

# $\mu$ A78L00 SERIES POSITIVE-VOLTAGE REGULATORS

SLVS010S – JANUARY 1976 – REVISED FEBRUARY 2004

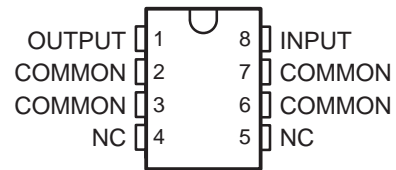
- 3-Terminal Regulators
- Output Current Up To 100 mA
- No External Components
- Internal Thermal-Overload Protection
- Internal Short-Circuit Current Limiting

## description/ordering information

This series of fixed-voltage integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. In addition, they can be used with power-pass elements to make high-current voltage regulators. One of these regulators can deliver up to 100 mA of output current. The internal limiting and thermal-shutdown features of these regulators essentially make them immune to overload. When used as a replacement for a Zener diode-resistor combination, an effective improvement in output impedance can be obtained, together with lower bias current.

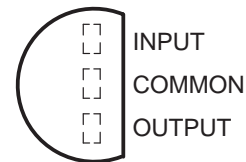
The  $\mu$ A78L00C and  $\mu$ A78L00AC series are characterized for operation over the virtual junction temperature range of 0°C to 125°C. The  $\mu$ A78L05AI is characterized for operation over the virtual junction temperature range of -40°C to 125°C.

**D PACKAGE  
(TOP VIEW)**

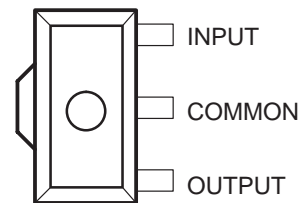


NC – No internal connection

**LP PACKAGE  
(TO-92, TO-226AA)  
(TOP VIEW)**



**PK PACKAGE  
(TOP VIEW)**



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.

 **TEXAS  
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2004, Texas Instruments Incorporated

# μA78L00 SERIES POSITIVE-VOLTAGE REGULATORS

SLVS010S – JANUARY 1976 – REVISED FEBRUARY 2004

## description/ordering information (continued)

### ORDERING INFORMATION

T <sub>J</sub>	V <sub>O(NOM)</sub> (V)	OUTPUT VOLTAGE TOLERANCE	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 125°C	2.6 V	5%	SOIC (D)	Tube of 75	μA78L02ACD	78L02A
			TO-226/TO-92 (LP)	Bulk of 1000	μA78L02ACL P	78L02AC
	5 V	5%	SOIC (D)	Tube of 75	μA78L05ACD	78L05A
				Reel of 2500	μA78L05ACDR	
			SOT-89 (PK)	Reel of 1000	μA78L05ACPK	F5
			TO-92 (LP) TO-226AA (LP)	Bulk of 1000	μA78L05ACL P	78L05AC
		Pack of 2000		μA78L05ACL PM		
		10%	SOIC (D)	Tube of 75	μA78L05CD	78L05C
				Reel of 2500	μA78L05CDR	
			SOT-89 (PK)	Tube of	μA78L05CPK	B5
	TO-92 (LP) TO-226AA (LP)		Bulk of 1000	μA78L05CL P	78L05C	
		Reel of 2000	μA78L05CL PR			
	6.2 V	5%	SOT-89 (PK)	Reel of 1000	μA78L06ACPK	F6
			TO-92 (LP) TO-226AA (LP)	Bulk of 1000	μA78L06ACL P	78L06AC
	Reel of 2000	μA78L06ACL PR				
	8 V	5%	SOIC (D)	Tube of 75	μA78L08ACD	78L08A
				Reel of 2500	μA78L08ACDR	78L08A
			SOT-89 (PK)	Reel of 1000	μA78L08ACPK	F8
			TO-92 (LP) TO-226AA (LP)	Bulk of 1000	μA78L08ACL P	78L08AC
		Reel of 2000		μA78L08ACL PR		
		10%	SOIC (D)	Tube of 75	μA78L08CD	78L08C
	Reel of 2500			μA78L08CDR		
	9 V	5%	SOIC (D)	Tube of 75	μA78L09ACD	78L09A
				Reel of 2500	μA78L09ACDR	
			SOT-89 (PK)	Reel of 1000	μA78L09ACPK	F9
			TO-92 (LP) TO-226AA (LP)	Bulk of 1000	μA78L09ACL P	78L09AC
	Reel of 2000	μA78L09ACL PR				
	10 V	5%	SOIC (D)	Tube of 75	μA78L10ACD	78L10A
				Reel of 2500	μA78L10ACDR	
			SOT-89 (PK)	Reel of 1000	μA78L10ACPK	FA
TO-92 (LP) TO-226AA (LP)			Bulk of 1000	μA78L10ACL P	78L10AC	
	Reel of 2000	μA78L10ACL PR				
12 V	5%	SOIC (D)	Tube of 75	μA78L12ACD	78L12A	
			Reel of 2500	μA78L12ACDR		
		SOT-89 (PK)	Reel of 1000	μA78L12ACPK	FC	
		TO-92 (LP) TO-226AA (LP)	Bulk of 1000	μA78L12ACL P	78L12AC	
			Pack of 2000	μA78L12ACL PM		
Reel of 2000	μA78L12ACL PR					

