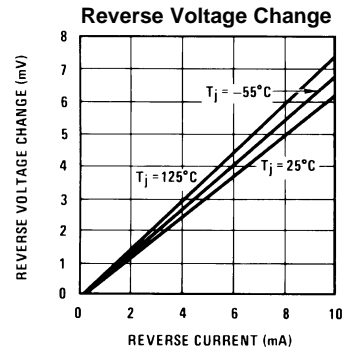


Figure 10.

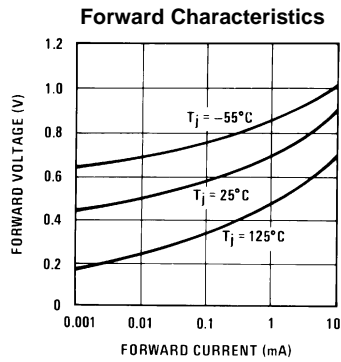


Figure 11.

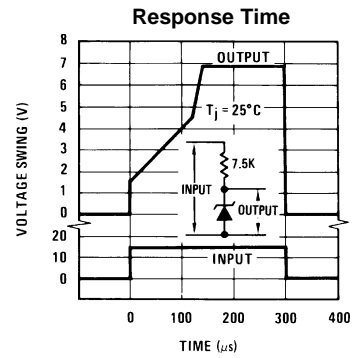


Figure 12.

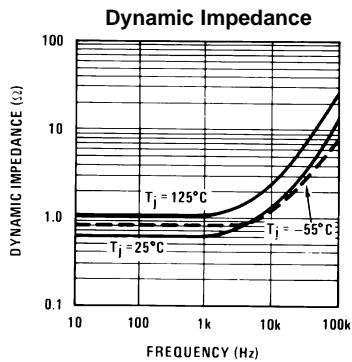


Figure 13.

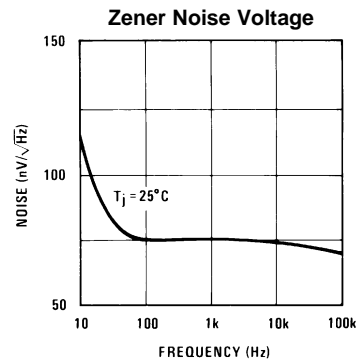


Figure 14.

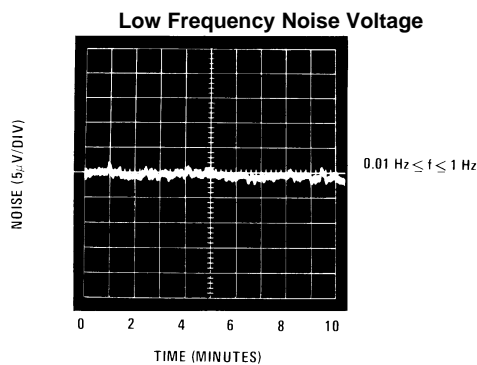



Figure 15.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LM329DZ/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM	0 to 70	LM329 DZ	

(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.

(4) Only one of markings shown within the brackets will appear on the physical device.

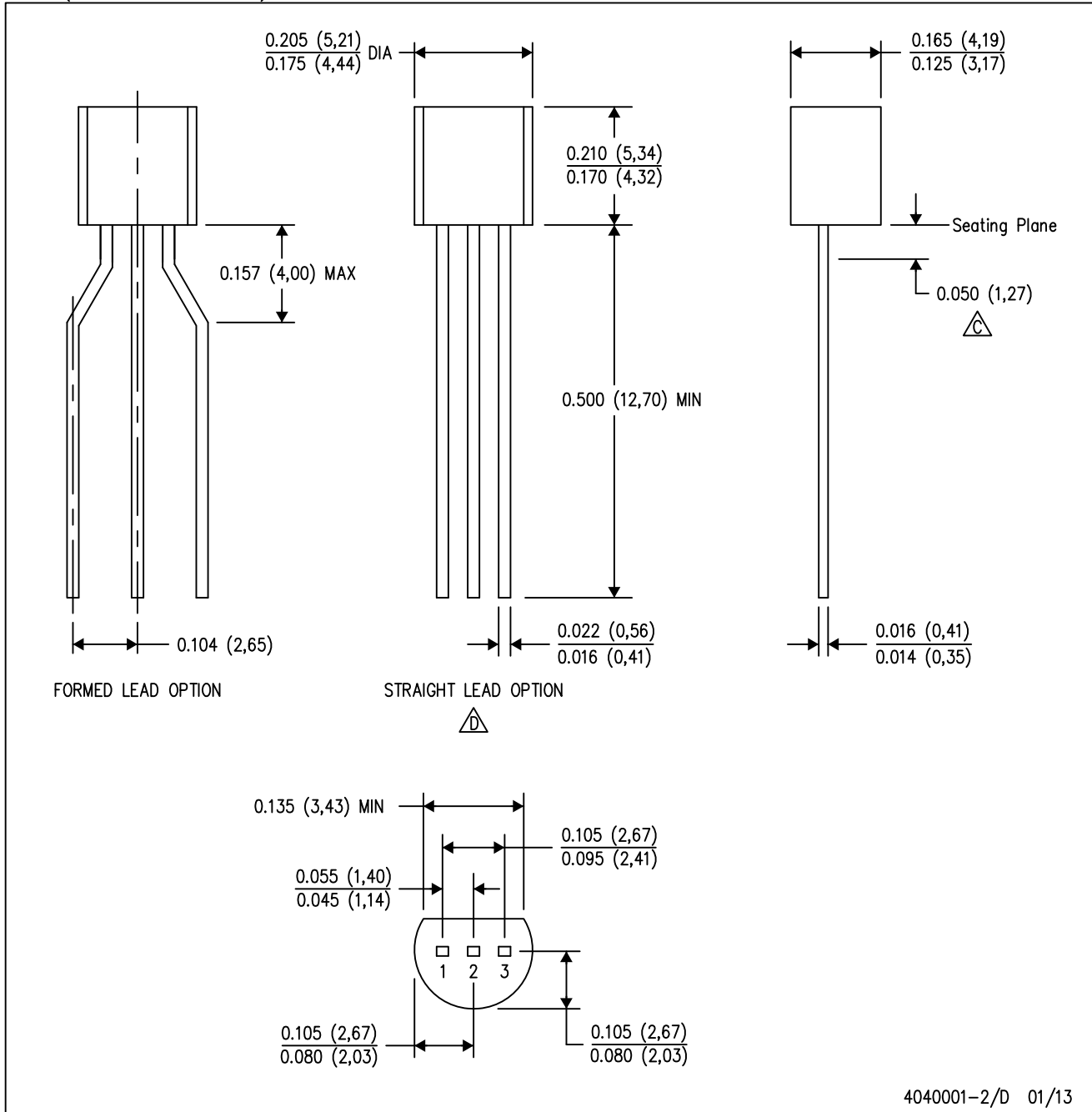
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MECHANICAL DATA

