# LM140L/LM340L Series 3-Terminal Positive Regulators

**Check for Samples: LM140L, LM340L**

## FEATURES

- **Line Regulation of 0.04%/V**
- **Load Regulation of 0.01%/mA**
- **Output Voltage Tolerances of**
  - **±2% at $T_j$ = 25°C and ±4% Over the Temperature Range (LM140LA)**
  - **±3% Over the Temperature Range (LM340LA)**
- **Output Current of 100 mA**
- **Internal Thermal Overload Protection**
- **Output Transistor Safe Area Protection**
- **Internal Short Circuit Current Limit**
- **Available in**
  - **Metal TO Low Profile Package (LM140LA/LM340LA)**
  - **Plastic TO-92 (LM340LA)**

## DESCRIPTION

The LM140L series of three terminal positive regulators is available with several fixed output voltages making them useful in a wide range of applications. The LM140LA is an improved version of the LM78LXX series with a tighter output voltage tolerance (specified over the full military temperature range), higher ripple rejection, better regulation and lower quiescent current. The LM140LA regulators have ±2% $V_{OUT}$ specification, 0.04%/V line regulation, and 0.01%/mA load regulation. When used as a zener diode/resistor combination replacement, the LM140LA usually results in an effective output impedance improvement of two orders of magnitude, and lower quiescent current. These regulators can provide local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow the LM140LA to be used in logic systems, instrumentation, Hi-Fi, and other solid state electronic equipment. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

The LM140LA/LM340LA are available in the low profile metal three lead TO (NDT) and the LM340LA are also available in the plastic TO-92 (LP). With adequate heat sinking the regulator can deliver 100 mA output current. Current limiting is included to limit the peak output current to a safe value. Safe area protection for the output transistor is provided to limit internal power dissipation. If internal power dissipation becomes too high for the heat sinking provided, the thermal shut-down circuit takes over, preventing the IC from overheating.

For applications requiring other voltages, see LM117L Data Sheet.

### Output Voltage Options

| | | | |
|---|---|---|---|
| LM140LA-5.0 | 5V | LM340LA-5.0 | 5V |
| LM140LA-12 | 12V | LM340LA-12 | 12V |
| LM140LA-15 | 15V | LM340LA-15 | 15V |

### Connection Diagrams

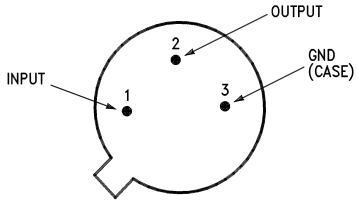


**Figure 1. TO Metal Can Package (NDT)**
**(Bottom View)**

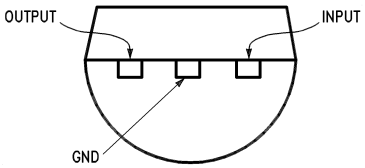


**Figure 2. TO-92 Plastic Package (LP)**
**(Bottom View)**

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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][2][3]

| | | |
|---|---|---|
| Input Voltage | | 35V |
| Internal Power Dissipation[4] | | Internally Limited |
| Operating Temperature Range | LM140LA | −55°C to +125°C |
| | LM340LA | 0°C to +70°C |
| Maximum Junction Temperature | | +150°C |
| Storage Temperature Range | Metal Can (NDT package) | −65°C to +150°C |
| | Molded TO-92 | −55°C to +150°C |
| Lead Temperature (Soldering, 10 sec.) | Metal Can | +300°C |
| | Plastic TO-92 | +230°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 ensure specific performance limits.
(2) A military RETS specification is available upon request. At the time of printing, the LM140LA-5.0, -12, and -15 RETS specifications complied with the Min and Max limits in this table. The LM140LAH-5.0, LM140LAH-12, and LM140LAH-15 may also be procured as Standard Military Drawings.
(3) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.
(4) Thermal resistance of NDT-package is typically 26°C/W $\theta_{jC}$, 250°C/W $\theta_{jA}$ still air, and 94°C/W $\theta_{jA}$ 400 lf/min of air. For the LP-package is 60°C/W $\theta_{jC}$, 232°C/W $\theta_{jA}$ still air, and 88°C/W $\theta_{jA}$ at 400 lf/min of air. The maximum junction temperature shall not exceed 125°C on electrical parameters.