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



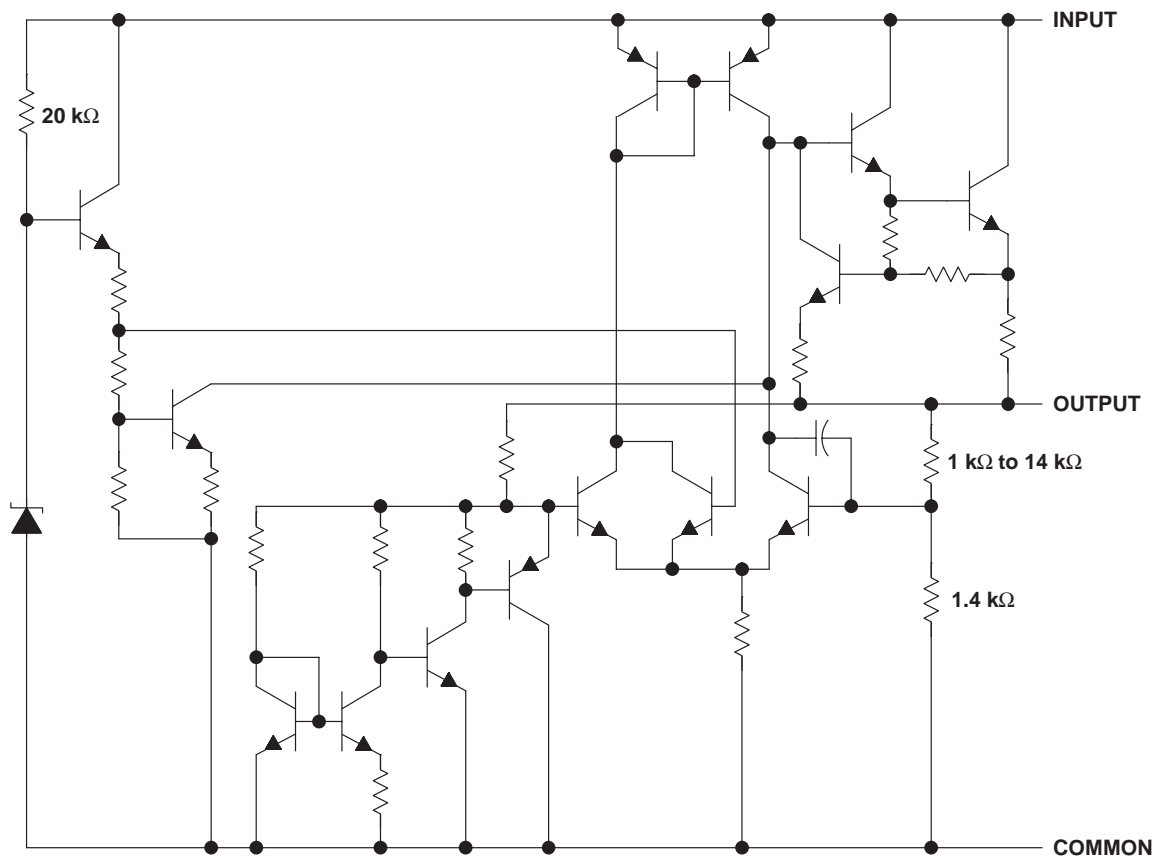
**description/ordering information (continued)**

**ORDERING INFORMATION (continued)**

T <sub>J</sub>	V <sub>O(NOM)</sub> (V)	OUTPUT VOLTAGE TOLERANCE	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 125°C	15 V	5%	SOIC (D)	Tube of 75	μA78L15ACD	78L15A
				Reel of 2500	μA78L15ACDR	
			SOT-89 (PK)	Reel of 1000	μA78L15ACPK	FF
			TO-92 (LP) TO-226AA (LP)	Bulk of 1000 Reel of 2000	μA78L15ACL μA78L15ACLPR	78L15AC
-40°C to 125°C	5 V	5%	SOIC (D)	Tube of 75	μA78L05AID	78L15AI
				Reel of 2500	μA78L05AIDR	
			SOT-89 (PK)	Reel of 1000	μA78L05AIPK	J5
			TO-92 (LP) TO-226AA (LP)	Bulk of 1000 Reel of 2000	μA78L05AIL μA78L05AILPR	78L05AI

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

**schematic**



NOTE A: Resistor values shown are nominal.

# μA78L00 SERIES POSITIVE-VOLTAGE REGULATORS

SLVS010S – JANUARY 1976 – REVISED FEBRUARY 2004

## absolute maximum ratings over virtual junction temperature range (unless otherwise noted)†

Input voltage, $V_I$ : μA78L02AC, μA78L05C–μA78L09C, μA78L10AC	30 V
μA78L12C, μA78L12AC, μA78L15C, μA78L15AC	35 V
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.

## package thermal data (see Note 1)

PACKAGE	BOARD	$\theta_{JC}$	$\theta_{JA}$
SOIC (D)	High K, JESD 51-7	39°C/W	97°C/W
TO-92/TO-226AA (LP)	High K, JESD 51-7	55°C/W	140°C/W
SOT-89 (PK)	High K, JESD 51-7	9°C/W	52°C/W

NOTE 1: Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$ , 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. Due to variations in individual device electrical characteristics and thermal resistance, the built-in thermal-overload protection may be activated at power levels slightly above or below the rated dissipation.

## recommended operating conditions

		MIN	MAX	UNIT	
$V_I$	Input voltage	μA78L02AC	4.75	20	V
		μA78L05C, μA78L05AC	7	20	
		μA78L06C, μA78L06AC	8.5	20	
		μA78L08C, μA78L08AC	10.5	23	
		μA78L09C, μA78L09AC	11.5	24	
		μA78L10AC	12.5	25	
		μA78L12C, μA78L12AC	14.5	27	
	μA78L15C, μA78L15AC	17.5	30		
$I_O$	Output current		100	mA	
$T_J$	Operating virtual junction temperature range	μA78LxxC and μA78LxxAC series	0	125	°C
		μA78L05AI	–40	125	



