LM78LXX Series 3-Terminal Positive Regulators

Check for Samples: LM78L05, LM78L09, LM78L12, LM78L15, LM78L62, LM78L82

FEATURES

- **LM78L05 in DSBGA Package**
- **Output Voltage Tolerances of ±5% Over the Temperature Range**
- **Output Current of 100mA**
- **Internal Thermal Overload Protection**
- **Output Transistor Safe Area Protection**
- **Internal Short Circuit Current Limit**
- **Available in TO-92 and SOIC-8 Low Profile Packages**
- **No External Components**
- **Output Voltages of 5.0V, 6.2V, 8.2V, 9.0V, 12V, 15V**
- **See AN-1112 (SNVA009) for DSBGA Considerations**

DESCRIPTION

The LM78LXX series of three terminal positive regulators is available with several fixed output voltages making them useful in a wide range of applications. When used as a zener diode/resistor combination replacement, the LM78LXX 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 LM78LXX to be used in logic systems, instrumentation, HiFi, and other solid state electronic equipment.

The LM78LXX is available in the plastic TO-92 (LP) package, the SOIC-8 (D) package and a chip sized package (8-Bump DSBGA) using TI's DSBGA package technology. With adequate heat sinking the regulator can deliver 100mA output current. Current limiting is included to limit the peak output current to a safe value. Safe area protection for the output transistors is provided to limit internal power dissipation. If internal power dissipation becomes too high for the heat sinking provided, the thermal shutdown circuit takes over preventing the IC from overheating.

Connection Diagram

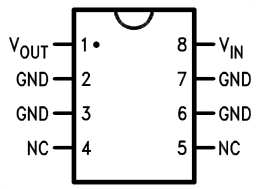


Figure 1. SOIC-8 (D)
(Narrow Body)
Top View

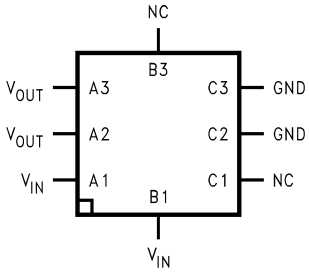


Figure 2. 8-Bump DSBGA
Top View
(Bump Side Down)

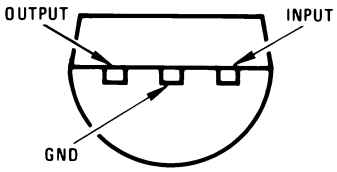


Figure 3. TO-92 Package (LP)
Bottom View

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)

Power Dissipation (3)	Internally Limited
Input Voltage	35V
Storage Temperature	−65°C to +150°C
ESD Susceptibility (4)	1kV
Operating Junction Temperature	
LM78LxxACZ, TO-92	0°C to 125°C
LM78LxxACM, SOIC-8	0°C to 125°C
LM78LxxAIM, SOIC-8	-40°C to 125°C
LM78LxxIBPX, DSBGA	−40°C to 85°C
LM78LxxITP, Thin DSBGA	−40°C to 85°C
Soldering Information	
Infrared or Convection (20 sec.)	235°C
Wave Soldering (10 sec.)	260°C (lead time)

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Electrical specifications do not apply when operating the device outside of its stated operating conditions.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.
(3) Typical thermal resistance values for the packages are:
LP Package: θ_{JC} = 60 °C/W, = θ_{JA} = 230 °C/W
D Package: θ_{JA} = 180 °C/W
DSBGA Package: θ_{JA} = 230.9°C/W
(4) Human body model, 1.5 kΩ in series with 100pF.

