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

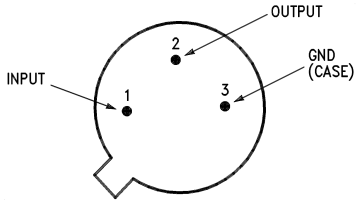


Figure 1. TO Metal Can Package (NDT)
(Bottom View)

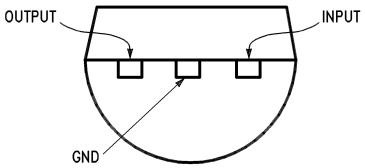


Figure 2. TO-92 Plastic Package (LP)
(Bottom View)

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 guarantee 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 θ_{jC}, 250°C/W θ_{jA} still air, and 94°C/W θ_{jA} 400 lf/min of air. For the LP-package is 60°C/W θ_{jC}, 232°C/W θ_{jA} still air, and 88°C/W θ_{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)			
ΔV_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	
ΔI_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.

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.

Typical Performance Characteristics

Maximum Average Power Dissipation

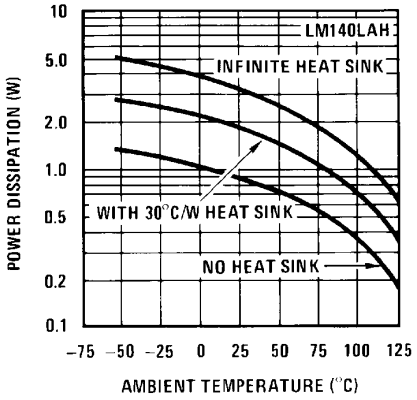


Figure 3.

Maximum Average Power Dissipation (Metal Can Package)

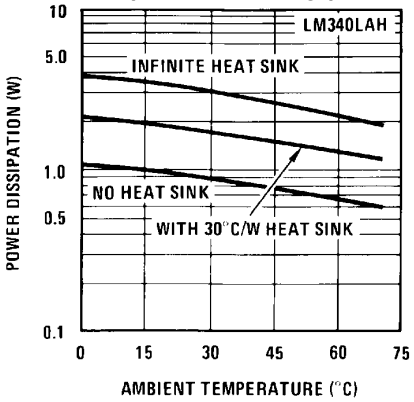


Figure 4.

Maximum Average Power Dissipation (Plastic Package)

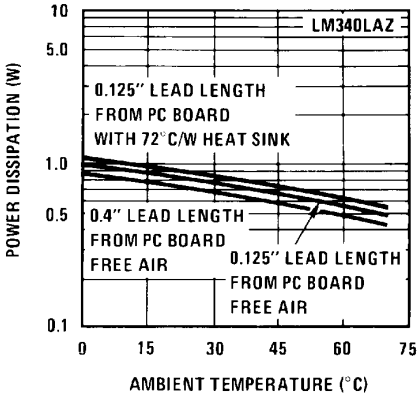


Figure 5.

Peak Output Current

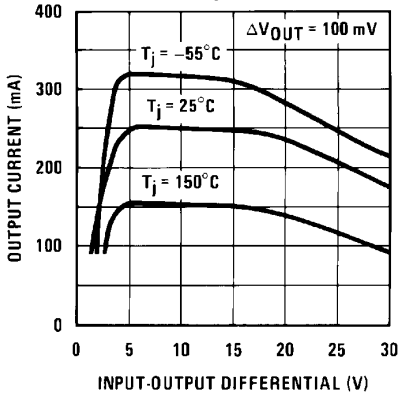


Figure 6.

Dropout Voltage

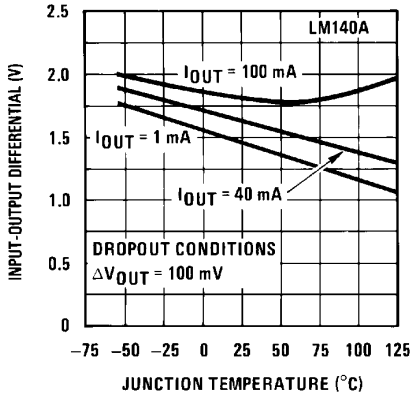


Figure 7.

