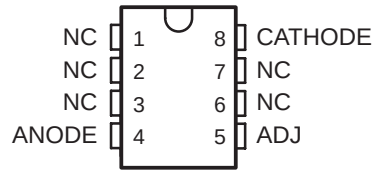
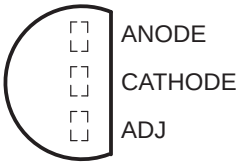
- **Low Temperature Coefficient**
- **Wide Operating Current . . . 400 μA to 10 mA**
- **0.27-Ω Dynamic Impedance**
- **±1% Tolerance Available**
- **Specified Temperature Stability**
- **Easily Trimmed for Minimum Temperature Drift**
- **Fast Turnon**

D PACKAGE
(TOP VIEW)



NC − No internal connection

LM336-2.5, LM336B-2.5 . . . LP PACKAGE
(TOP VIEW)



description/ordering information

The LM236-2.5, LM336-2.5, and LM336B-2.5 integrated circuits are precision 2.5-V shunt regulator diodes. These reference circuits operate as low-temperature-coefficient 2.5-V Zener diodes with a 0.2-Ω dynamic impedance. A third terminal provided on the circuit allows the reference voltage and temperature coefficient to be trimmed easily.

The series is useful as precision 2.5-V low-voltage references (V_Z) for digital voltmeters, power supplies, or operational-amplifier circuitry. The 2.5-V voltage reference makes it convenient to obtain a stable reference from 5-V logic supplies. Devices in this series operate as shunt regulators, and can be used as either positive or negative voltage references.

The LM236-2.5 is characterized for operation from −25°C to 85°C. The LM336-2.5 and LM336B-2.5 are 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	SOIC (D)	Tube of 75	LM336D-2-5	336-25
		Reel of 2500	LM336DR-2-5	
		Tube of 75	LM336BD-2-5	336B25
		Reel of 2500	LM336BDR−2-5	
	TO-226 / TO-92 (LP)	Bulk of 1000	LM336LP-2-5	336-25
		Reel of 2000	LM336LPR-2-5	
		Bulk of 1000	LM336BLP-2-5	336B25
		Reel of 2000	LM336BLPR-2-5	
−25°C to 85°C	SOIC (D)	Tube of 75	LM236D-2-5	236-25
		Reel of 2500	LM236DR-2-5	

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

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

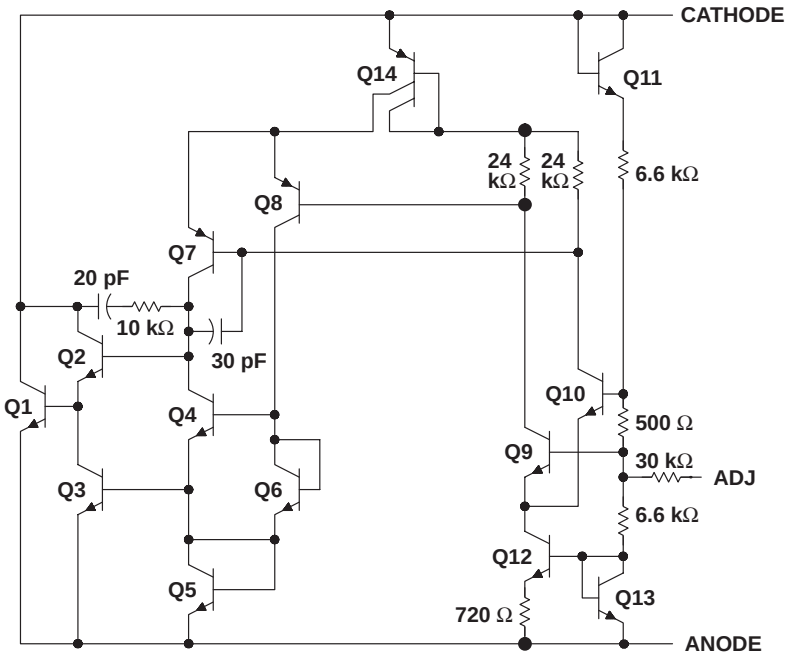
PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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symbol



schematic diagram



NOTE A: All component values are nominal.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Reverse current, I_R	20 mA
Forward current, I_F	10 mA
Package thermal impedance, θ_{JA} (see Notes 1 and 2): D package	97°C/W
LP package	140°C/W
Operating virtual junction temperature, T_J	150°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. 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.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

