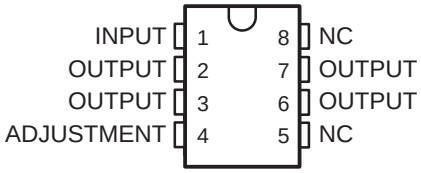
LM317L
3-TERMINAL ADJUSTABLE REGULATOR

SLCS144 − JULY 2004

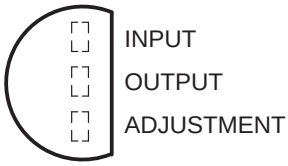
- **Output Voltage Range Adjustable From 1.2 V to 32 V When Used With an External Resistor Divider**
- **Output Current Capability of 100 mA**
- **Input Regulation Typically 0.01% Per Input-Voltage Change**
- **Output Regulation Typically 0.5%**
- **Ripple Rejection Typically 80 dB**
- **For Higher Output Current Requirements, See LM317M (500 mA) and LM317 (1.5 A)**

D OR PW PACKAGE
(TOP VIEW)



NC − No internal connection
OUTPUT terminals are all internally connected.

LP PACKAGE
(TOP VIEW)



description/ordering information

The LM317L is an adjustable three-terminal positive-voltage regulator capable of supplying 100 mA over an output-voltage range of 1.2 V to 32 V. It is exceptionally easy to use and requires only two external resistors to set the output voltage.

In addition to higher performance than fixed regulators, this regulator offers full overload protection, available only in integrated circuits. Included on the chip are current-limiting and thermal-overload protection. All overload-protection circuitry remains fully functional, even when ADJUSTMENT is disconnected. Normally, no capacitors are needed unless the device is situated far from the input filter capacitors, in which case an input bypass is needed. An optional output capacitor can be added to improve transient response. ADJUSTMENT can be bypassed to achieve very high ripple rejection, which is difficult to achieve with standard three-terminal regulators.

In addition to replacing fixed regulators, the LM317L regulator is useful in a wide variety of other applications. Since the regulator is floating and sees only the input-to-output differential voltage, supplies of several hundred volts can be regulated as long as the maximum input-to-output differential is not exceeded. Its primary application is that of a programmable output regulator, but by connecting a fixed resistor between ADJUSTMENT and OUTPUT, this device can be used as a precision current regulator. Supplies with electronic shutdown can be achieved by clamping ADJUSTMENT to ground, programming the output to 1.2 V, where most loads draw little current.

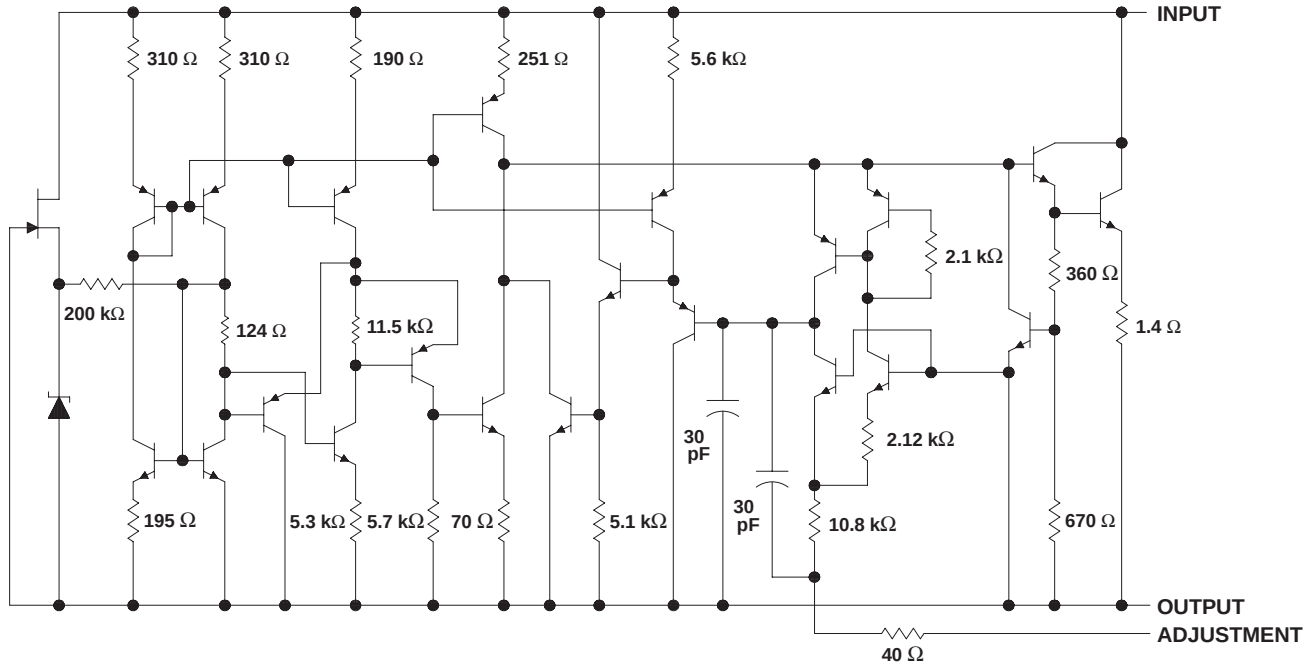
The LM317LC is characterized for operation over the virtual junction temperature range of 0°C to 125°C.