Output Impedance

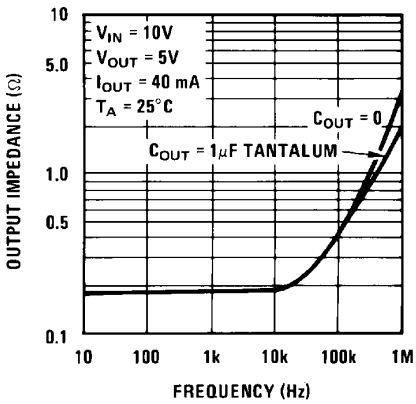


Figure 8.

Typical Performance Characteristics (continued)

Ripple Rejection

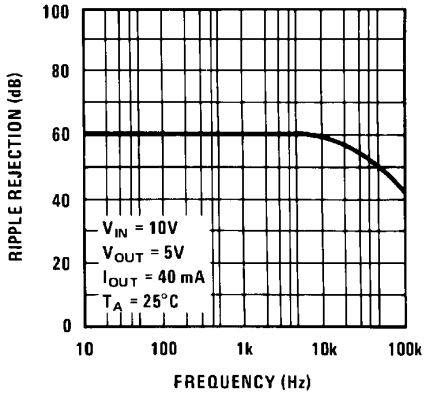


Figure 9.

Quiescent Current

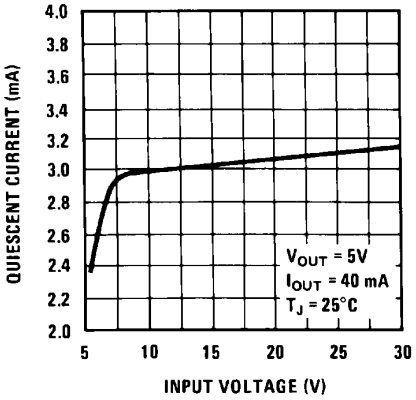


Figure 10.

Quiescent Current

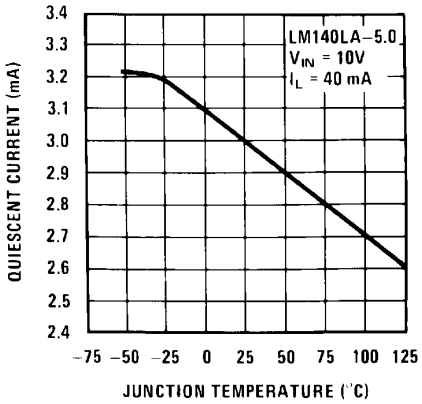
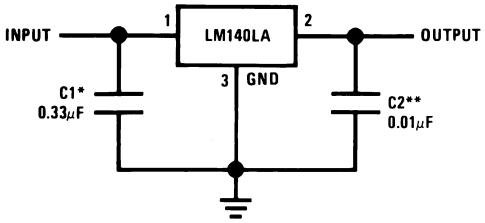


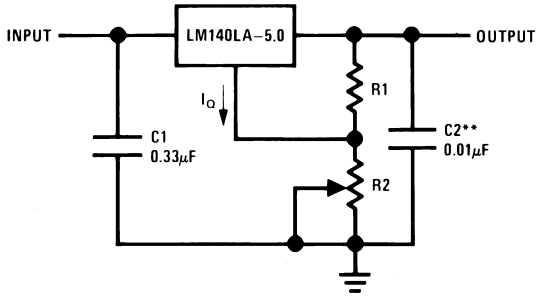
Figure 11.

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.

