

## LM329 Precision Reference

Check for Samples: [LM329](#)

### FEATURES

- 0.6 mA to 15 mA Operating Current
- $0.8\Omega$  Dynamic Impedance at Any Current
- Available With Temperature Coefficient of  $0.01\%/^{\circ}\text{C}$
- $7\mu\text{V}$  Wideband Noise
- 5% Initial Tolerance
- 0.002% Long Term Stability
- Low Cost
- Subsurface Zener

### DESCRIPTION

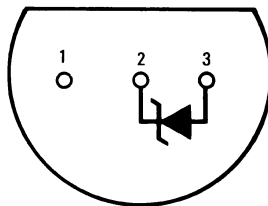
The LM329 is a precision multi-current temperature-compensated 6.9V zener reference with dynamic impedance a factor of 10 to 100 less than discrete diodes. Constructed in a single silicon chip, the LM329 uses active circuitry to buffer the internal zener allowing the device to operate over a 0.5 mA to 15 mA range with virtually no change in performance. The LM329 is available with a temperature coefficients of  $0.01\%/^{\circ}\text{C}$ . 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.

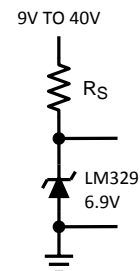
The LM329 for operation over  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$  is available in a TO-92 epoxy package.

### 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<sup>(1)</sup>

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<sup>(1)</sup>

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 <sup>(2)</sup>	$0.6\text{ mA} \leq I_R \leq 15\text{ mA}$		9	20	mV
Reverse Dynamic Impedance <sup>(2)</sup>	$T_A = 25^\circ\text{C}$ , $I_R = 1\text{ mA}$		0.8	2	$\Omega$
RMS Noise	$T_A = 25^\circ\text{C}$ , $10\text{ Hz} \leq F \leq 10\text{ kHz}$		7	100	$\mu\text{V}$
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		$\Omega$

- (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  $100^\circ\text{C}$ . For operating at elevated temperature. The TO-92 package, the derating is based on  $180^\circ\text{C/W}$  junction to ambient with 0.4" leads from a PC board and  $160^\circ\text{C/W}$  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