ORDERING INFORMATION

T_J	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 125°C	SOIC (D)	Tube of 75	LM317LCD	L317LC
		Reel of 2500	LM317LCDR	
	TO-226 / TO-92 (LP)	Bulk of 1000	LM317LCLP	L317LC
		Reel of 2000	LM317LCLPR	
	TSSOP (PW)	Tube of 150	LM317LCPW	L317LC
		Reel of 2000	LM317LCPWR	

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

schematic



NOTE A: All component values shown are nominal.

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

Input-to-output differential voltage, $V_I - V_O$ . . . . . 35 V
Package thermal impedance, θ_{JA} (see Notes 1 and 2): D package . . . . . 97°C/W
LP package . . . . . 140°C/W
PW package . . . . . 149°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 affect reliability.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

			MIN	MAX	UNIT
$V_I - V_O$	Input-to-output voltage differential			35	V
I_O	Output current		2.5	100	mA
T_J	Operating virtual-junction temperature	LM317LC	0	125	°C

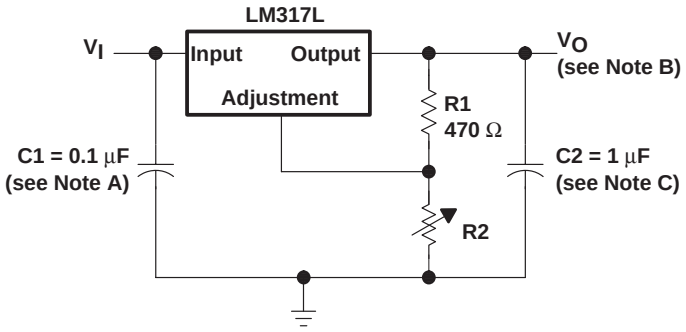
electrical characteristics over recommended operating virtual-junction temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†		LM317LC			UNIT
			MIN	TYP	MAX	
Input voltage regulation (see Note 3)	$V_I - V_O$ = 5 V to 35 V	T_J = 25°C		0.01	0.02	%V
		I_O = 2.5 mA to 100 mA		0.02	0.05	
Ripple regulation	V_O = 10 V,	f = 120 Hz		65		dB
	V_O = 10 V, 10-µF capacitor between ADJUSTMENT and ground		66	80		
Output voltage regulation	V_I = 5 V to 35 V, I_O = 2.5 mA to 100 mA, T_J = 25°C	$V_O \le$ 5 V		25		mV
		$V_O \ge$ 5 V		5		mV/V
	V_I = 5 V to 35 V, I_O = 2.5 mA to 100 mA	$V_O \le$ 5 V		50		mV
		$V_O \ge$ 5 V		10		mV/V
Output voltage change with temperature	T_J = 0°C to 125°C			10		mV/V
Output voltage long-term drift	After 1000 hours at T_J = 125°C and $V_I - V_O$ = 35 V			3	10	mV/V
Output noise voltage	f = 10 Hz to 10 kHz,	T_J = 25°C		30		µV/V
Minimum output current to maintain regulation	$V_I - V_O$ = 35 V			1.5	2.5	mA
Peak output current	$V_I - V_O \le$ 35 V		100	200		mA
ADJUSTMENT current				50	100	µA
Change in ADJUSTMENT current	$V_I - V_O$ = 2.5 V to 35 V,	I_O = 2.5 mA to 100 mA		0.2	5	µA
Reference voltage (output to ADJUSTMENT)	$V_I - V_O$ = 5 V to 35 V, P ≤ rated dissipation	I_O = 2.5 mA to 100 mA,	1.2	1.25	1.3	V