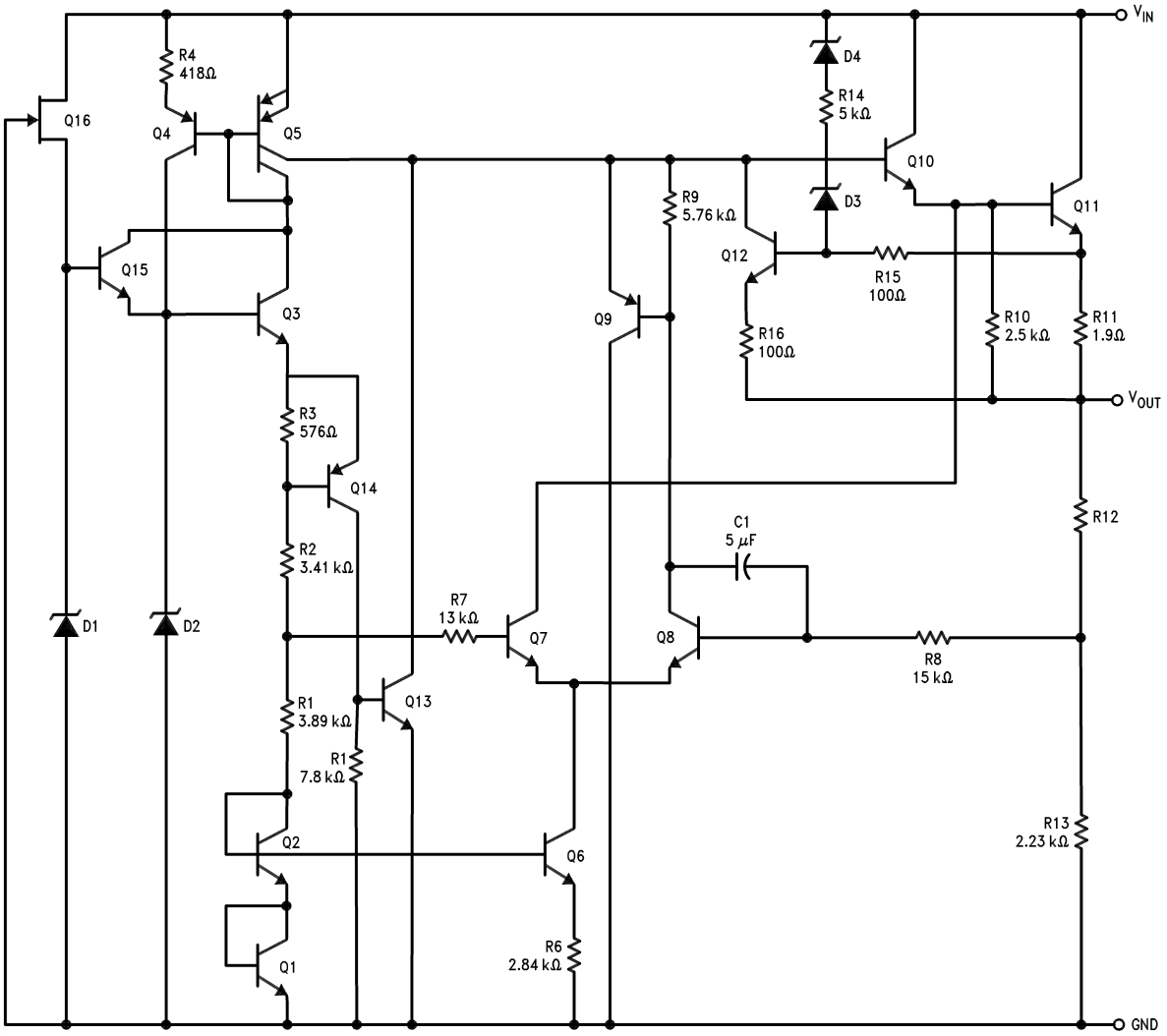
Figure 12. Fixed Output Regulator



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

Equivalent Circuit



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
LM140LAH-12	ACTIVE	TO	NDT	3	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	-55 to 125	LM140LAH-12	Samples
LM140LAH-12/NOPB	ACTIVE	TO	NDT	3	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	-55 to 125	LM140LAH-12	Samples
LM140LAH-15	ACTIVE	TO	NDT	3	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	-55 to 125	LM140LAH-15	Samples
LM140LAH-15/NOPB	ACTIVE	TO	NDT	3	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	-55 to 125	LM140LAH-15	Samples