## Electrical Characteristics

Test conditions unless otherwise specified. $T_A$ = −55°C to +125°C (LM140LA), $T_A$ = 0°C to +70°C (LM340LA), $I_O$ = 40 mA, $C_{IN}$ = 0.33 µF, $C_O$ = 0.01 µF.

| Output Voltage Option | | | | 5.0V | | | 12V | | | 15V | | | Units |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Input Voltage (unless otherwise noted) | | | | 10V | | | 19V | | | 23V | | | |
| Symbol | Parameter | Conditions | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| $V_O$ | Output Voltage | $T_j$ = 25°C | | 4.9 | 5 | 5.1 | 11.75 | 12 | 12.25 | 14.7 | 15 | 15.3 | V |
| | Output Voltage Over Temp.[1] | LM140LA | $I_O$ = 1 − 100 mA | 4.8 | | 5.2 | 11.5 | | 12.5 | 14.4 | | 15.6 | |
| | | | | (7.2–20) | | | (14.5–27) | | | (17.6–30) | | | |
| | | LM340LA | $I_O$ = 1 − 100 mA or $I_O$ = 1 − 40 mA and $V_{IN}$ = ( )V | 4.85 | | 5.15 | 11.65 | | 12.35 | 14.55 | | 15.45 | |
| | | | | (7–20) | | | (14.3–27) | | | (17.5–30) | | | |
| $\Delta V_O$ | Line Regulation | $T_j$ = 25°C | $I_O$ = 40 mA | | 18 | 30 | | 30 | 65 | | 37 | 70 | mV |
| | | | $V_{IN}$ = ( )V | | (7–25) | | | (14.2–30) | | | (17.3–30) | | |
| | | | $I_O$ = 100 mA | | 18 | 30 | | 30 | 65 | | 37 | 70 | |
| | | | $V_{IN}$ = ( )V | | (7.5–25) | | | (14.5–30) | | | (17.5–30) | | |
| | Load Regulation | $T_j$ = 25°C | $I_O$ = 1 − 40 mA | | 5 | 20 | | 10 | 40 | | 12 | 50 | |
| | | | $I_O$ = 1 − 100 mA | | 20 | 40 | | 30 | 80 | | 35 | 100 | |
| | Long Term Stability | | | | 12 | | | 24 | | | 30 | | mV 1000 hrs |
| $I_O$ | Quiescent Current | $T_j$ = 25°C | | | 3 | 4.5 | | 3 | 4.5 | | 3.1 | 4.5 | mA |
| | | $T_j$ = 125°C | | | | 4.2 | | | 4.2 | | | 4.2 | |
| $\Delta I_Q$ | Quiescent Current Change | $T_j$ = 25°C | ΔLoad $I_O$ = 1 − 40 mA | | | 0.1 | | | 0.1 | | | 0.1 | mA |
| | | | ΔLine $V_{IN}$ = ( )V | | | 0.5 | | | 0.5 | | | 0.5 | |
| | | | | | (7.5–25) | | | (14.3–30) | | | (17.5–30) | | |

(1) The temperature coefficient of $V_{OUT}$ is typically within 0.01% $V_O$/°C.


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## Electrical Characteristics (continued)

Test conditions unless otherwise specified. $T_A$ = −55°C to +125°C (LM140LA), $T_A$ = 0°C to +70°C (LM340LA), $I_O$ = 40 mA, $C_{IN}$ = 0.33 µF, $C_O$ = 0.01 µF.

| Output Voltage Option | | | 5.0V | | | 12V | | | 15V | | | Units |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Input Voltage (unless otherwise noted) | | | 10V | | | 19V | | | 23V | | | |
| Symbol | Parameter | Conditions | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| $V_N$ | Output Noise Voltage | $T_j$ = 25°C[2], f = 10 Hz–10 kHz | | 40 | | | 80 | | | 90 | | µV |
| $\frac{\Delta V_{IN}}{\Delta Vout}$ | Ripple Rejection | f = 120 Hz, $V_{IN}$ = ( )V | 55 | 62 | | 47 | 54 | | 45 | 52 | | dB |
| | | | (7.5–18) | | | (14.5–25) | | | (17.5–28.5) | | | |
| | Input Voltage Required to Maintain Line Regulation | $T_j$ = 25°C, $I_O$ = 40 mA | 7 | | | 14.2 | | | 17.3 | | | V |

(2) It is recommended that a minimum load capacitor of 0.01 µF be used to limit the high frequency noise bandwidth.