			MIN	MAX	UNIT
T_A	Operating free-air temperature	LM236-2.5	−25	85	°C
		LM336-2.5, LM336B-2.5	0	70	

electrical characteristics at specified free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	LM236-2.5			LM336-2.5			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V_Z	Reference voltage	I_Z = 1 mA	LM236, LM336	25°C	2.44	2.49	2.54	2.39	2.49	2.59	V
			LM336B					2.44	2.49	2.54	
$\Delta V_{Z(\Delta T)}$	Change in reference voltage with temperature	V_Z adjusted to 2.490 V, I_Z = 1 mA		Full range		3.5	9		1.8	6	mV
$\Delta V_{Z(\Delta I)}$	Change in reference voltage with current	I_Z = 400 μA to 10 mA		25°C		2.6	6		2.6	10	mV
				Full range		3	10		3	12	
$\Delta V_{Z(\Delta t)}$	Long-term change in reference voltage	I_Z = 1 mA		25°C		20			20		ppm/khr
z_z	Reference impedance	I_Z = 1 mA, f = 1 kHz		25°C		0.2	0.6		0.2	1	W
				Full range		0.4	1		0.4	1.4	

† Full range is −25°C to 85°C for the LM236-2.5 and 0°C to 70°C for the LM336-2.5 and LM336B-2.5.