# μA78L00 SERIES POSITIVE-VOLTAGE REGULATORS

SLVS010S – JANUARY 1976 – REVISED FEBRUARY 2004

**electrical characteristics at specified virtual junction temperature,  $V_I = 9\text{ V}$ ,  $I_O = 40\text{ mA}$  (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	$T_J$ †	μA78L02AC			UNIT
			MIN	TYP	MAX	
Output voltage	$V_I = 4.75\text{ V to }20\text{ V}$ , $I_O = 1\text{ mA to }40\text{ mA}$	25°C	2.5	2.6	2.7	V
		0°C to 125°C	2.45		2.75	
	$I_O = 1\text{ mA to }70\text{ mA}$	0°C to 125°C	2.45		2.75	
Input voltage regulation	$V_I = 4.75\text{ V to }20\text{ V}$	25°C		20	100	mV
	$V_I = 5\text{ V to }20\text{ V}$			16	75	
Ripple rejection	$V_I = 6\text{ V to }20\text{ V}$ , $f = 120\text{ Hz}$	25°C	43	51		dB
Output voltage regulation	$I_O = 1\text{ mA to }100\text{ mA}$	25°C		12	50	mV
	$I_O = 1\text{ mA to }40\text{ mA}$			6	25	
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$	25°C		30		μV
Dropout voltage		25°C		1.7		V
Bias current		25°C		3.6	6	mA
		125°C			5.5	
Bias current change	$V_I = 5\text{ V to }20\text{ V}$	0°C to 125°C			2.5	mA
	$I_O = 1\text{ mA to }40\text{ mA}$				0.1	

† Pulse-testing techniques maintain  $T_J$  as close to  $T_A$  as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output.

**electrical characteristics at specified virtual junction temperature,  $V_I = 10\text{ V}$ ,  $I_O = 40\text{ mA}$  (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	$T_J$ ‡	μA78L05C			μA78L05AC μA78L05AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage	$V_I = 7\text{ V to }20\text{ V}$ , $I_O = 1\text{ mA to }40\text{ mA}$	25°C	4.6	5	5.4	4.8	5	5.2	V
		Full range	4.5		5.5	4.75		5.25	
	$I_O = 1\text{ mA to }70\text{ mA}$	Full range	4.5		5.5	4.75		5.25	
Input voltage regulation	$V_I = 7\text{ V to }20\text{ V}$	25°C		32	200		32	150	mV
	$V_I = 8\text{ V to }20\text{ V}$			26	150		26	100	
Ripple rejection	$V_I = 8\text{ V to }18\text{ V}$ , $f = 120\text{ Hz}$	25°C	40	49		41	49		dB
Output voltage regulation	$I_O = 1\text{ mA to }100\text{ mA}$	25°C		15	60		15	60	mV
	$I_O = 1\text{ mA to }40\text{ mA}$			8	30		8	30	
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$	25°C		42		42			μV
Dropout voltage		25°C		1.7		1.7			V
Bias current		25°C		3.8	6		3.8	6	mA
		125°C			5.5			5.5	
Bias current change	$V_I = 8\text{ V to }20\text{ V}$	Full range			1.5			1.5	mA
	$I_O = 1\text{ mA to }40\text{ mA}$				0.2			0.1	

‡ Pulse-testing techniques maintain  $T_J$  as close to  $T_A$  as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output. Full range for the μA78L05AC is  $T_J = 0^\circ\text{C to }125^\circ\text{C}$ , and full range for the μA78L05AI is  $T_J = -40^\circ\text{C to }125^\circ\text{C}$ .



# μA78L00 SERIES POSITIVE-VOLTAGE REGULATORS

SLVS010S – JANUARY 1976 – REVISED FEBRUARY 2004

electrical characteristics at specified virtual junction temperature,  $V_I = 12\text{ V}$ ,  $I_O = 40\text{ mA}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_J$ †	μA78L06C			μA78L06AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage	$V_I = 8.5\text{ V to }20\text{ V}$ , $I_O = 1\text{ mA to }40\text{ mA}$	25°C	5.7	6.2	6.7	5.95	6.2	6.45	V
		0°C to 125°C	5.6		6.8	5.9		6.5	
	$I_O = 1\text{ mA to }70\text{ mA}$	0°C to 125°C	5.6		6.8	5.9		6.5	
Input voltage regulation	$V_I = 8.5\text{ V to }20\text{ V}$	25°C	35		200	35		175	mV
	$V_I = 9\text{ V to }20\text{ V}$		29		150	29		125	
Ripple rejection	$V_I = 10\text{ V to }20\text{ V}$ , $f = 120\text{ Hz}$	25°C	39	48		40	48	dB	
Output voltage regulation	$I_O = 1\text{ mA to }100\text{ mA}$	25°C	16		80	16		80	mV
	$I_O = 1\text{ mA to }40\text{ mA}$		9		40	9		40	
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$	25°C	46			46			μV
Dropout voltage		25°C	1.7			1.7			V
Bias current		25°C	3.9		6	3.9		6	mA
		125°C			5.5	5.5			
Bias current change	$V_I = 9\text{ V to }20\text{ V}$	0°C to 125°C			1.5	1.5		mA	
	$I_O = 1\text{ mA to }40\text{ mA}$				0.2	0.1			

† Pulse-testing techniques maintain  $T_J$  as close to  $T_A$  as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output.