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## Typical Performance Characteristics

Maximum Average Power Dissipation

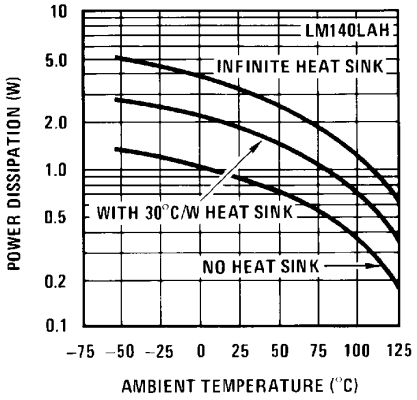


Figure 3.

Maximum Average Power Dissipation (Metal Can Package)

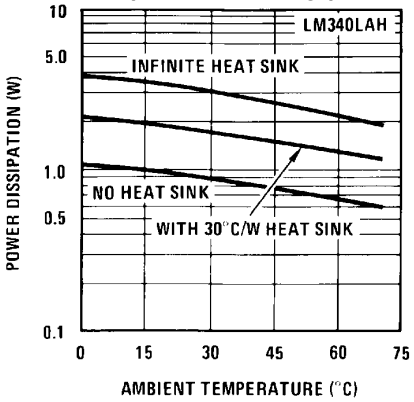


Figure 4.

Maximum Average Power Dissipation (Plastic Package)

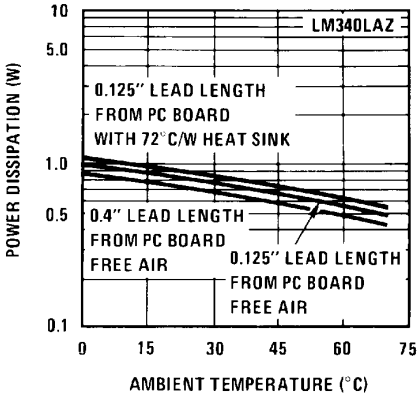


Figure 5.

Peak Output Current

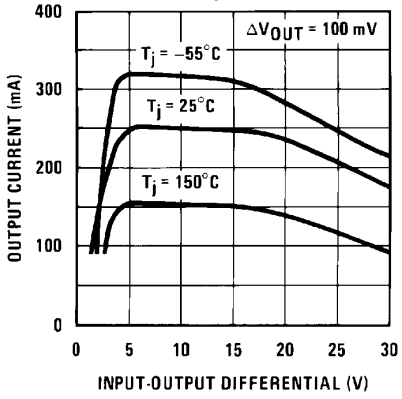


Figure 6.

Dropout Voltage

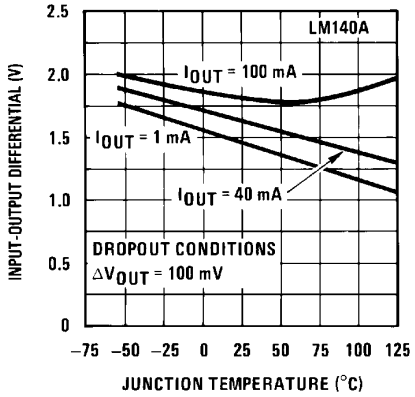


Figure 7.

Output Impedance

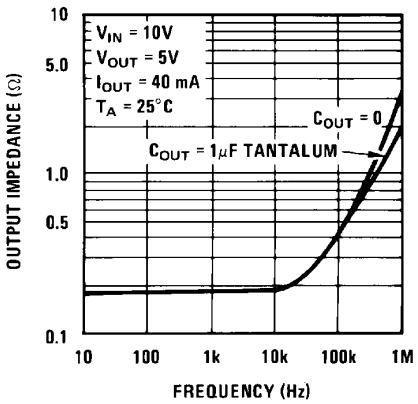


Figure 8.


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## Typical Performance Characteristics (continued)