† Unless otherwise noted, these specifications apply for the following test conditions: $V_I - V_O$ = 5 V and I_O = 40 mA. Pulse-testing techniques must be used that maintain the junction temperature as close to the ambient temperature as possible. All characteristics are measured with a 0.1-µF capacitor across the input and a 1-µF capacitor across the output.

NOTE 3: Input voltage regulation is expressed here as the percentage change in output voltage per 1-V change at the input.

APPLICATION INFORMATION



NOTES: A. Use of an input bypass capacitor is recommended if regulator is far from the filter capacitors.

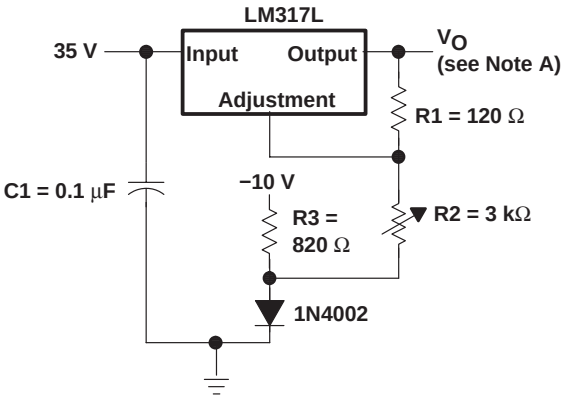
B. Output voltage is calculated from the equation:

$$V_O = V_{ref}\left(1 + \frac{R2}{R1}\right)$$

where: V_{ref} equals the difference between OUTPUT and ADJUSTMENT voltages (≈1.25 V).

C. Use of an output capacitor improves transient response, but is optional.

Figure 1. Adjustable Voltage Regulator

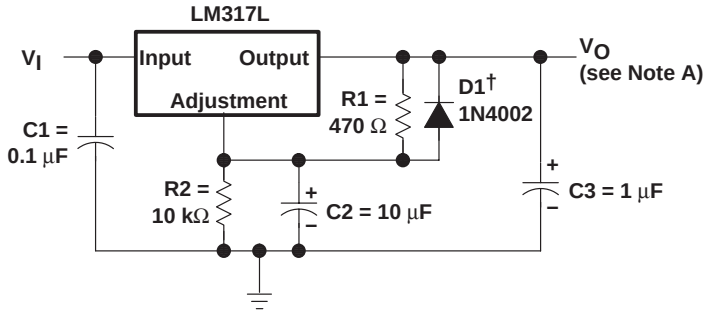


NOTE A: Output voltage is calculated from the equation:

$$V_O = V_{ref}\left(1 + \frac{R2 + R3}{R1}\right) - 10\ V$$

where: V_{ref} equals the difference between OUTPUT and ADJUSTMENT voltages (≈1.25 V).

Figure 2. 0-V to 30-V Regulator Circuit



† D1 discharges C2 if output is shorted to ground.

NOTE A: Use of an output capacitor improves transient response, but is optional.