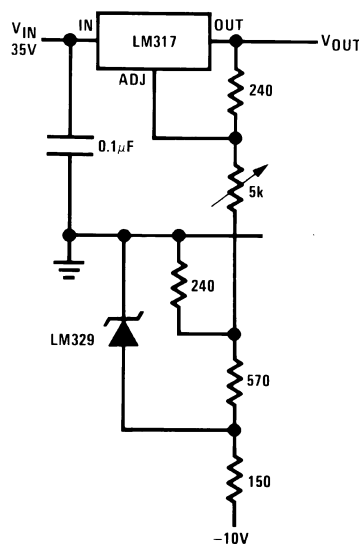


Figure 4. Adjustable Bipolar Output Reference

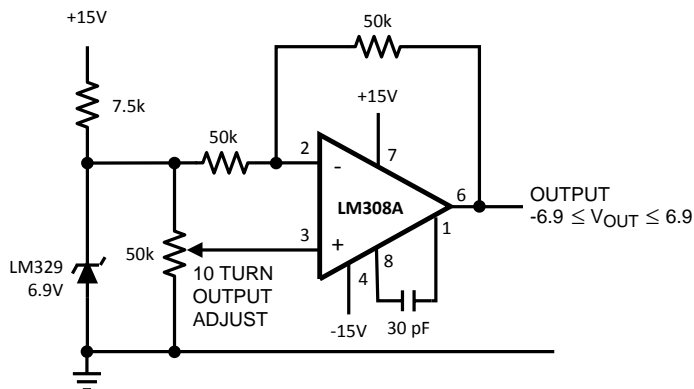


Figure 5. 0V to 20V Power Reference

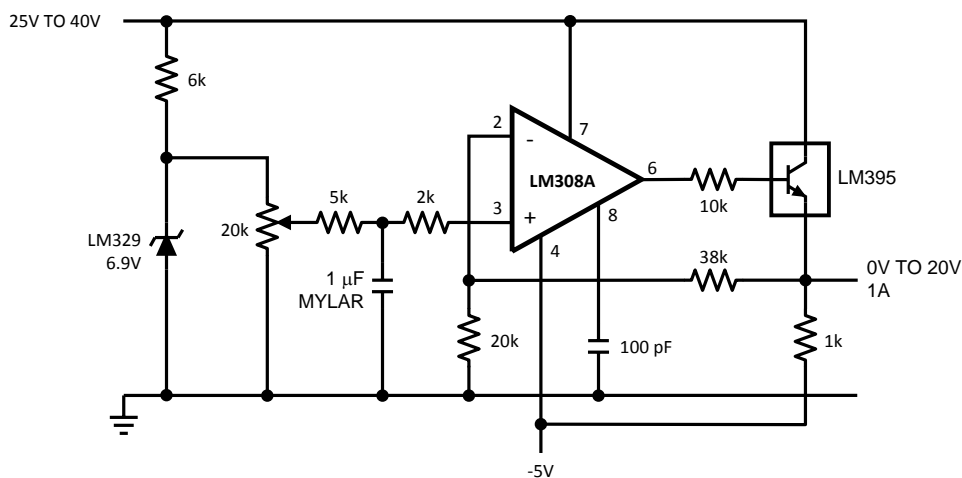


Figure 6. External Reference for Temperature Transducer

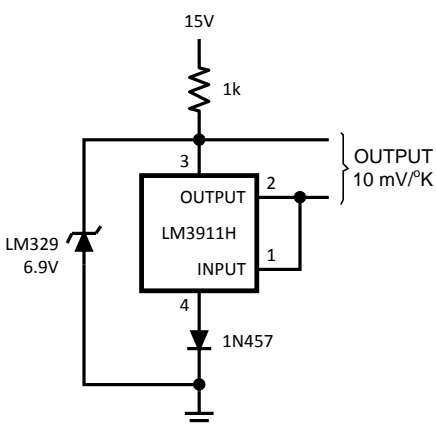


Figure 7. Positive Current Source

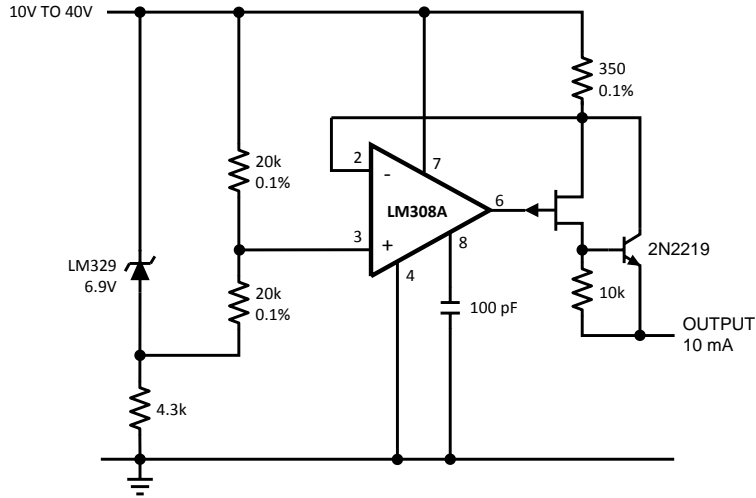
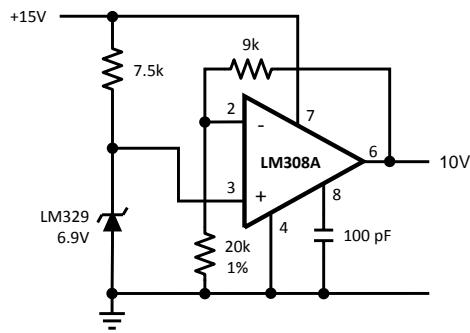
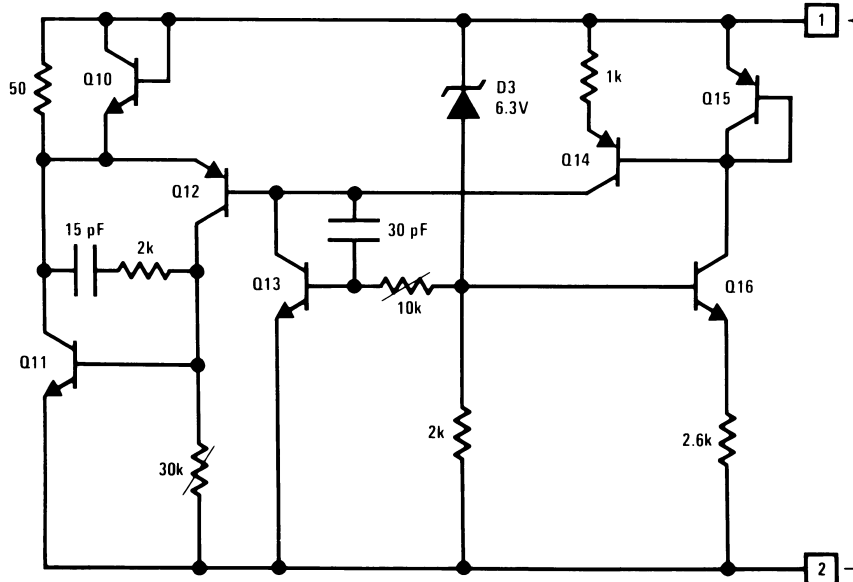