**Ripple Rejection**

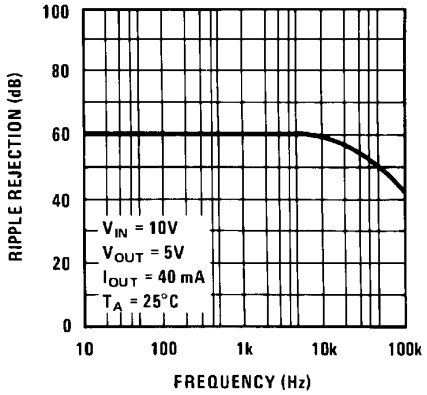



**Figure 9.**

**Quiescent Current**

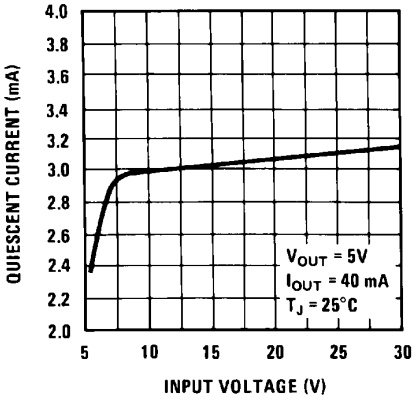



**Figure 10.**

**Quiescent Current**

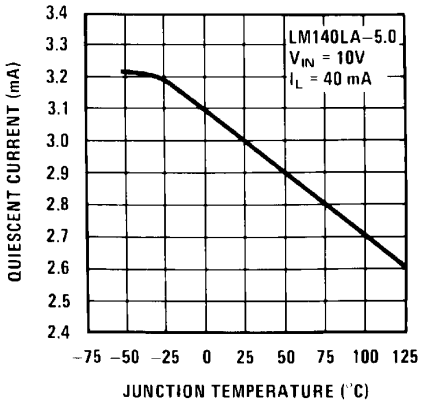
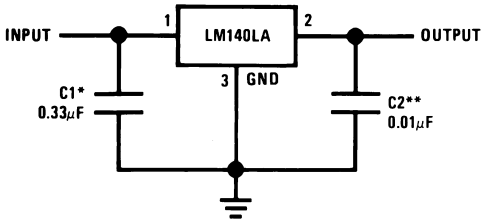


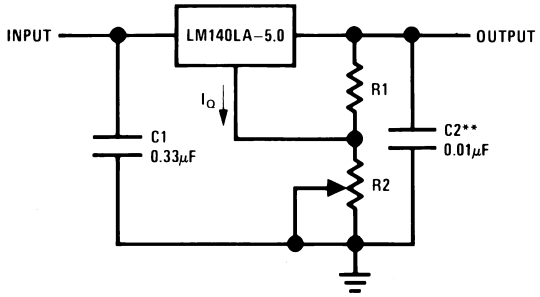

**Figure 11.**

## TYPICAL APPLICATIONS




*Required if the regulator is located far from the power supply filter.
**It is recommended that a minimum load capacitor of 0.01 μF be used to limit the high frequency noise bandwidth.

**Figure 12. Fixed Output Regulator**




$V_{OUT}$ = 5V + (5V/R1 + $I_O$) R2
5V/R1 = 3 $I_O$ load regulation (L,) [(R1 + R2)/R1] (L, of LM140LA-5.0)

**Figure 13. Adjustable Output Regulator**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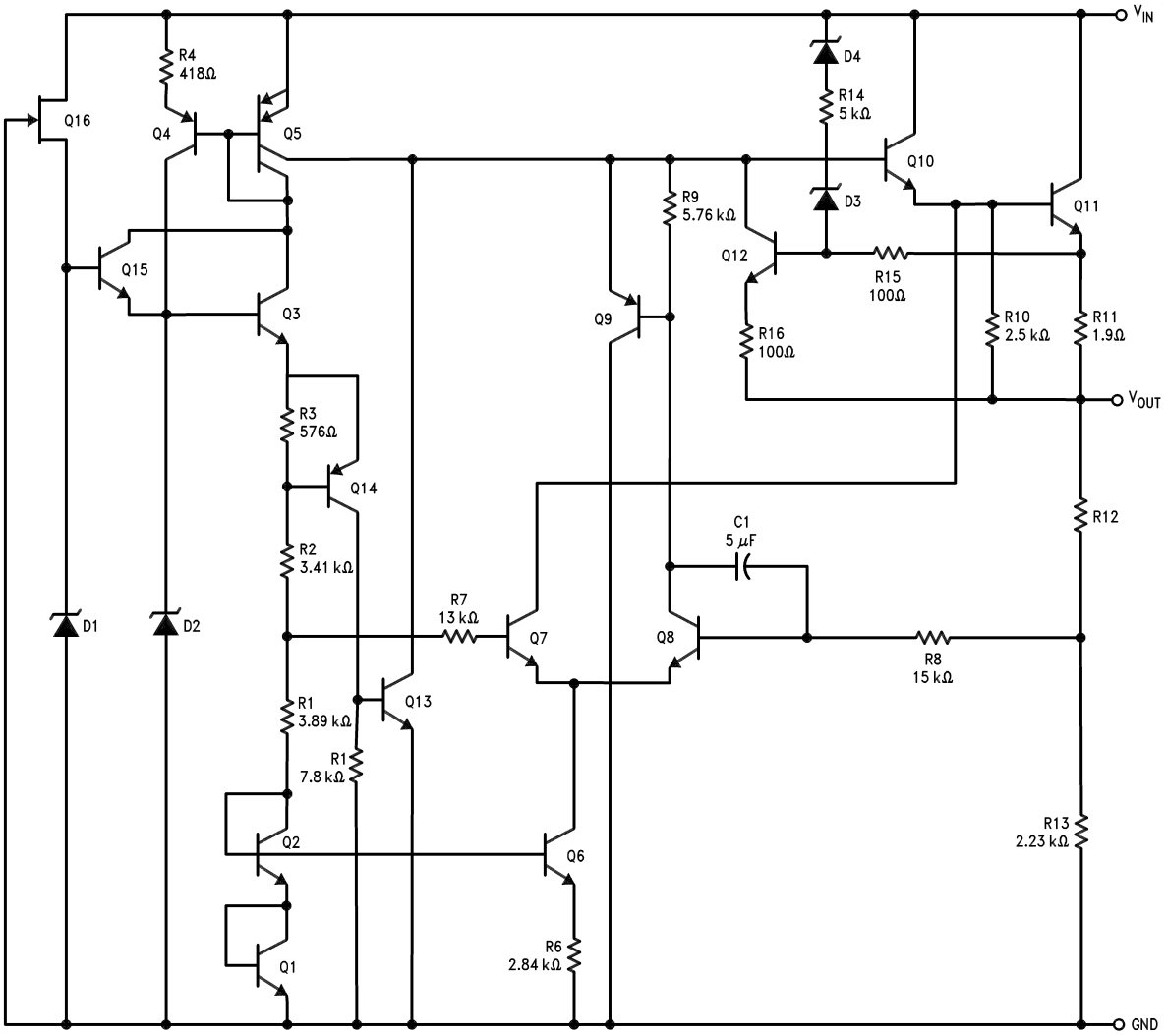
## Equivalent Circuit