LM78LXX Electrical Characteristics LM78L05AC / LM78L05I

Limits in standard typeface are for T_J = 25°C, **Bold typeface applies over the entire operating temperature range of the indicated package.** Limits are ensured by production testing or correlation techniques using standard Statistical Quality Control (SQC) methods. Unless otherwise specified: I_O = 40mA, C_I = 0.33µF, C_O = 0.1µF.
Unless otherwise specified, V_{IN} = 10V

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_O	Output Voltage		4.8	5	5.2	V
		7V ≤ V_{IN} ≤ 20V 1mA ≤ I_O ≤ 40mA (1)	**4.75**		**5.25**	
		1mA ≤ I_O ≤ 70mA (1)	**4.75**		**5.25**	
ΔV_O	Line Regulation	7V ≤ V_{IN} ≤ 20V		18	75	mV
		8V ≤ V_{IN} ≤ 20V		10	54	
ΔV_O	Load Regulation	1mA ≤ I_O ≤ 100mA		20	60	
		1mA ≤ I_O ≤ 40mA		5	30	
I_Q	Quiescent Current			3	5	mA
ΔI_Q	Quiescent Current Change	8V ≤ V_{IN} ≤ 20V			**1.0**	
		1mA ≤ I_O ≤ 40mA			**0.1**	
V_n	Output Noise Voltage	f = 10 Hz to 100 kHz (2)		40		µV
$\Delta V_{IN}/\Delta V_{OUT}$	Ripple Rejection	f = 120 Hz 8V ≤ V_{IN} ≤ 16V	47	62		dB
I_{PK}	Peak Output Current			140		mA
$\Delta V_O/\Delta T$	Average Output Voltage Tempco	I_O = 5mA		−0.65		mV/°C

(1) Power dissipation ≤ 0.75W.
(2) Recommended minimum load capacitance of 0.01µF to limit high frequency noise.

LM78LXX Electrical Characteristics LM78L05AC / LM78L05I (continued)

Limits in standard typeface are for T_J = 25°C, **Bold typeface applies over the entire operating temperature range of the indicated package.** Limits are ensured by production testing or correlation techniques using standard Statistical Quality Control (SQC) methods. Unless otherwise specified: I_O = 40mA, C_I = 0.33µF, C_O = 0.1µF.
Unless otherwise specified, V_{IN} = 10V

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{IN} (Min)	Minimum Value of Input Voltage Required to Maintain Line Regulation			6.7	7	V
θ_{JA}	Thermal Resistance (8-Bump micro SMD)			230.9		°C/W

LM78LXX Electrical Characteristics LM78L62AC

Unless otherwise specified, V_{IN} = 12V

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_O	Output Voltage		5.95	6.2	6.45	V
		8.5V ≤ V_{IN} ≤ 20V 1mA ≤ I_O ≤ 40mA (1)	**5.9**		**6.5**	
		1mA ≤ I_O ≤ 70mA (1)	**5.9**		**6.5**	
ΔV_O	Line Regulation	8.5V ≤ V_{IN} ≤ 20V		65	175	mV
		9V ≤ V_{IN} ≤ 20V		55	125	
ΔV_O	Load Regulation	1mA ≤ I_O ≤ 100mA		13	80	
		1mA ≤ I_O ≤ 40mA		6	40	
I_Q	Quiescent Current			2	5.5	mA
ΔI_Q	Quiescent Current Change	8V ≤ V_{IN} ≤ 20V			**1.5**	
		1mA ≤ I_O ≤ 40mA			**0.1**	
V_n	Output Noise Voltage	f = 10 Hz to 100 kHz (2)		50		µV
$\Delta V_{IN}/\Delta V_{OUT}$	Ripple Rejection	f = 120 Hz 10V ≤ V_{IN} ≤ 20V	40	46		dB
I_{PK}	Peak Output Current			140		mA
$\Delta V_O/\Delta T$	Average Output Voltage Tempco	I_O = 5mA		−0.75		mV/°C
V_{IN} (Min)	Minimum Value of Input Voltage Required to Maintain Line Regulation			7.9		V

(1) Power dissipation ≤ 0.75W.
(2) Recommended minimum load capacitance of 0.01µF to limit high frequency noise.