electrical characteristics at specified virtual junction temperature,  $V_I = 14\text{ V}$ ,  $I_O = 40\text{ mA}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_J$ †	μA78L08C			μA78L08AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage	$V_I = 10.5\text{ V to }23\text{ V}$ , $I_O = 1\text{ mA to }40\text{ mA}$	25°C	7.36	8	8.64	7.7	8	8.3	V
		0°C to 125°C	7.2		8.8	7.6		8.4	
	$I_O = 1\text{ mA to }70\text{ mA}$	0°C to 125°C	7.2		8.8	7.6		8.4	
Input voltage regulation	$V_I = 10.5\text{ V to }23\text{ V}$	25°C	42		200	42		175	mV
	$V_I = 11\text{ V to }23\text{ V}$		36		150	36		125	
Ripple rejection	$V_I = 13\text{ V to }23\text{ V}$ , $f = 120\text{ Hz}$	25°C	36	46		37	46	dB	
Output voltage regulation	$I_O = 1\text{ mA to }100\text{ mA}$	25°C	18		80	18		80	mV
	$I_O = 1\text{ mA to }40\text{ mA}$		10		40	10		40	
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$	25°C	54			54			μV
Dropout voltage		25°C	1.7			1.7			V
Bias current		25°C	4		6	4		6	mA
		125°C			5.5	5.5			
Bias current change	$V_I = 11\text{ V to }23\text{ V}$	0°C to 125°C			1.5	1.5		mA	
	$I_O = 1\text{ mA to }40\text{ mA}$				0.2	0.1			

† Pulse-testing techniques maintain  $T_J$  as close to  $T_A$  as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output.



# μA78L00 SERIES POSITIVE-VOLTAGE REGULATORS

SLVS010S – JANUARY 1976 – REVISED FEBRUARY 2004

**electrical characteristics at specified virtual junction temperature,  $V_I = 16\text{ V}$ ,  $I_O = 40\text{ mA}$  (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	$T_J$ †	μA78L09C			μA78L09AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage	$V_I = 12\text{ V to }24\text{ V}$ , $I_O = 1\text{ mA to }40\text{ mA}$	25°C	8.3	9	9.7	8.6	9	9.4	V
		0°C to 125°C	8.1		9.9	8.55		9.45	
	$I_O = 1\text{ mA to }70\text{ mA}$	0°C to 125°C	8.1		9.9	8.55		9.45	
Input voltage regulation	$V_I = 12\text{ V to }24\text{ V}$	25°C		45	225		45	175	mV
	$V_I = 13\text{ V to }24\text{ V}$			40	175		40	125	
Ripple rejection	$V_I = 15\text{ V to }25\text{ V}$ , $f = 120\text{ Hz}$	25°C	36	45		38	45		dB
Output voltage regulation	$I_O = 1\text{ mA to }100\text{ mA}$	25°C		19	90		19	90	mV
	$I_O = 1\text{ mA to }40\text{ mA}$			11	40		11	40	
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$	25°C		58		58			μV
Dropout voltage		25°C		1.7		1.7			V
Bias current		25°C		4.1	6		4.1	6	mA
		125°C			5.5			5.5	
Bias current change	$V_I = 13\text{ V to }24\text{ V}$	0°C to 125°C			1.5			1.5	mA
	$I_O = 1\text{ mA to }40\text{ mA}$				0.2			0.1	

† Pulse-testing techniques maintain  $T_J$  as close to  $T_A$  as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output.

**electrical characteristics at specified virtual junction temperature,  $V_I = 14\text{ V}$ ,  $I_O = 40\text{ mA}$  (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	$T_J$ †	μA78L10AC			UNIT
			MIN	TYP	MAX	
Output voltage	$V_I = 13\text{ V to }25\text{ V}$ , $I_O = 1\text{ mA to }40\text{ mA}$	25°C	9.6	10	10.4	V
		0°C to 125°C	9.5		10.5	
	$I_O = 1\text{ mA to }70\text{ mA}$	0°C to 125°C	9.5		10.5	
Input voltage regulation	$V_I = 13\text{ V to }25\text{ V}$	25°C		51	175	mV
	$V_I = 14\text{ V to }25\text{ V}$			42	125	
Ripple rejection	$V_I = 15\text{ V to }25\text{ V}$ , $f = 120\text{ Hz}$	25°C	37	44		dB
Output voltage regulation	$I_O = 1\text{ mA to }100\text{ mA}$	25°C		20	90	mV
	$I_O = 1\text{ mA to }40\text{ mA}$			11	40	
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$	25°C		62		μV
Dropout voltage		25°C		1.7		V
Bias current		25°C		4.2	6	mA
		125°C			5.5	
Bias current change	$V_I = 14\text{ V to }25\text{ V}$	0°C to 125°C			1.5	mA
	$I_O = 1\text{ mA to }40\text{ mA}$				0.1	

† Pulse-testing techniques maintain  $T_J$  as close to  $T_A$  as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output.



# μA78L00 SERIES POSITIVE-VOLTAGE REGULATORS

SLVS010S – JANUARY 1976 – REVISED FEBRUARY 2004

electrical characteristics at specified virtual junction temperature,  $V_I = 19\text{ V}$ ,  $I_O = 40\text{ mA}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_J$ †	μA78L12C			μA78L12AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage	$V_I = 14\text{ V to }27\text{ V}$ , $I_O = 1\text{ mA to }40\text{ mA}$	25°C	11.1	12	12.9	11.5	12	12.5	V
		0°C to 125°C	10.8		13.2	11.4		12.6	
	$I_O = 1\text{ mA to }70\text{ mA}$	0°C to 125°C	10.8		13.2	11.4		12.6	
Input voltage regulation	$V_I = 14.5\text{ V to }27\text{ V}$	25°C		55	250		55	250	mV
	$V_I = 16\text{ V to }27\text{ V}$			49	200		49	200	
Ripple rejection	$V_I = 15\text{ V to }25\text{ V}$ , $f = 120\text{ Hz}$	25°C	36	42		37	42	dB	
Output voltage regulation	$I_O = 1\text{ mA to }100\text{ mA}$	25°C		22	100		22	100	mV
	$I_O = 1\text{ mA to }40\text{ mA}$			13	50		13	50	
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$	25°C		70		70		μV	
Dropout voltage		25°C		1.7		1.7		V	
Bias current		25°C		4.3	6.5		4.3	6.5	mA
		125°C			6			6	
Bias current change	$V_I = 16\text{ V to }27\text{ V}$	0°C to 125°C			1.5			1.5	mA
	$I_O = 1\text{ mA to }40\text{ mA}$				0.2			0.1	