TYPICAL CHARACTERISTICS

CHANGE IN REFERENCE VOLTAGE vs REFERENCE CURRENT

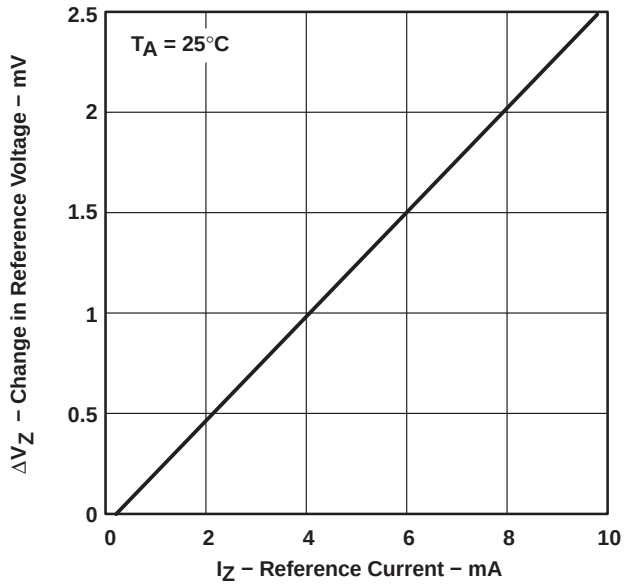


Figure 1

NOISE VOLTAGE vs FREQUENCY

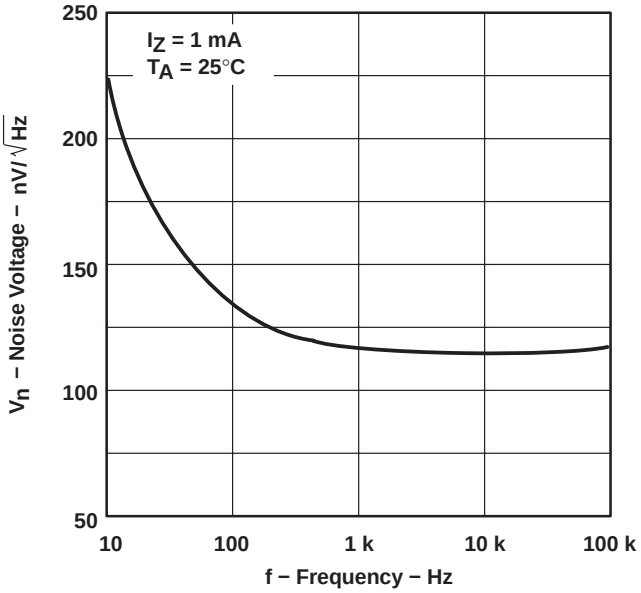


Figure 2

REFERENCE IMPEDANCE vs FREQUENCY

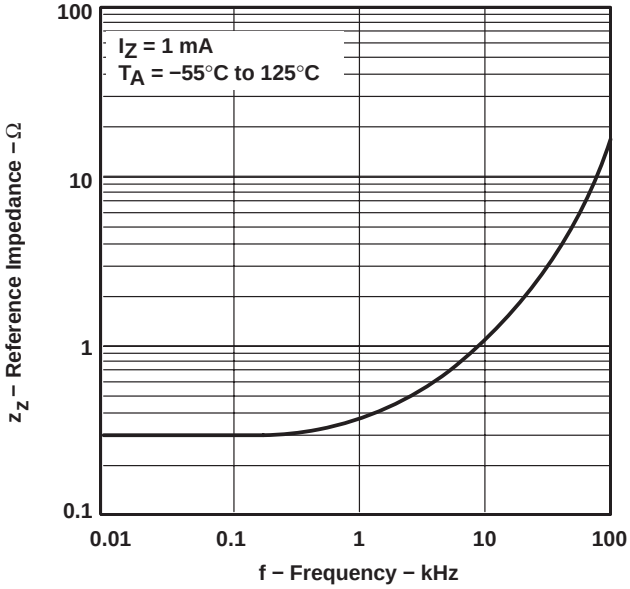


Figure 3

APPLICATION INFORMATION

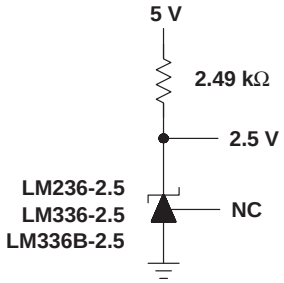


Figure 4. 2.5-V Reference

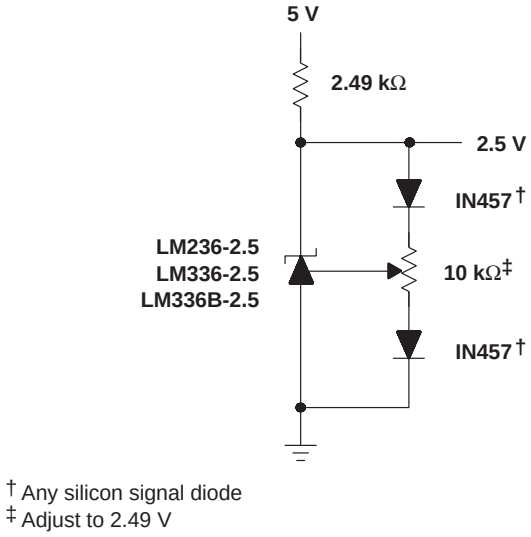


Figure 5. 2.5-V Reference With Minimum Temperature Coefficient

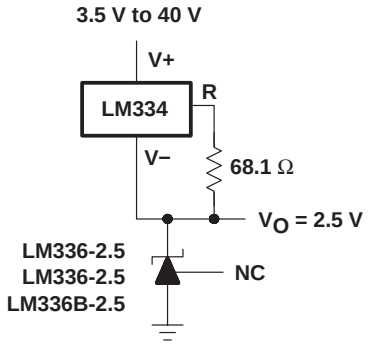


Figure 6. Wide-Input-Range Reference

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
LM236D-2-5	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-25 to 85	236-25
LM236D-2-5.A	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-25 to 85	236-25
LM236DR-2-5	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-25 to 85	236-25
LM236DR-2-5.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-25 to 85	236-25
LM336-2.5 MDC	Active	Production	DIESALE (Y) | 0	400 | NOT REQUIRED	Yes	Call TI	Level-1-NA-UNLIM	-40 to 85	
LM336BD-2-5	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	336B25
LM336BD-2-5.A	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	336B25
LM336BDR-2-5	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	336B25
LM336BDR-2-5.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	336B25
LM336BLP-2-5	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	0 to 70	336B25
LM336BLP-2-5.A	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	0 to 70	336B25
LM336BLPR-2-5	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	0 to 70	336B25
LM336BLPR-2-5.A	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	0 to 70	336B25
LM336D-2-5	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	336-25
LM336D-2-5.A	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	336-25
LM336DR-2-5	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	336-25
LM336DR-2-5.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	336-25
LM336LP-2-5	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	0 to 70	336-25
LM336LP-2-5.A	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	0 to 70	336-25
LM336LPR-2-5	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	0 to 70	336-25
LM336LPR-2-5.A	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	0 to 70	336-25

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

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

(5) MSL rating/Peak reflow: The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) Part marking: There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

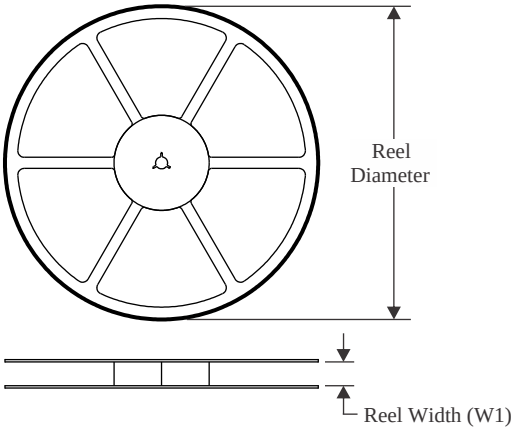
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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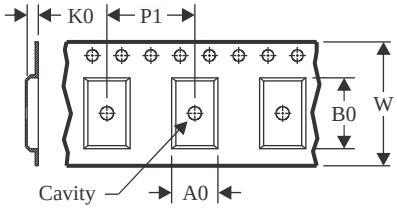
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TAPE AND REEL INFORMATION