LM140LAH-5.0	ACTIVE	TO	NDT	3	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	-55 to 125	LM140LAH-5.0	Samples
LM140LAH-5.0/NOPB	ACTIVE	TO	NDT	3	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	-55 to 125	LM140LAH-5.0	Samples
LM340LAZ-5.0/LFT4	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		340LA Z-5.0	Samples
LM340LAZ-5.0/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM	0 to 70	340LA Z-5.0	Samples

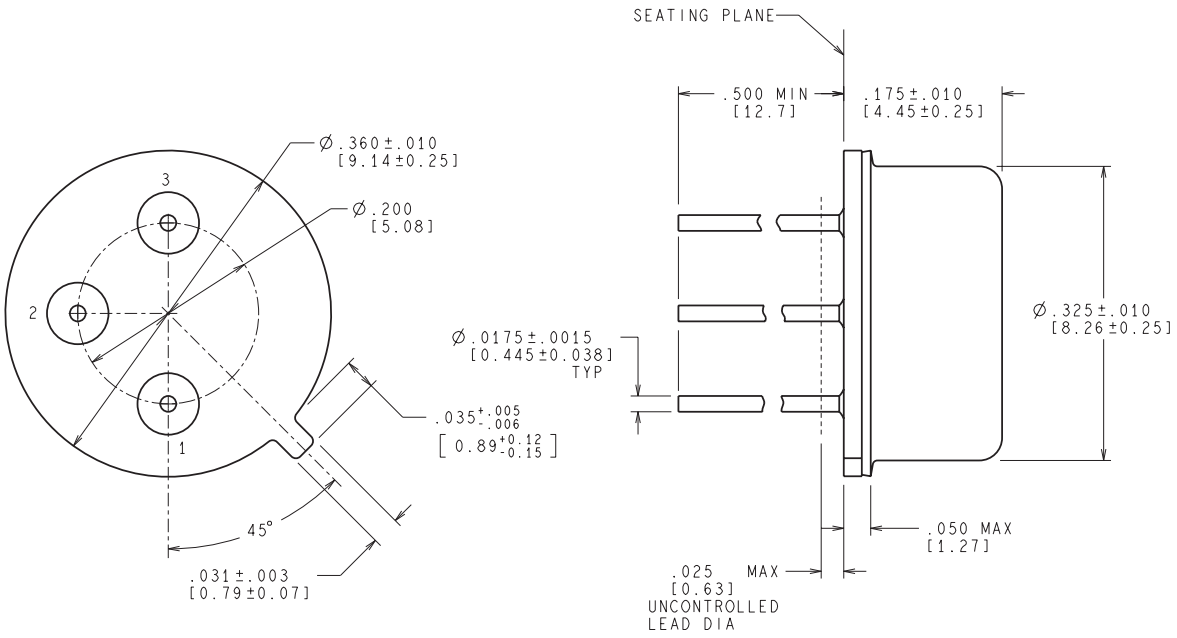
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, 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.