† Pulse-testing techniques maintain  $T_J$  as close to  $T_A$  as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output.

electrical characteristics at specified virtual junction temperature,  $V_I = 23\text{ V}$ ,  $I_O = 40\text{ mA}$  (unless otherwise noted)

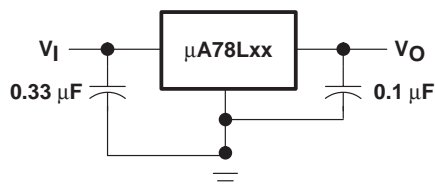
PARAMETER	TEST CONDITIONS	$T_J$ †	μA78L15C			μA78L15AC			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage	$V_I = 17.5\text{ V to }30\text{ V}$ , $I_O = 1\text{ mA to }40\text{ mA}$	25°C	13.8	15	16.2	14.4	15	15.6	V
		0°C to 125°C	13.5		16.5	14.25		15.75	
	$I_O = 1\text{ mA to }70\text{ mA}$	0°C to 125°C	13.5		16.5	14.25		15.75	
Input voltage regulation	$V_I = 17.5\text{ V to }30\text{ V}$	25°C		65	300		65	300	mV
	$V_I = 20\text{ V to }30\text{ V}$			58	250		58	250	
Ripple rejection	$V_I = 18.5\text{ V to }28.5\text{ V}$ , $f = 120\text{ Hz}$	25°C	33	39		34	39	dB	
Output voltage regulation	$I_O = 1\text{ mA to }100\text{ mA}$	25°C		25	150		25	150	mV
	$I_O = 1\text{ mA to }40\text{ mA}$			15	75		15	75	
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$	25°C		82		82		μV	
Dropout voltage		25°C		1.7		1.7		V	
Bias current		25°C		4.6	6.5		4.6	6.5	mA
		125°C			6			6	
Bias current change	$V_I = 10\text{ V to }30\text{ V}$	0°C to 125°C			1.5			1.5	mA
	$I_O = 1\text{ mA to }40\text{ mA}$				0.2			0.1	

† Pulse-testing techniques maintain  $T_J$  as close to  $T_A$  as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output.

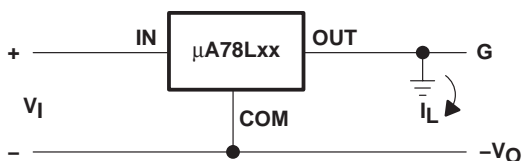




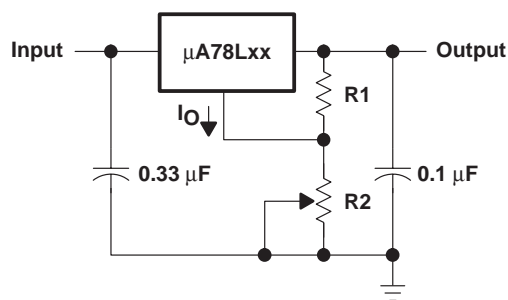
**APPLICATION INFORMATION**



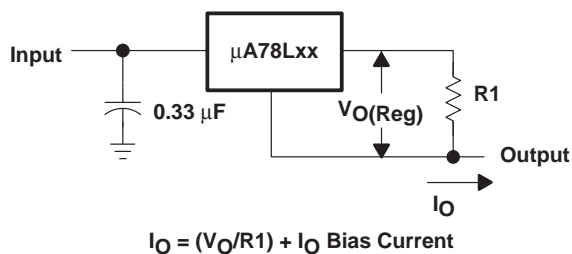
**Figure 1. Fixed-Output Regulator**



**Figure 2. Positive Regulator in Negative Configuration ( $V_I$  Must Float)**

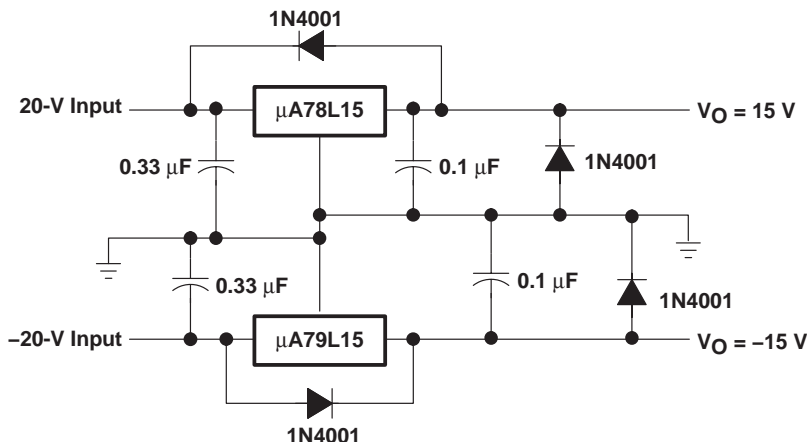


**Figure 3. Adjustable-Output Regulator**



**Figure 4. Current Regulator**

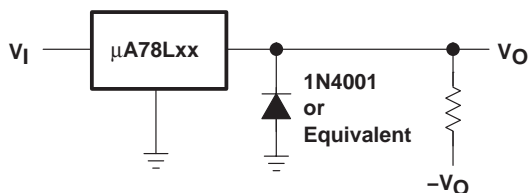
**APPLICATION INFORMATION**



**Figure 5. Regulated Dual Supply**

**operation with a load common to a voltage of opposite polarity**

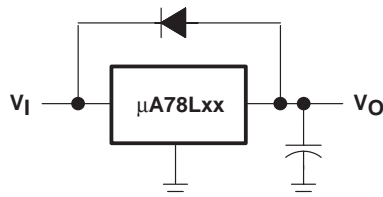
In many cases, a regulator powers a load that is not connected to ground, but instead, is connected to a voltage source of opposite polarity (e.g., operational amplifiers, level-shifting circuits, etc.). In these cases, a clamp diode should be connected to the regulator output as shown in Figure 6. This protects the regulator from output polarity reversals during startup and short-circuit operation.