Figure 8. Buffered Reference with Single Supply



Schematic Diagram



Typical Performance Characteristics

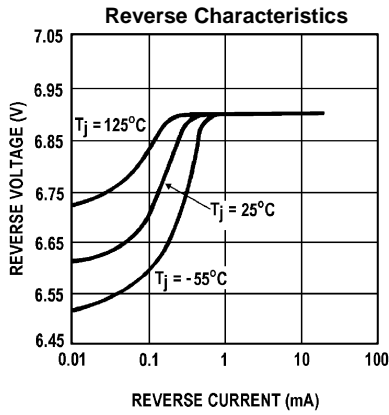


Figure 9.

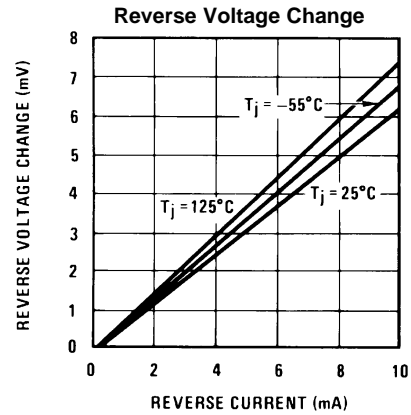


Figure 10.

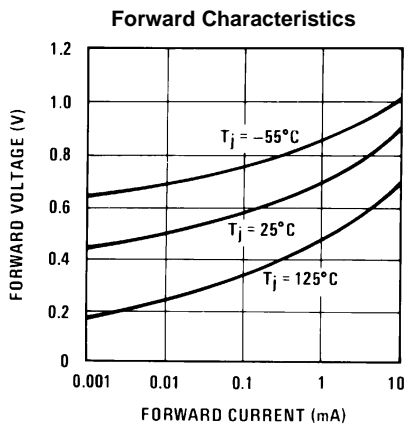


Figure 11.

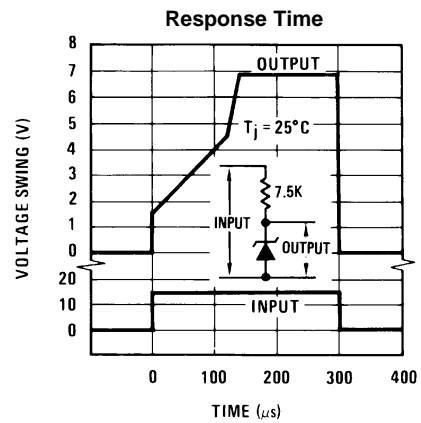


Figure 12.

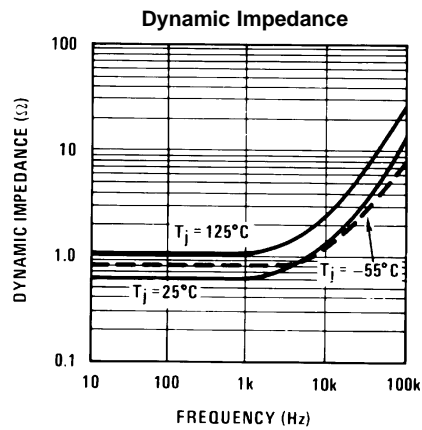


Figure 13.