## REVISION HISTORY

| Changes from Revision A (March 2013) to Revision B | Page |
|---|---|
| • Changed layout of National Data Sheet to TI format | 7 |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## 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) |
|---|---|---|---|---|---|---|---|---|---|
| LM140LAH-12 | Active | Production | TO (NDT) \| 3 | 500 \| BULK | Yes | AU | Level-1-NA-UNLIM | -55 to 125 | ( LM140LAH-12, LM140LAH-12) |
| LM140LAH-12/NOPB | Active | Production | TO (NDT) \| 3 | 500 \| BULK | Yes | AU | Level-1-NA-UNLIM | -55 to 125 | ( LM140LAH-12, LM140LAH-12) |
| LM140LAH-15 | Active | Production | TO (NDT) \| 3 | 500 \| BULK | Yes | AU | Level-1-NA-UNLIM | -55 to 125 | ( LM140LAH-15, LM140LAH-15) |
| LM140LAH-15/NOPB | Active | Production | TO (NDT) \| 3 | 500 \| BULK | Yes | AU | Level-1-NA-UNLIM | -55 to 125 | ( LM140LAH-15, LM140LAH-15) |
| LM140LAH-5.0 | Active | Production | TO (NDT) \| 3 | 500 \| BULK | Yes | AU | Level-1-NA-UNLIM | -55 to 125 | ( LM140LAH-5.0, LM140LAH-5.0) |
| LM140LAH-5.0/NOPB | Active | Production | TO (NDT) \| 3 | 500 \| BULK | Yes | AU | Level-1-NA-UNLIM | -55 to 125 | ( LM140LAH-5.0, LM140LAH-5.0) |
| LM340LAZ-5.0/LFT4 | Active | Production | TO-92 (LP) \| 3 | 2000 \| LARGE T&R | Yes | Call TI | N/A for Pkg Type | - | 340LAZ-5.0 |
| LM340LAZ-5.0/LFT4.B | Active | Production | TO-92 (LP) \| 3 | 2000 \| LARGE T&R | Yes | Call TI | N/A for Pkg Type | See LM340LAZ-5.0/LFT4 | 340LAZ-5.0 |
| LM340LAZ-5.0/NOPB | Active | Production | TO-92 (LP) \| 3 | 1800 \| BULK | Yes | Call TI | N/A for Pkg Type | 0 to 70 | 340LAZ-5.0 |
| LM340LAZ-5.0/NOPB.B | Active | Production | TO-92 (LP) \| 3 | 1800 \| BULK | Yes | Call TI | N/A for Pkg Type | 0 to 70 | 340LAZ-5.0 |