**Figure 6. Output Polarity-Reversal-Protection Circuit**

**reverse-bias protection**

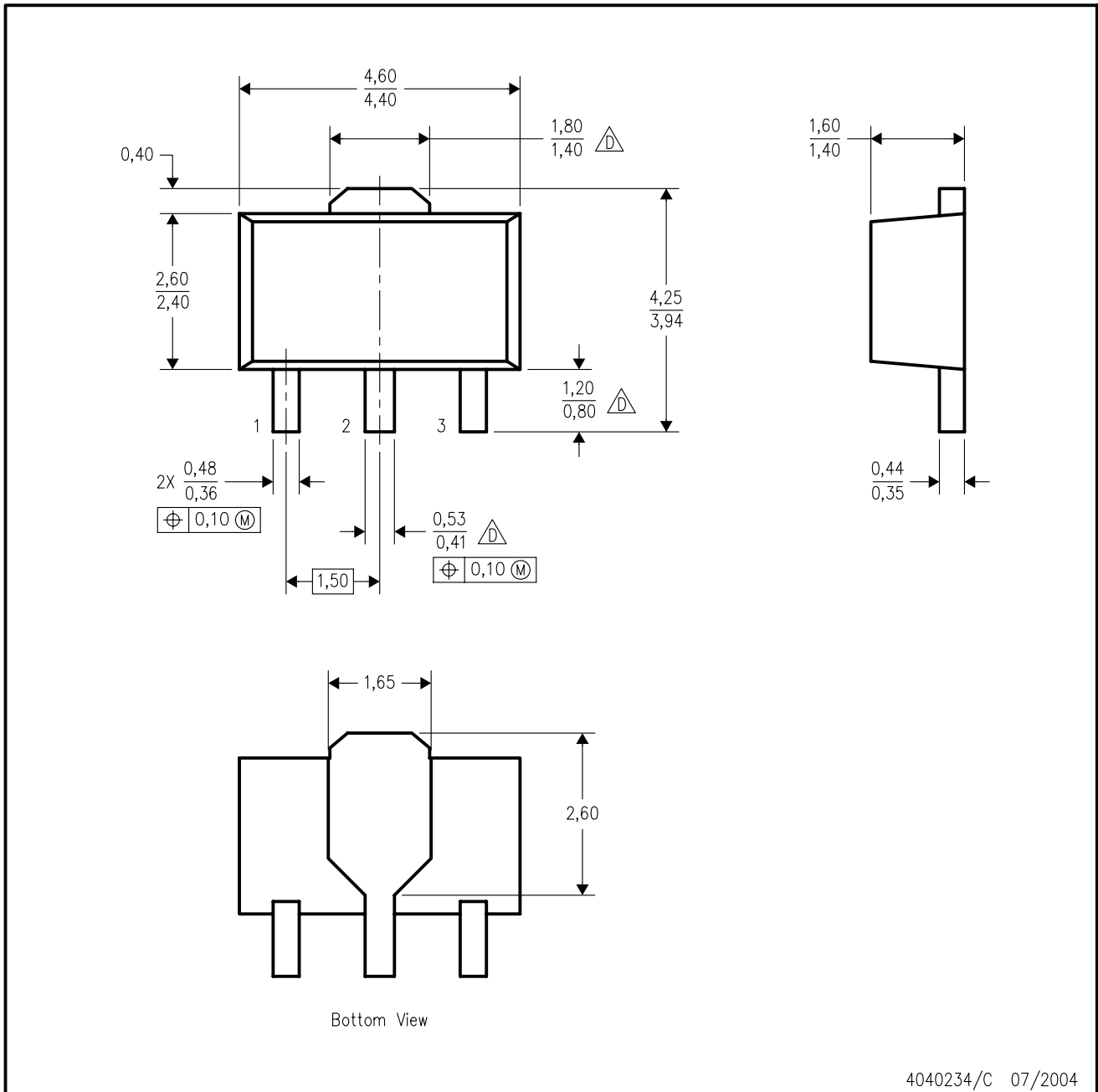
Occasionally, the input voltage to the regulator can collapse faster than the output voltage. This can occur, for example, when the input supply is crowbarred during an output overvoltage condition. If the output voltage is greater than approximately 7 V, the emitter-base junction of the series-pass element (internal or external) could break down and be damaged. To prevent this, a diode shunt can be employed as shown in Figure 7.



**Figure 7. Reverse-Bias-Protection Circuit**

PK (R-PSSO-F3)