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE

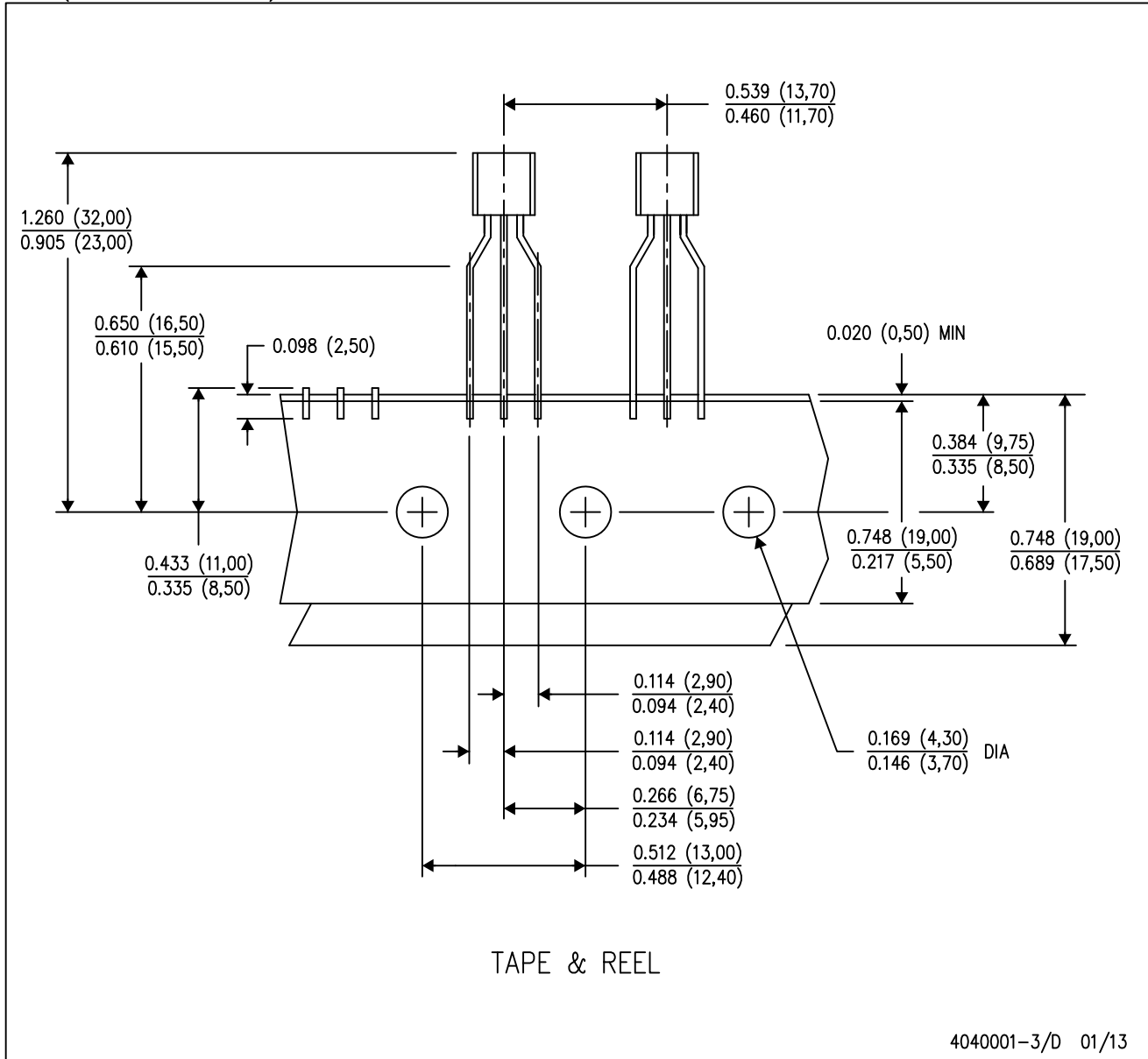


- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - $\triangle C$ Lead dimensions are not controlled within this area.
 - $\triangle D$ Falls within JEDEC TO-226 Variation AA (TO-226 replaces TO-92).
 - Shipping Method:
 - Straight lead option available in either bulk pack or tape & reel.
 - Formed lead option available in tape & reel or ammo pack.
 - Specific products can be offered in limited combinations of shipping mediums and lead options.
 - Consult product folder for more information on available options.

MECHANICAL DATA

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 Formed Lead Option package.

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