Typical Performance Characteristics (continued)

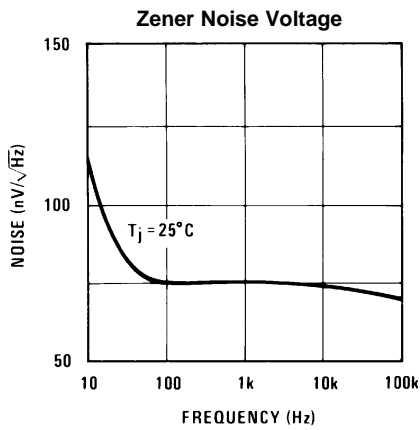


Figure 14.

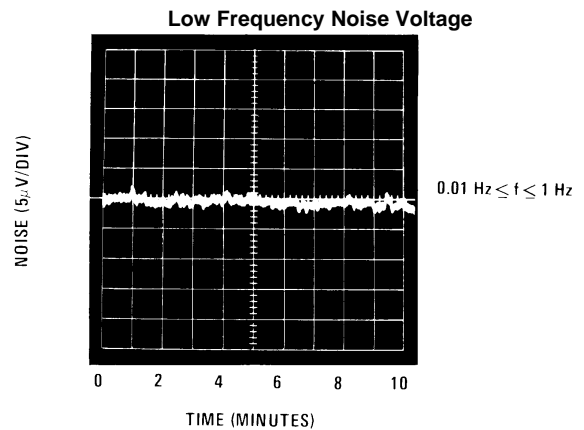


Figure 15.

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**REVISION HISTORY****Changes from Revision E (April 2013) to Revision F****Page**

- 
- Changed layout of National Data Sheet to TI format ..... [6](#)
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**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM329DZ/NOPB	NRND	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	CU SN	N / A for Pkg Type	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.

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

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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## GENERIC PACKAGE VIEW