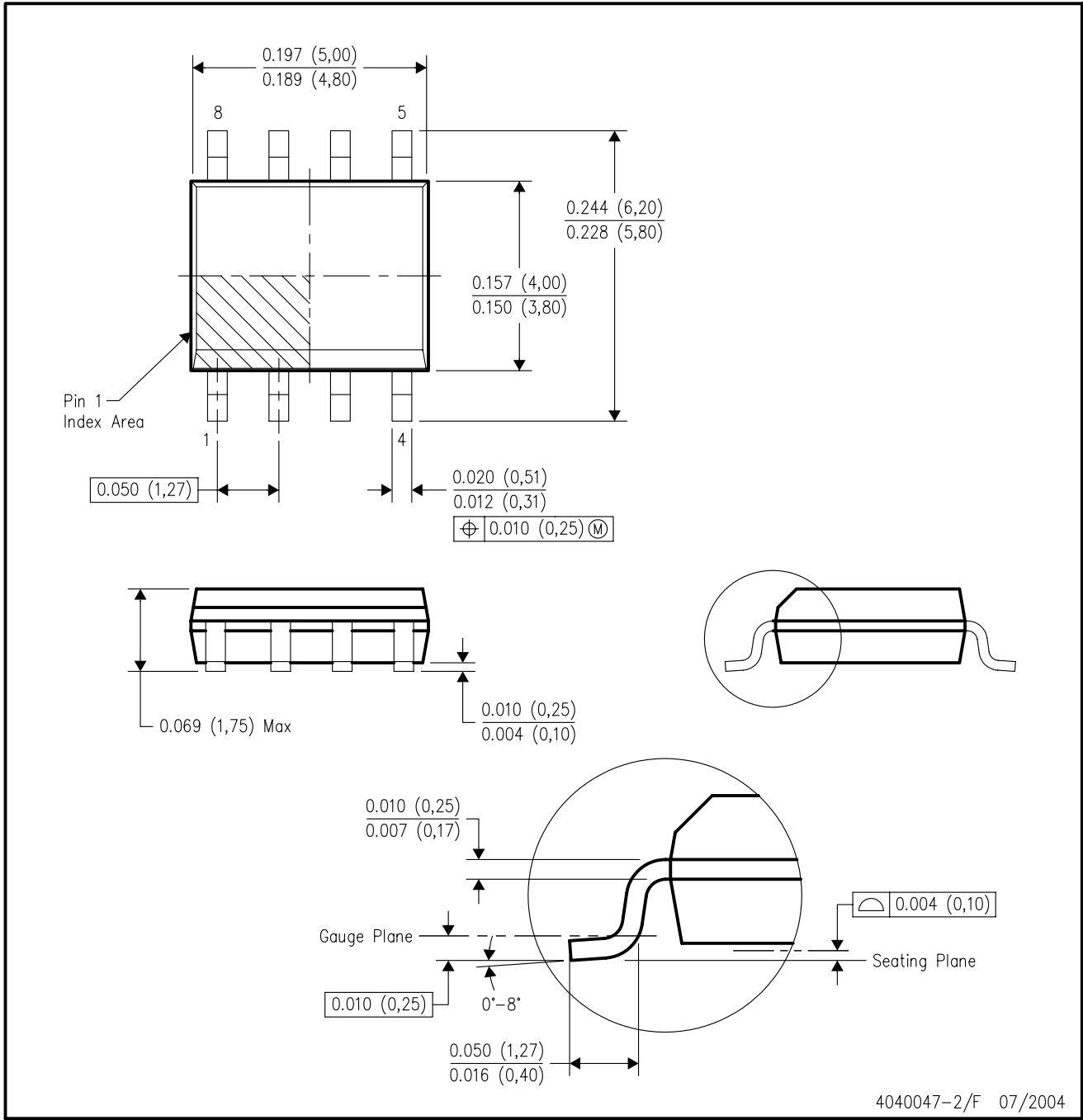
PLASTIC SINGLE-IN-LINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5-1994.
  - B. This drawing is subject to change without notice.
  - C. The center lead is in electrical contact with the tab.
- $\triangle D$  Falls within JEDEC TO-243 variation AA, except minimum lead length, pin 2 minimum lead width, and minimum tab width.