REEL DIMENSIONS

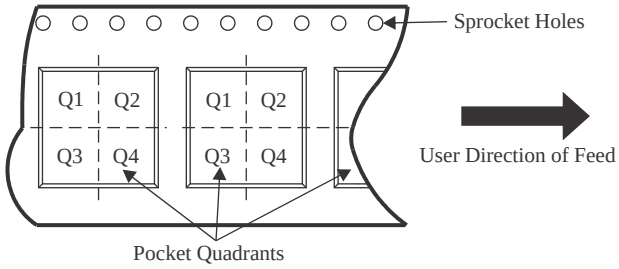


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

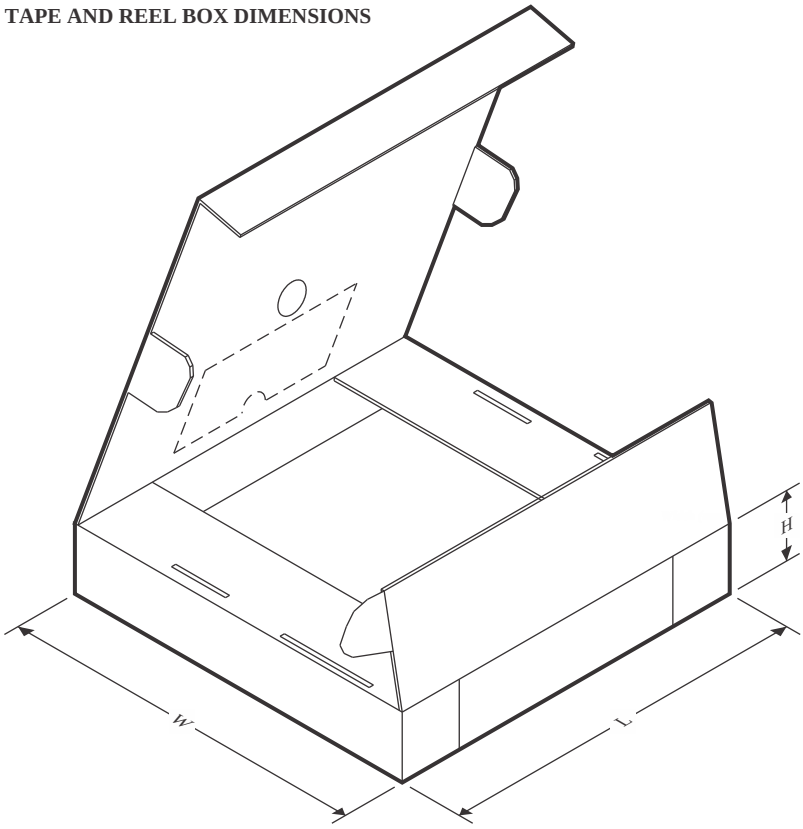
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM236DR-2-5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM336BDR-2-5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LM336DR-2-5	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

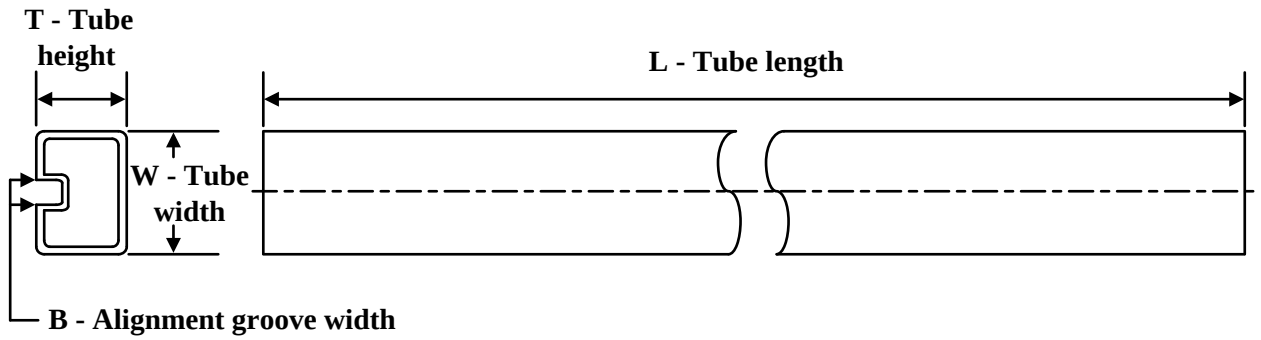
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM236DR-2-5	SOIC	D	8	2500	353.0	353.0	32.0
LM336BDR-2-5	SOIC	D	8	2500	353.0	353.0	32.0
LM336DR-2-5	SOIC	D	8	2500	353.0	353.0	32.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
LM236D-2-5	D	SOIC	8	75	507	8	3940	4.32
LM236D-2-5.A	D	SOIC	8	75	507	8	3940	4.32
LM336BD-2-5	D	SOIC	8	75	507	8	3940	4.32
LM336BD-2-5.A	D	SOIC	8	75	507	8	3940	4.32
LM336D-2-5	D	SOIC	8	75	507	8	3940	4.32
LM336D-2-5.A	D	SOIC	8	75	507	8	3940	4.32