(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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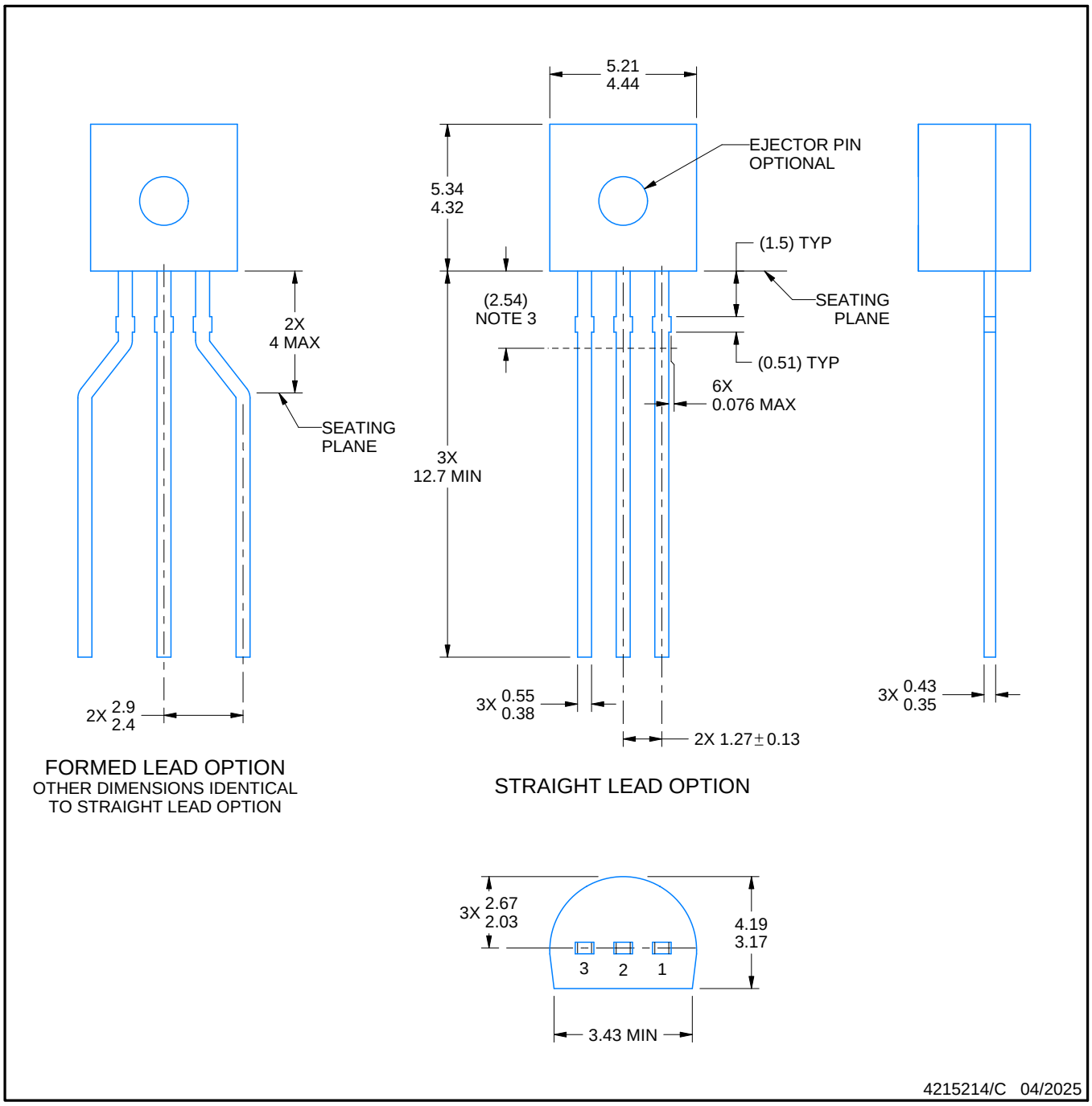
# LP0003A