D (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE

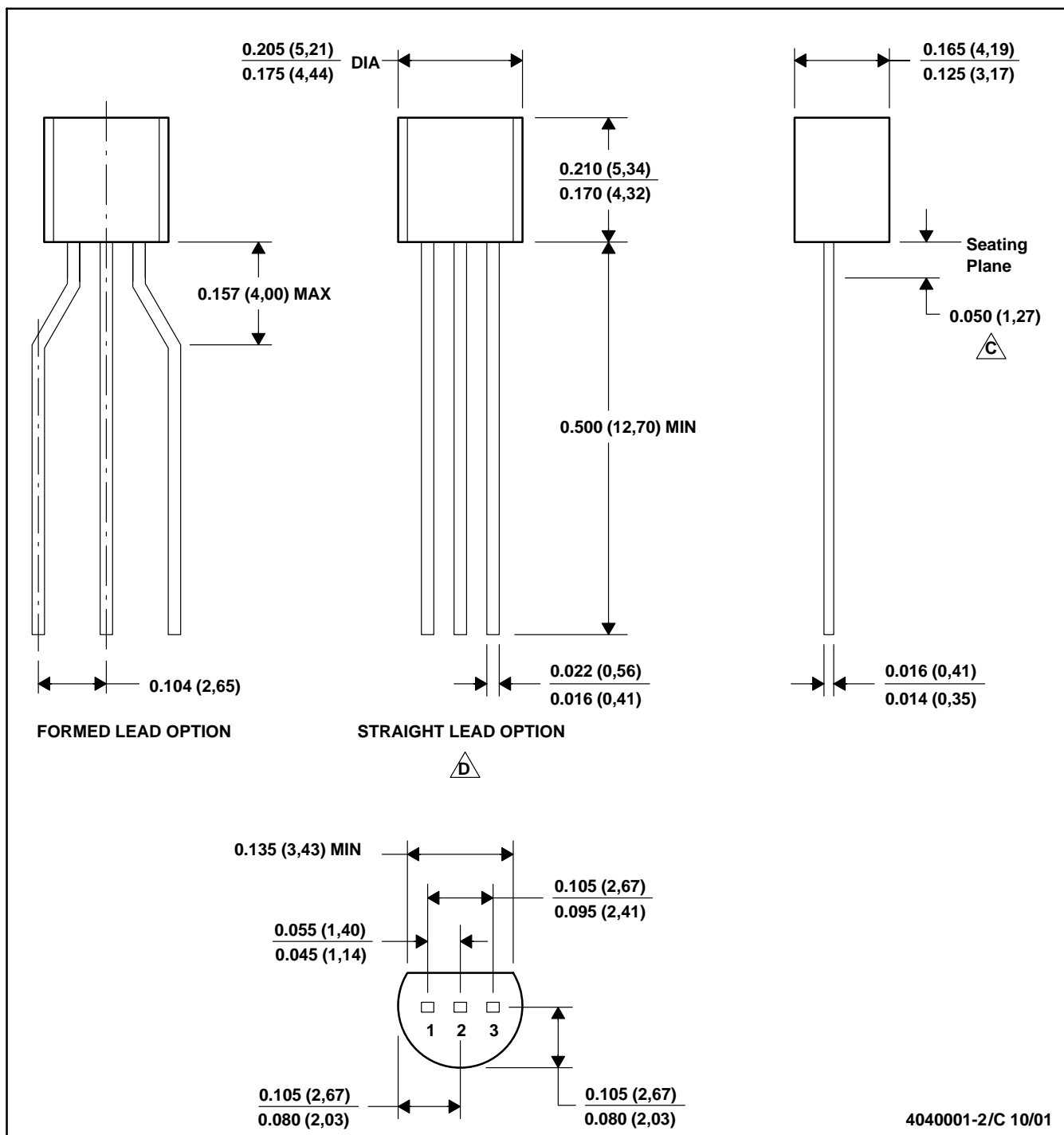


4040047-2/F 07/2004

- 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.

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



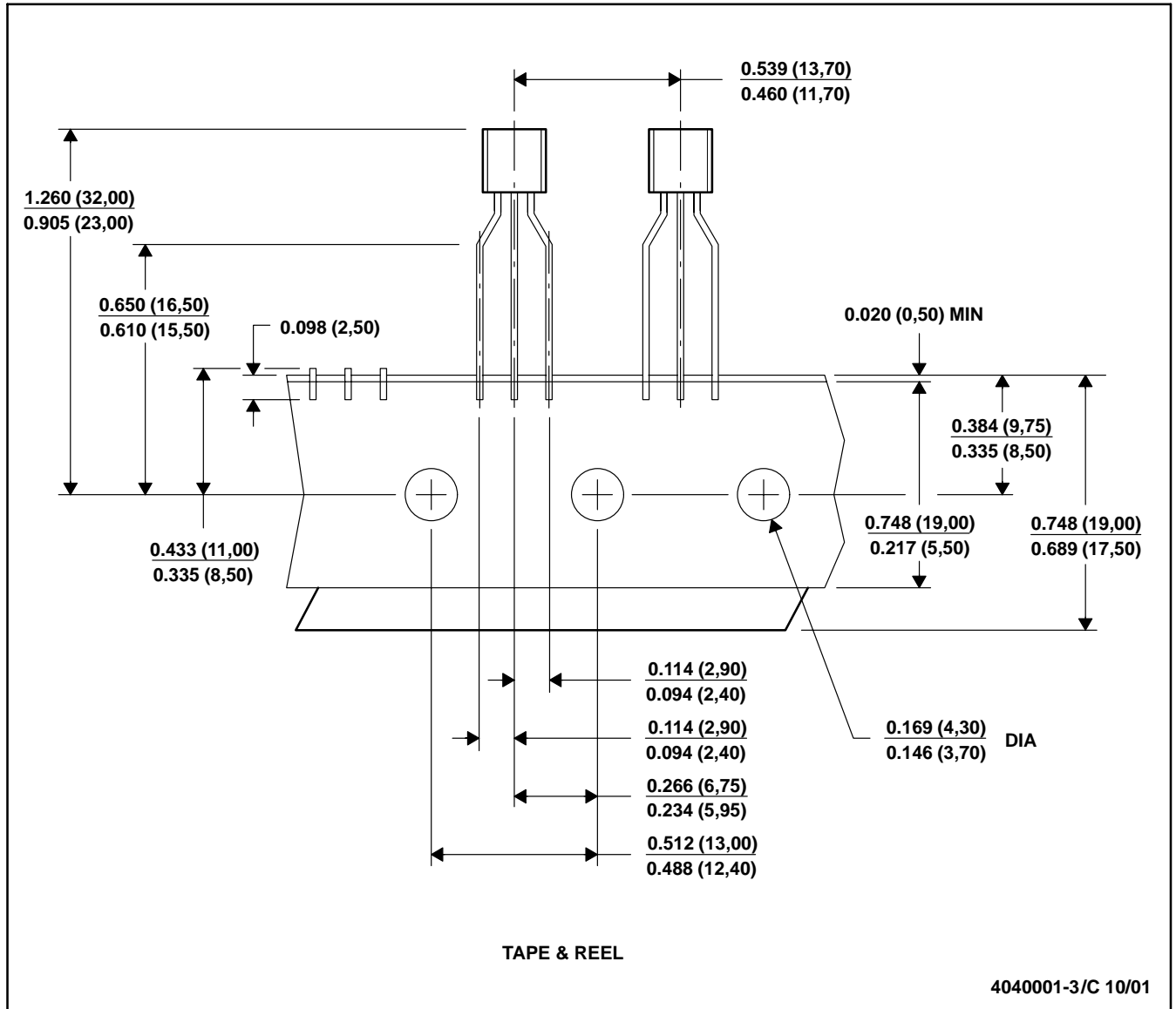
- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Lead dimensions are not controlled within this area  
 D. Falls within JEDEC TO -226 Variation AA (TO-226 replaces TO-92)  
 E. Shipping Method:  
 Straight lead option available in bulk pack only.  
 Formed lead option available in tape & reel or ammo pack.

# MECHANICAL DATA

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. Tape and Reel information for the Format Lead Option package.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

<b>Products</b>		<b>Applications</b>	
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>	Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>	Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>	Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
		Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
		Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
		Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

Mailing Address: Texas Instruments  
Post Office Box 655303 Dallas, Texas 75265