NDT0003A

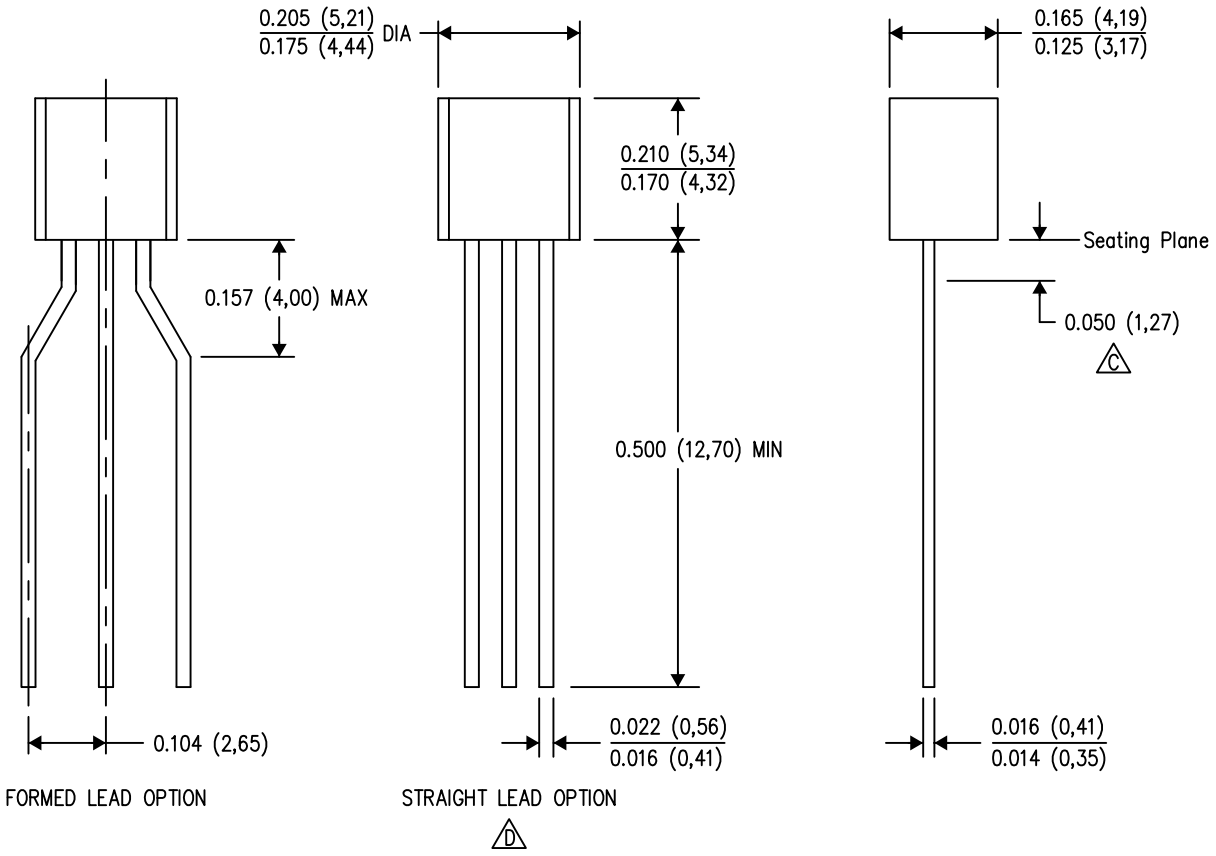


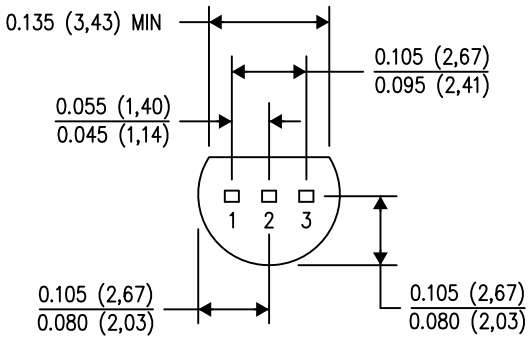
CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

MIL-PRF-38535
CONFIGURATION CONTROL

H03A (Rev D)