LP 3

TO-92 - 5.34 mm max height

TRANSISTOR OUTLINE



Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

4040001-2/F

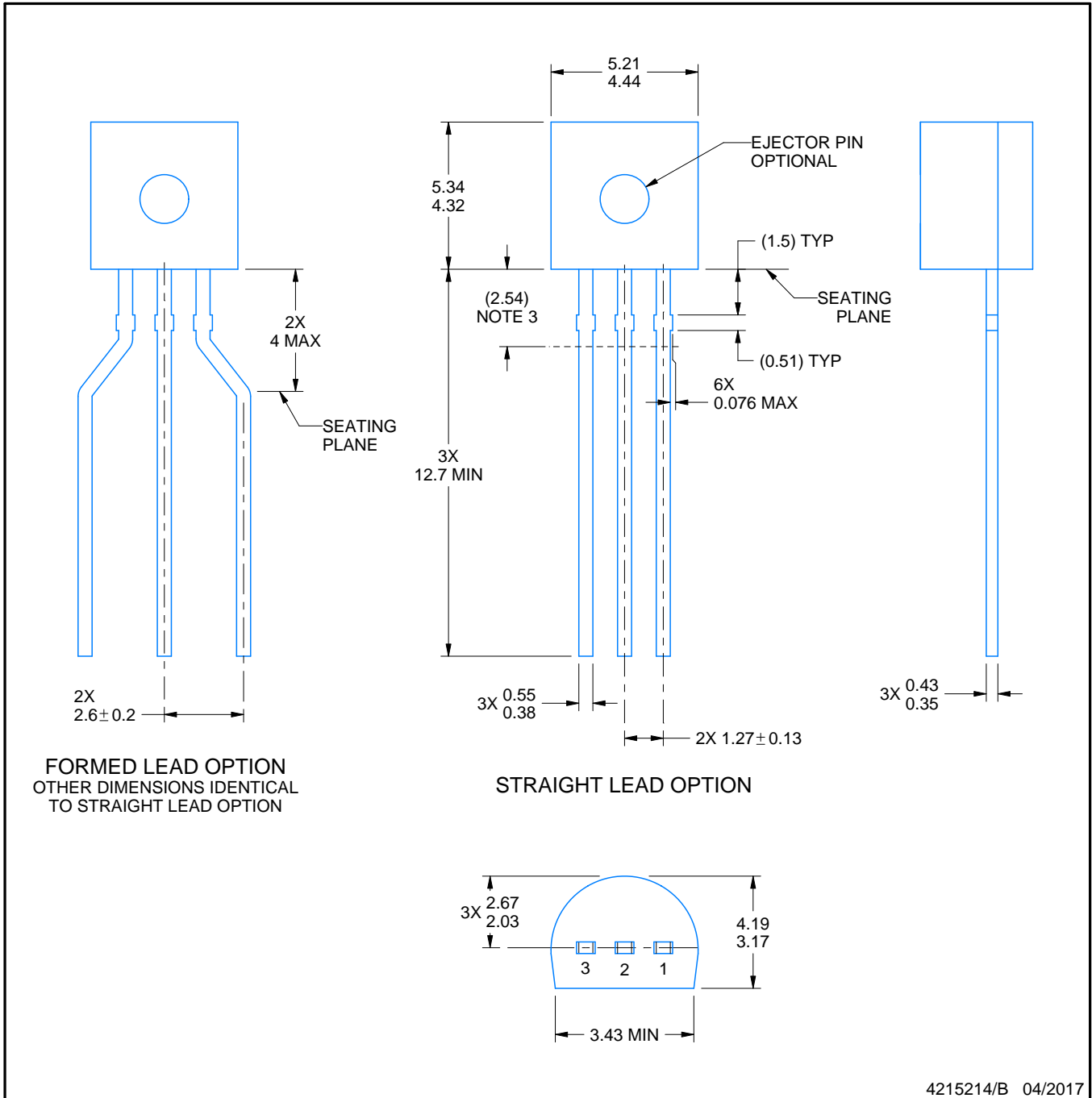
LP0003A



# PACKAGE OUTLINE

TO-92 - 5.34 mm max height

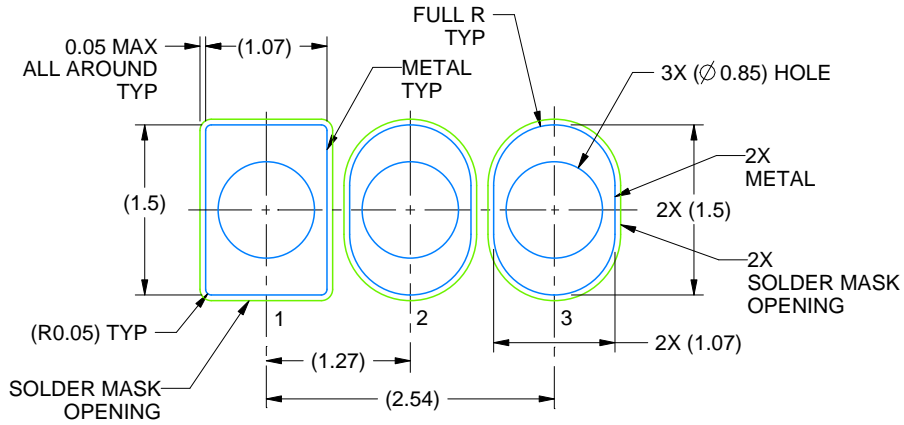
TO-92



4215214/B 04/2017

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Lead dimensions are not controlled within this area.
4. Reference JEDEC TO-226, variation AA.
5. Shipping method:
  - a. Straight lead option available in bulk pack only.
  - b. Formed lead option available in tape and reel or ammo pack.
  - c. Specific products can be offered in limited combinations of shipping medium and lead options.
  - d. Consult product folder for more information on available options.