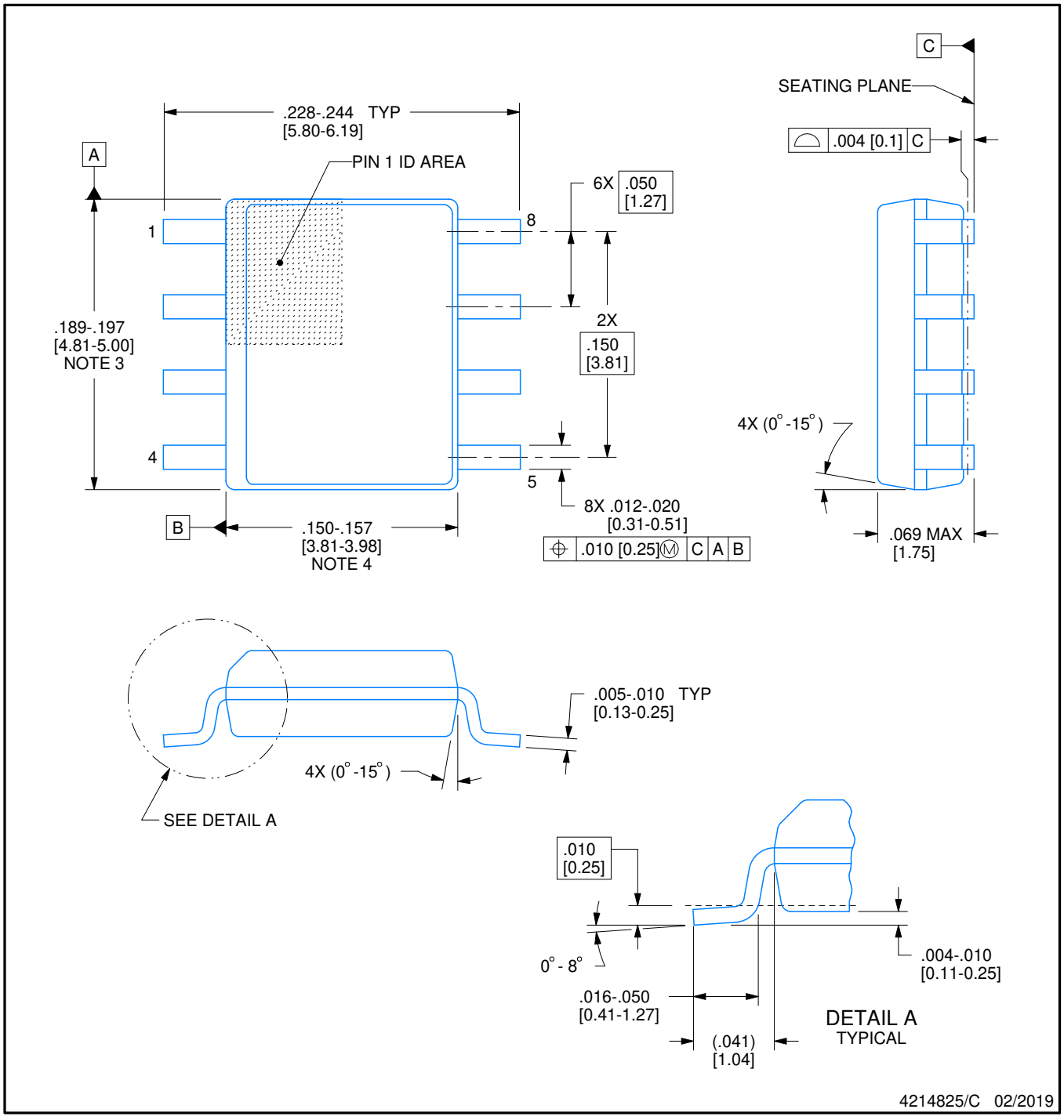


PACKAGE OUTLINE

D0008A

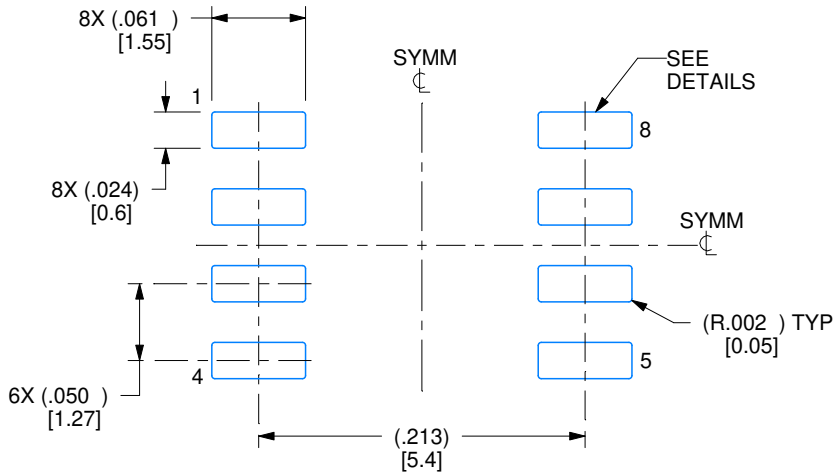
SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT

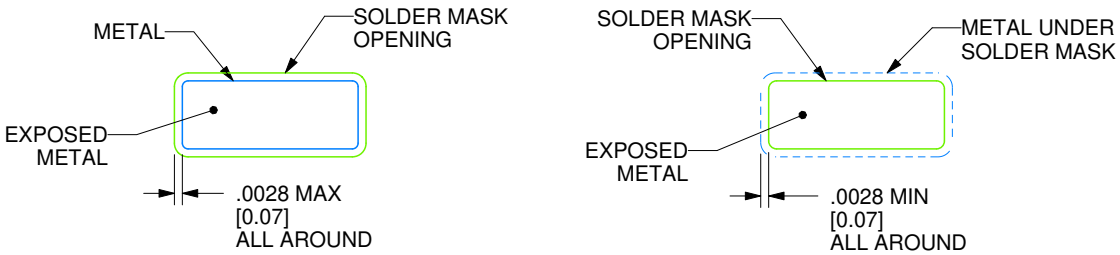


NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

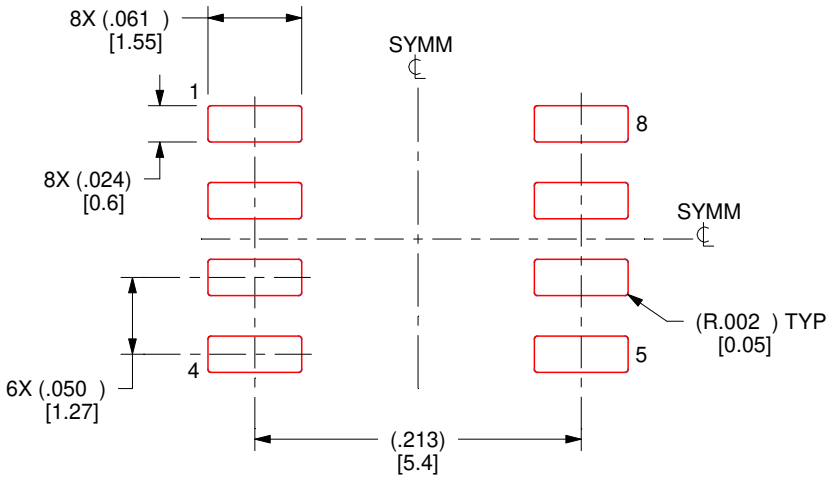
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X