LP (O–PBCY–W3) PLASTIC CYLINDRICAL PACKAGE

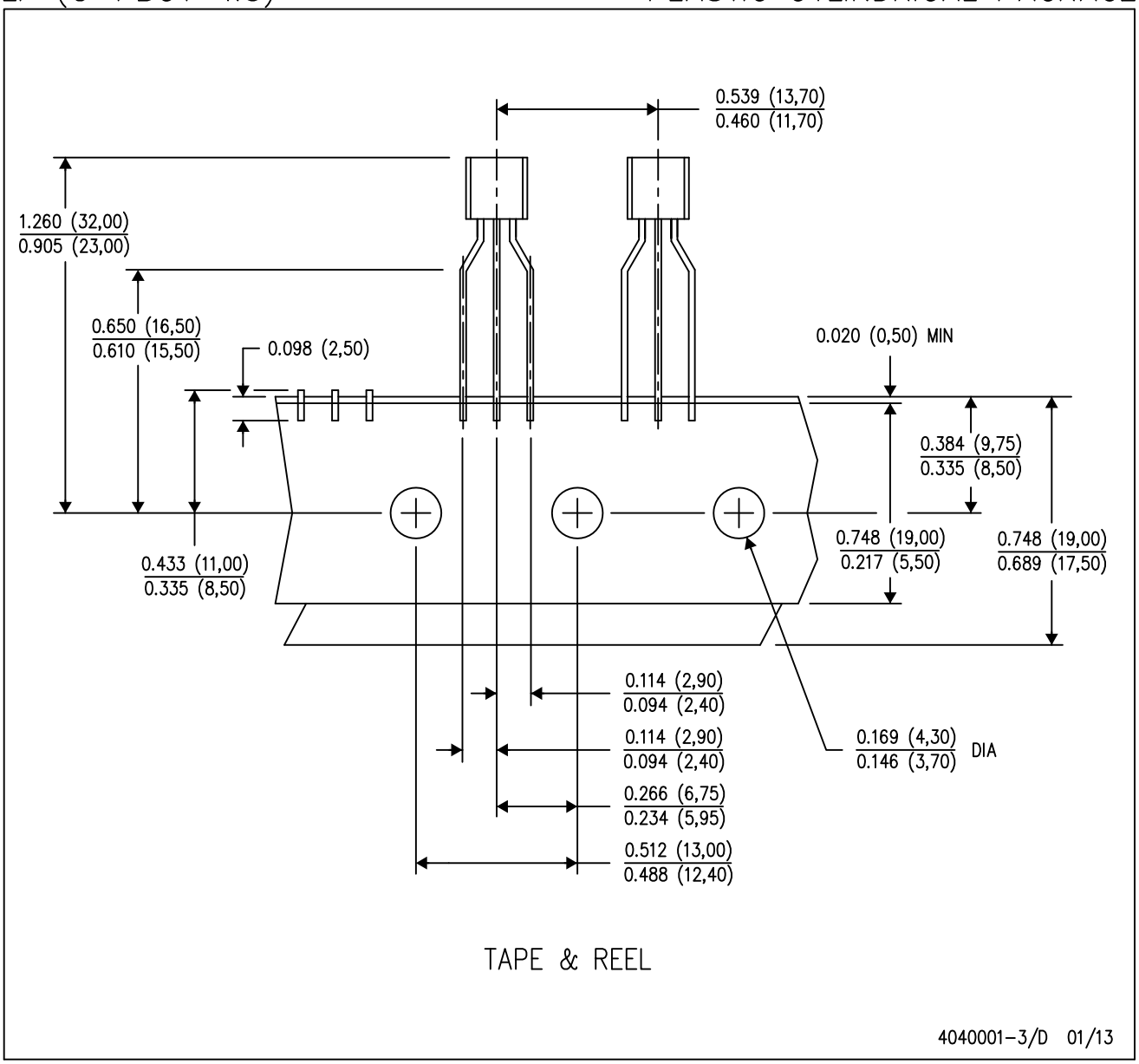




4040001–2/D 01/13

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 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.

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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