Figure 3. Regulator Circuit With Improved Ripple Rejection

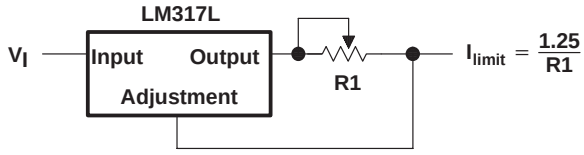


Figure 4. Precision Current-Limiter Circuit

APPLICATION INFORMATION

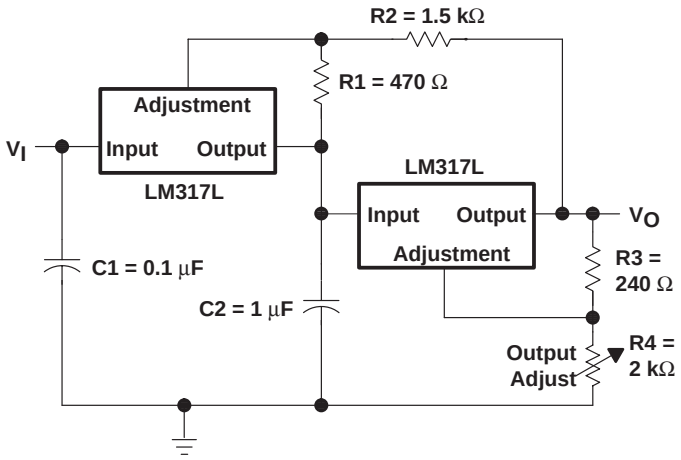


Figure 5. Tracking Preregulator Circuit

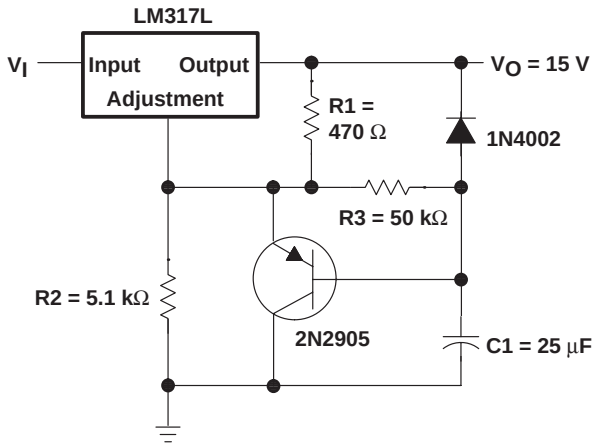


Figure 6. Slow-Turnon 15-V Regulator Circuit

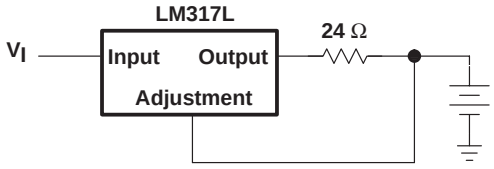


Figure 7. 50-mA Constant-Current Battery-Charger Circuit

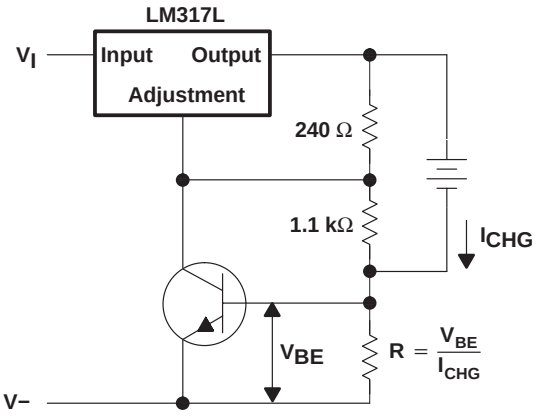
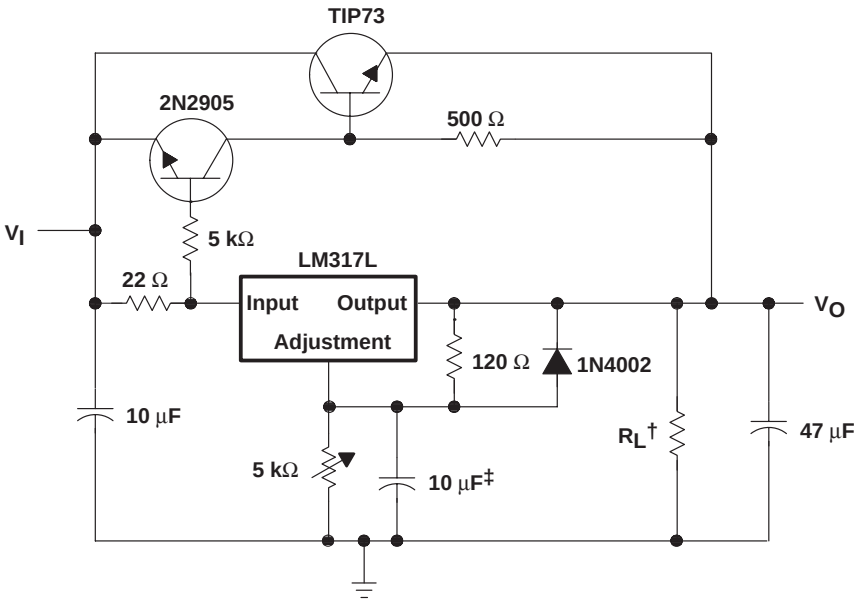