4214825/C 02/2019

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

LP0003A

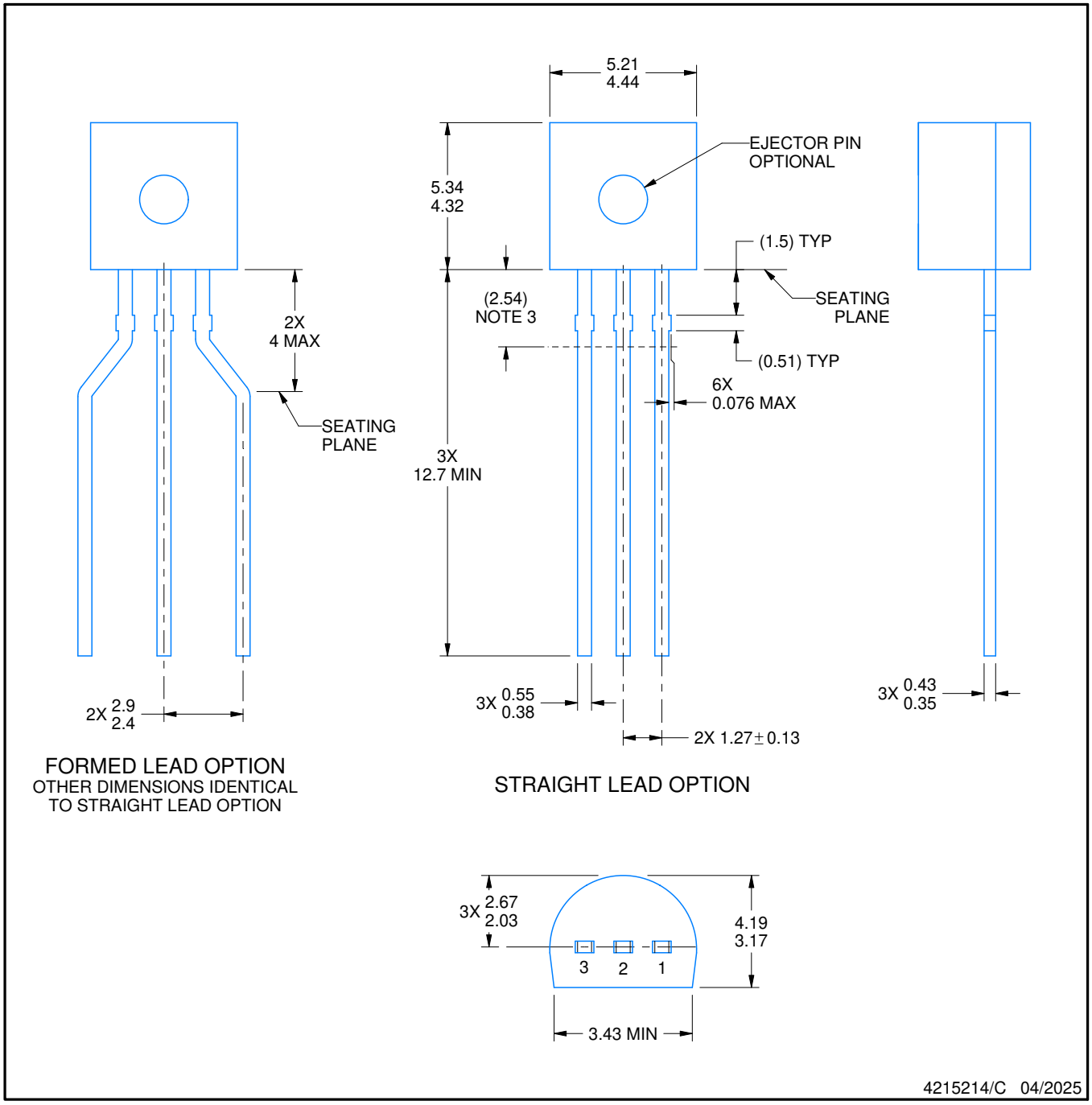




PACKAGE OUTLINE

TO-92 - 5.34 mm max height

TO-92



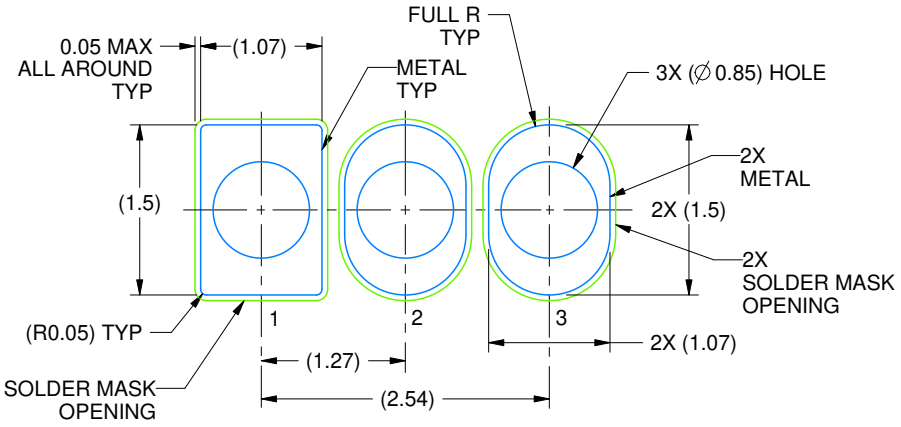
FORMED LEAD OPTION
OTHER DIMENSIONS IDENTICAL
TO STRAIGHT LEAD OPTION

STRAIGHT LEAD OPTION

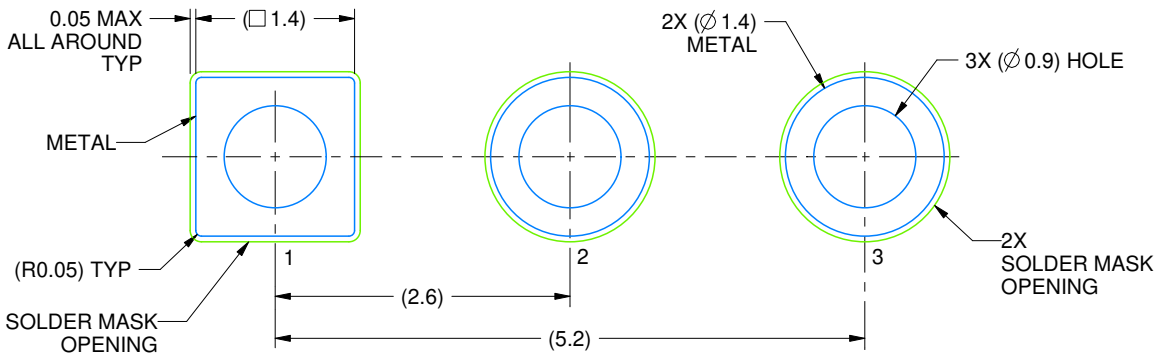