LAND PATTERN EXAMPLE  
STRAIGHT LEAD OPTION  
NON-SOLDER MASK DEFINED  
SCALE:15X



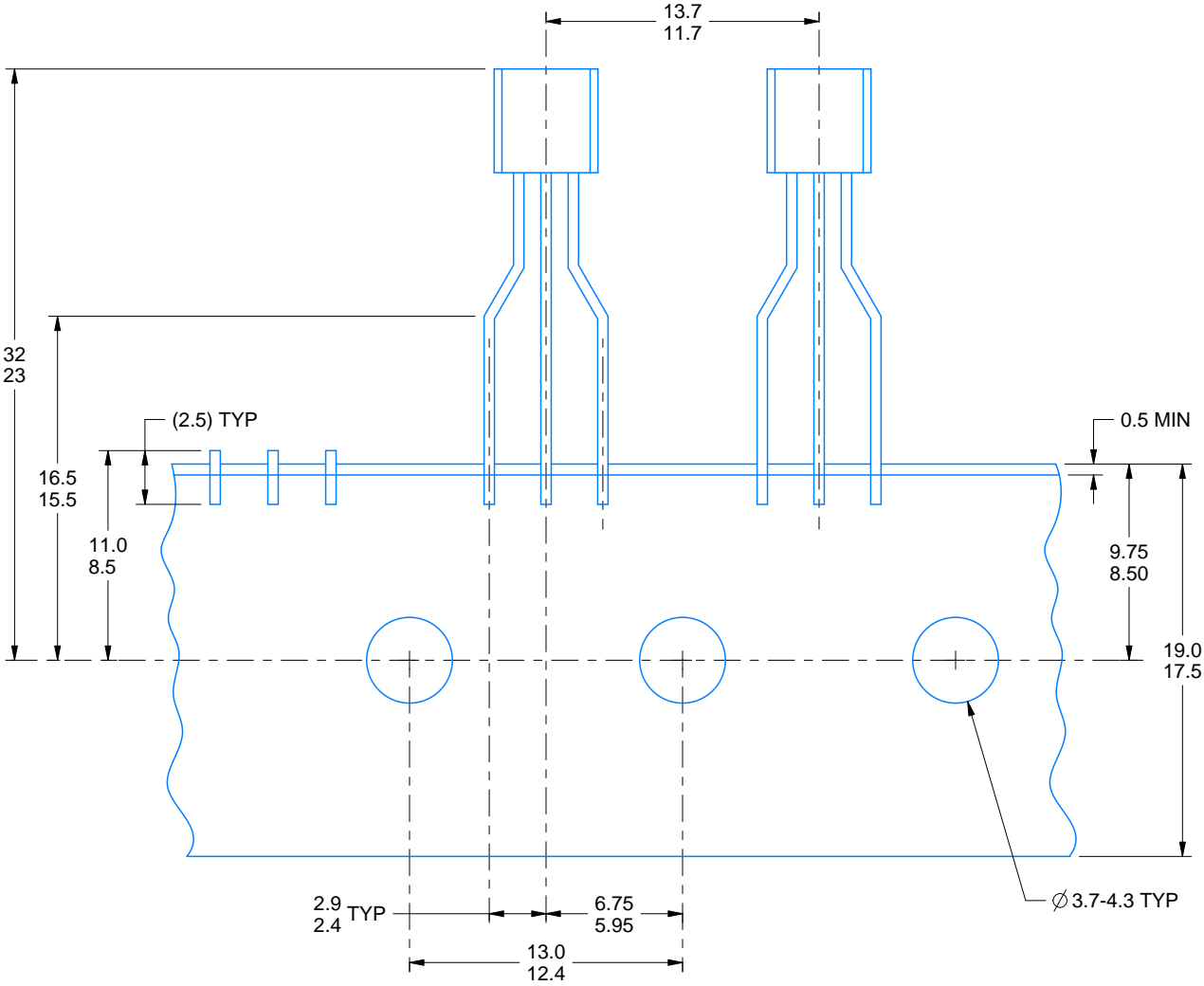
LAND PATTERN EXAMPLE  
FORMED LEAD OPTION  
NON-SOLDER MASK DEFINED  
SCALE:15X

**TAPE SPECIFICATIONS**

**LP0003A**

**TO-92 - 5.34 mm max height**

TO-92



FOR FORMED LEAD OPTION PACKAGE

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