Figure 8. Current-Limited 6-V Charger

APPLICATION INFORMATION



† Minimum load current is 30 mA.
‡ Optional capacitor improves ripple rejection.

Figure 9. High-Current Adjustable Regulator

PACKAGING INFORMATION

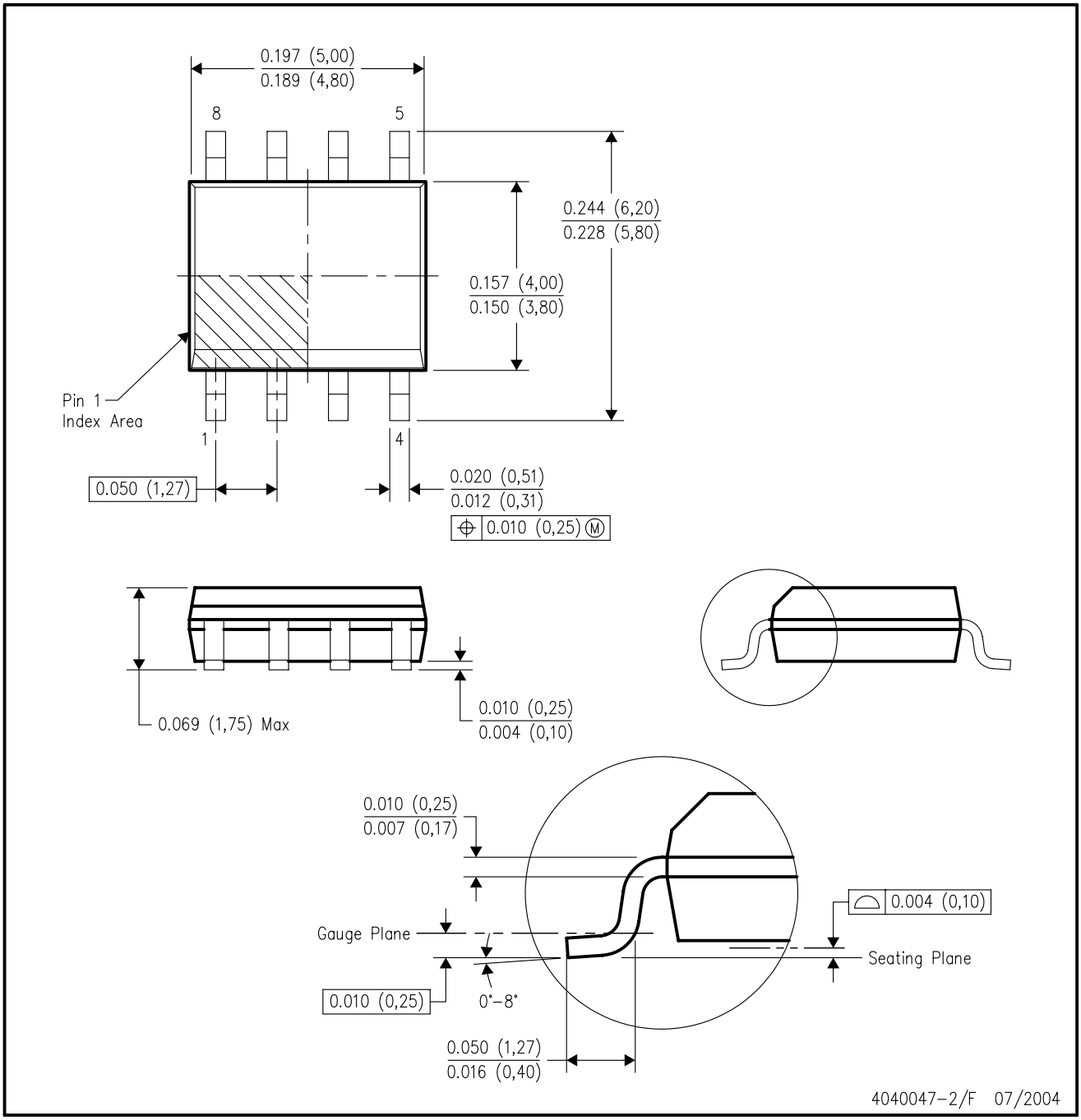
Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
LM317LCD	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM317LCDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LM317LCLP	ACTIVE	TO-92	LP	3	1000	None	CU SNPB	Level-NC-NC-NC
LM317LCLPR	ACTIVE	TO-92	LP	3	2000	None	CU SNPB	Level-NC-NC-NC
LM317LCPW	ACTIVE	TSSOP	PW	8	150	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LM317LCPWR	ACTIVE	TSSOP	PW	8	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM

[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 - May not be currently available - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
None: Not yet available Lead (Pb-Free).
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.
Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDECindustry standard classifications, and peak solder temperature.

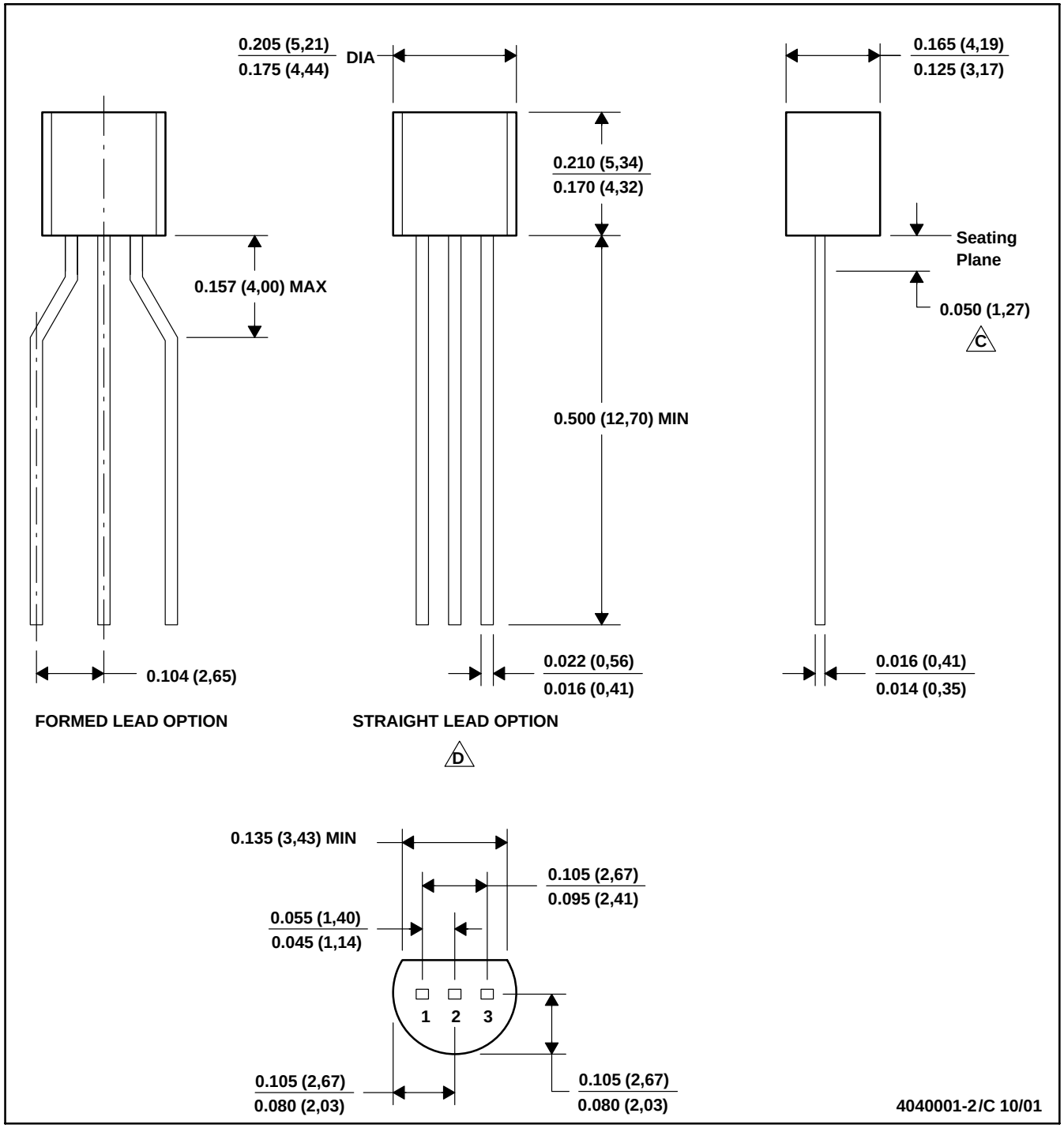
D (R–PDSO–G8) PLASTIC SMALL–OUTLINE PACKAGE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS–012 variation AA.