## PACKAGE OUTLINE

### TO-92 - 5.34 mm max height

TO-92

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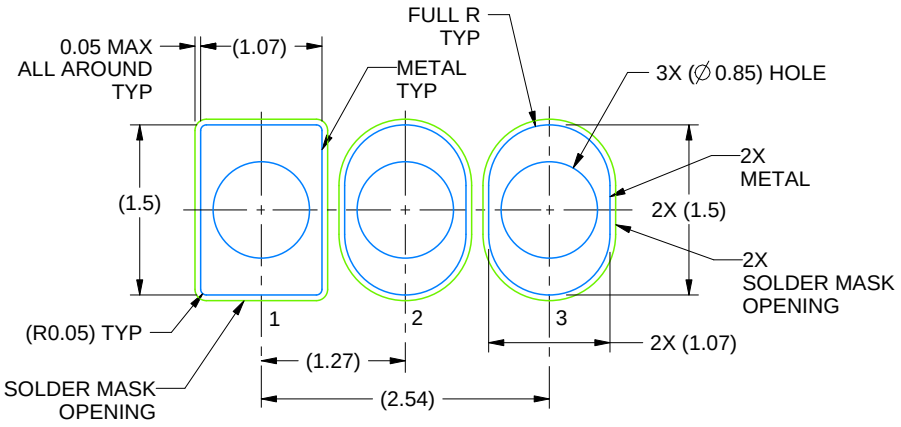
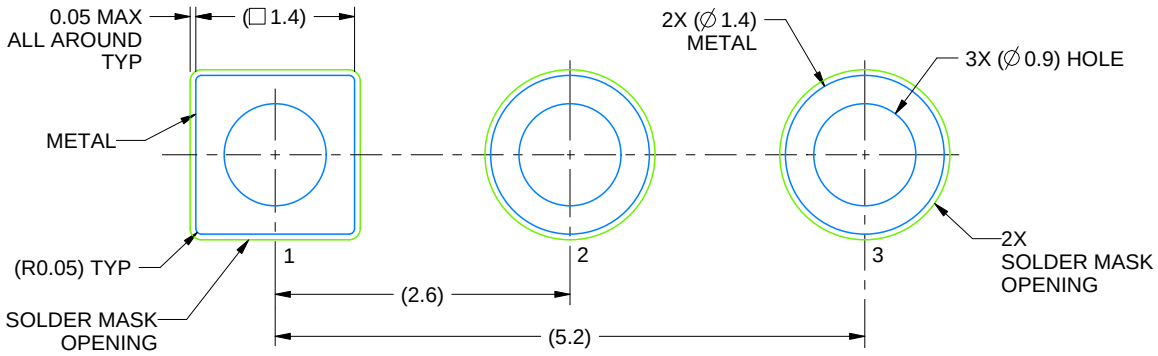
NOTES:

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

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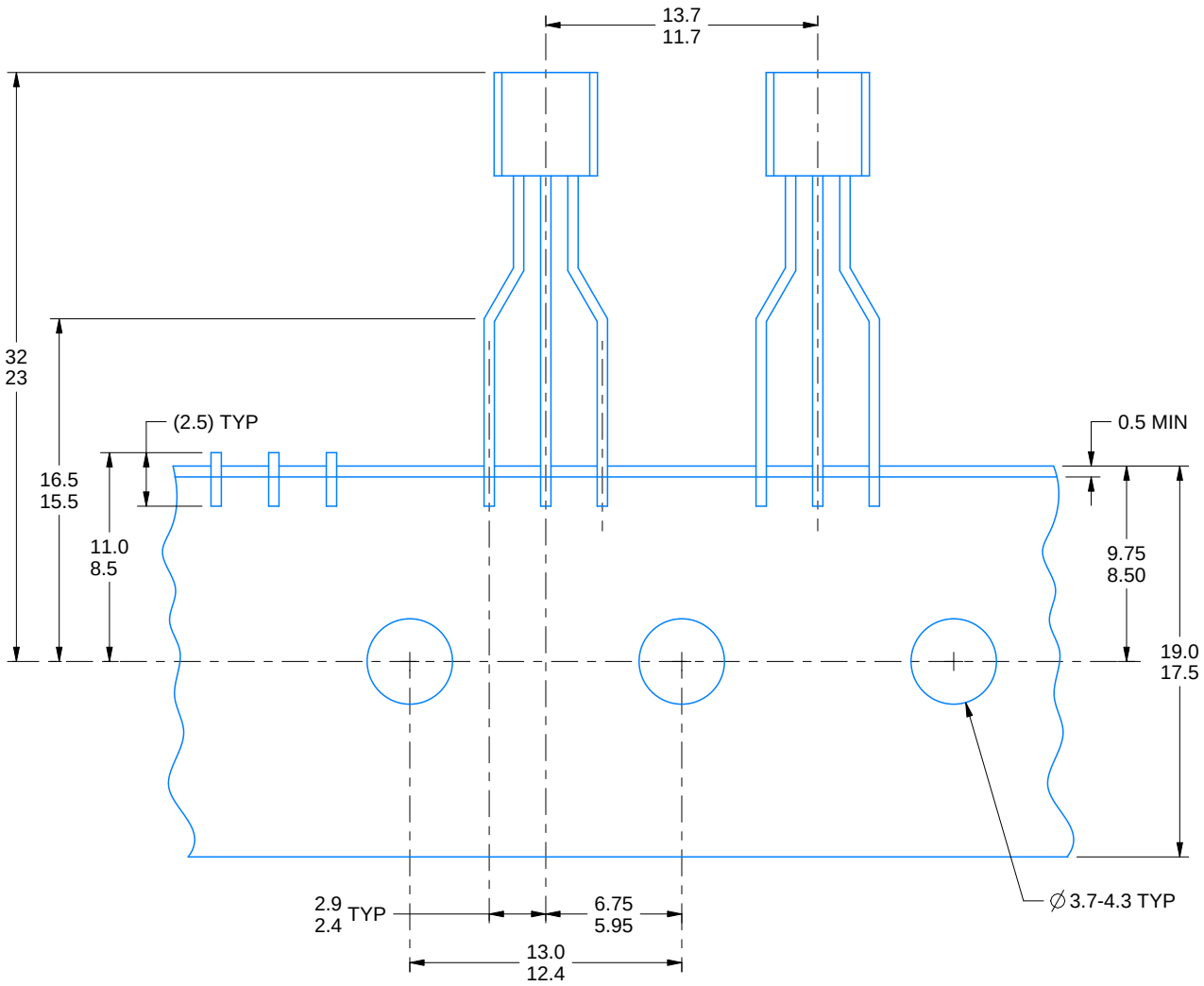
# LP0003A