4215214/C 04/2025

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



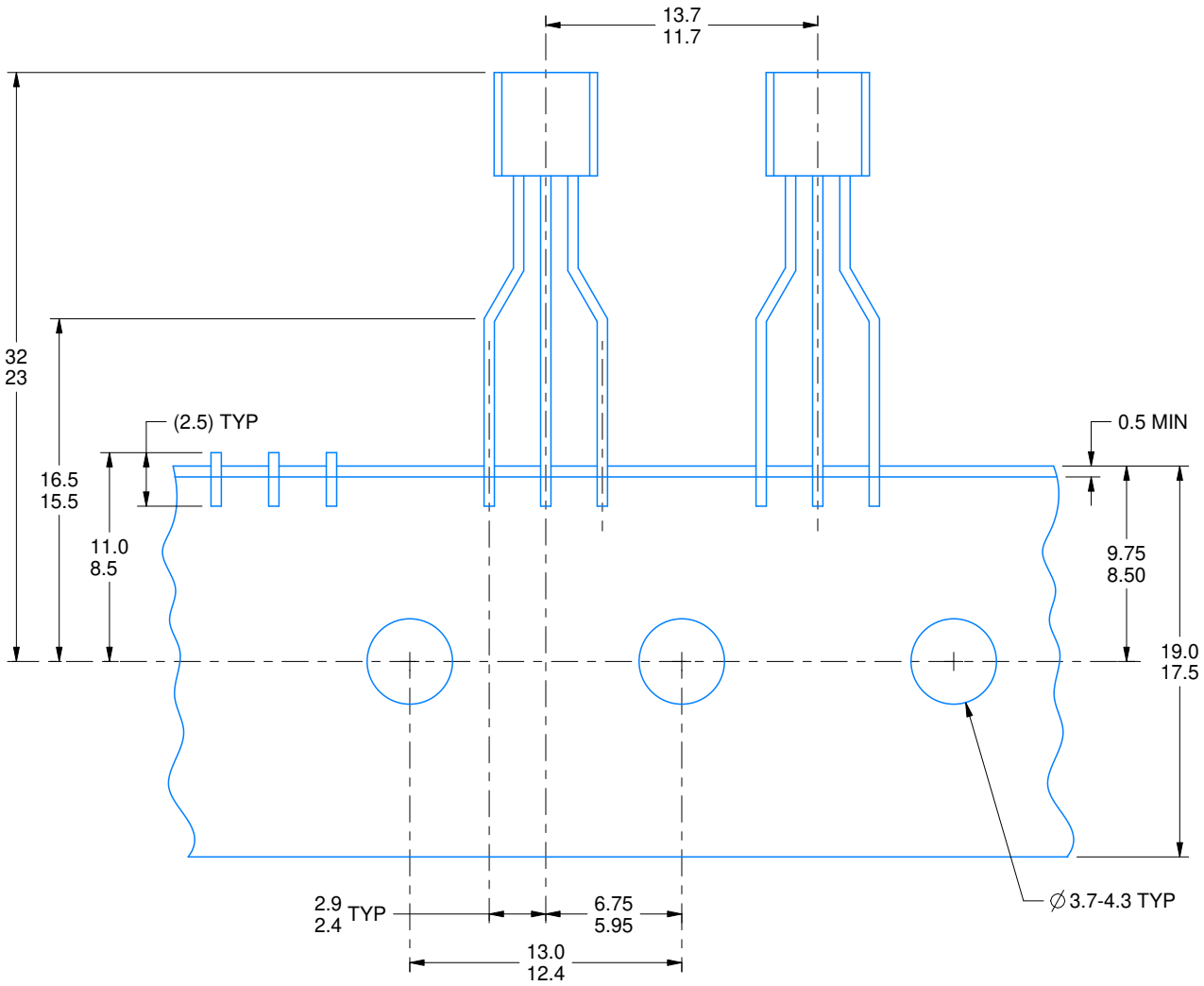
LAND PATTERN EXAMPLE
FORMED LEAD OPTION
NON-SOLDER MASK DEFINED
SCALE:15X

4215214/C 04/2025

LP0003A

TO-92 - 5.34 mm max height

TO-92



FOR FORMED LEAD OPTION PACKAGE

4215214/C 04/2025

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