MSOT002A – OCTOBER 1994 – REVISED NOVEMBER 2001

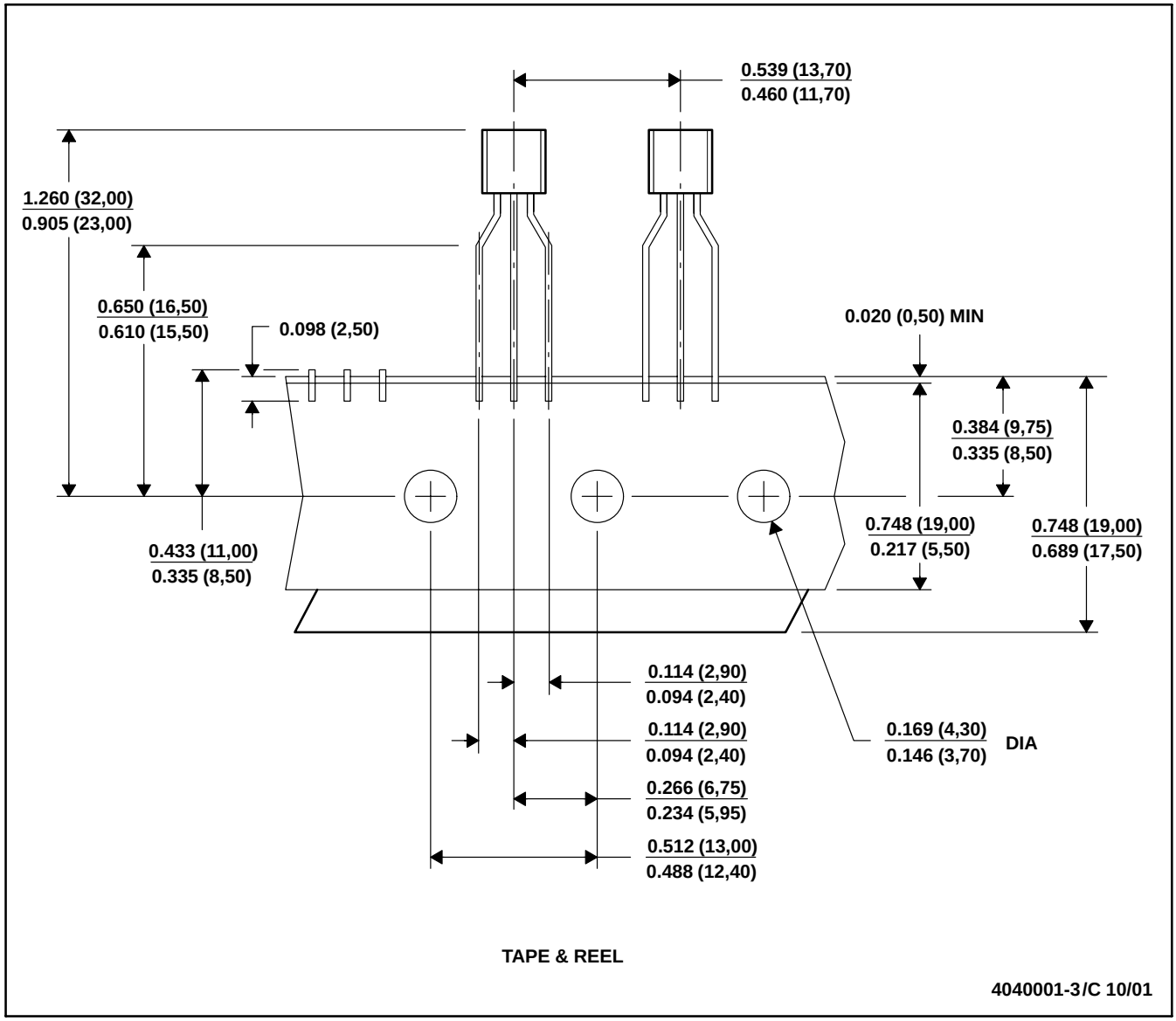
LP (O-PBCY-W3) **PLASTIC CYLINDRICAL PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. 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 bulk pack only.
Formed lead option available in tape & reel or ammo pack.