## TO-92 - 5.34 mm max height

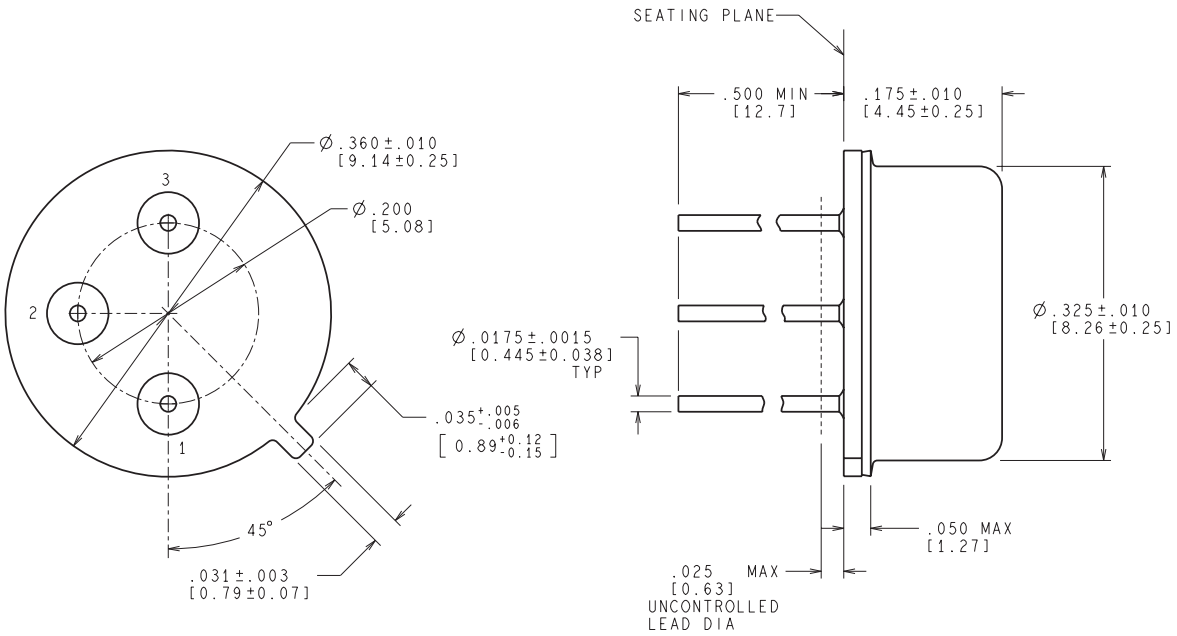
TO-92




FOR FORMED LEAD OPTION PACKAGE

4215214/C 04/2025

# NDT0003A




CONTROLLING DIMENSION IS INCH
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MIL-PRF-38535
CONFIGURATION CONTROL

H03A (Rev D)

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