MECHANICAL DATA

LP (O-PBCY-W3) **PLASTIC CYLINDRICAL PACKAGE**

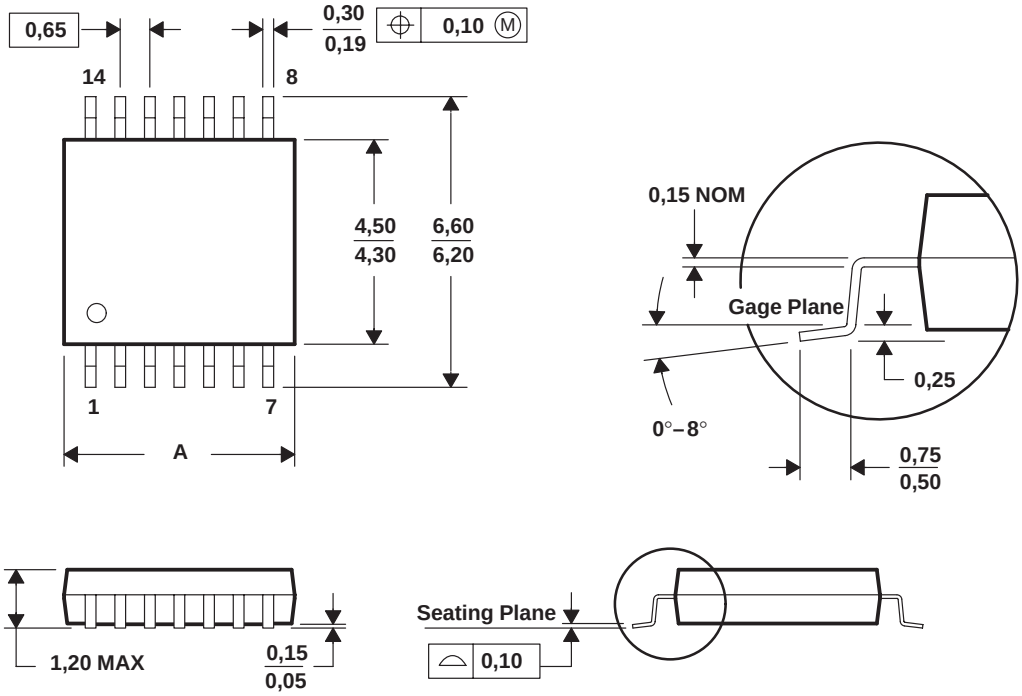


NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Tape and Reel information for the Format Lead Option package.

MTSS001C – JANUARY 1995 – REVISED FEBRUARY 1999

PW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN



DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

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