LM78LXX Electrical Characteristics LM78L82AC

Unless otherwise specified, V_{IN} = 14V

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_O	Output Voltage		7.87	8.2	8.53	V
		11V ≤ V_{IN} ≤ 23V 1mA ≤ I_O ≤ 40mA (1)	**7.8**		**8.6**	
		1mA ≤ I_O ≤ 70mA (1)	**7.8**		**8.6**	
ΔV_O	Line Regulation	11V ≤ V_{IN} ≤ 23V		80	175	mV
		12V ≤ V_{IN} ≤ 23V		70	125	
ΔV_O	Load Regulation	1mA ≤ I_O ≤ 100mA		15	80	
		1mA ≤ I_O ≤ 40mA		8	40	

(1) Power dissipation ≤ 0.75W.

LM78LXX Electrical Characteristics LM78L82AC (continued)

Unless otherwise specified, V_{IN} = 14V

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_Q	Quiescent Current			2	5.5	mA
ΔI_Q	Quiescent Current Change	12V ≤ V_{IN} ≤ 23V			**1.5**	
		1mA ≤ I_O ≤ 40mA			**0.1**	
V_n	Output Noise Voltage	f = 10 Hz to 100 kHz (2)		60		µV
$\Delta V_{IN}/\Delta V_{OUT}$	Ripple Rejection	f = 120 Hz 12V ≤ V_{IN} ≤ 22V	39	45		dB
I_{PK}	Peak Output Current			140		mA
$\Delta V_O/\Delta T$	Average Output Voltage Tempco	I_O = 5mA		−0.8		mV/°C
V_{IN} (Min)	Minimum Value of Input Voltage Required to Maintain Line Regulation			9.9		V

(2) Recommended minimum load capacitance of 0.01µF to limit high frequency noise.

LM78LXX Electrical Characteristics LM78L09AC / LM78L09I

Unless otherwise specified, V_{IN} = 15V

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_O	Output Voltage		8.64	9.0	9.36	V
		11.5V ≤ V_{IN} ≤ 24V 1mA ≤ I_O ≤ 40mA (1)	**8.55**		**9.45**	
		1mA ≤ I_O ≤ 70mA (1)	**8.55**		**9.45**	
ΔV_O	Line Regulation	11.5V ≤ V_{IN} ≤ 24V		100	200	mV
		13V ≤ V_{IN} ≤ 24V		90	150	
ΔV_O	Load Regulation	1mA ≤ I_O ≤ 100mA		20	90	
		1mA ≤ I_O ≤ 40mA		10	45	
I_Q	Quiescent Current			2	5.5	mA
ΔI_Q	Quiescent Current Change	11.5V ≤ V_{IN} ≤ 24V			**1.5**	
		1mA ≤ I_O ≤ 40mA			**0.1**	
V_n	Output Noise Voltage			70		µV
$\Delta V_{IN}/\Delta V_{OUT}$	Ripple Rejection	f = 120 Hz 15V ≤ V_{IN} ≤ 25V	38	44		dB
I_{PK}	Peak Output Current			140		mA
$\Delta V_O/\Delta T$	Average Output Voltage Tempco	I_O = 5mA		−0.9		mV/°C
V_{IN} (Min)	Minimum Value of Input Voltage Required to Maintain Line Regulation			10.7		V

(1) Power dissipation ≤ 0.75W.

LM78LXX Electrical Characteristics LM78L12AC

Unless otherwise specified, V_{IN} = 19V

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_O	Output Voltage		11.5	12	12.5	V
		14.5V ≤ V_{IN} ≤ 27V 1mA ≤ I_O ≤ 40mA (1)	**11.4**		**12.6**	
		1mA ≤ I_O ≤ 70mA (1)	**11.4**		**12.6**	
ΔV_O	Line Regulation	14.5V ≤ V_{IN} ≤ 27V		30	180	mV
		16V ≤ V_{IN} ≤ 27V		20	110	
ΔV_O	Load Regulation	1mA ≤ I_O ≤ 100mA		30	100	
		1mA ≤ I_O ≤ 40mA		10	50	
I_Q	Quiescent Current			3	5	mA
ΔI_Q	Quiescent Current Change	16V ≤ V_{IN} ≤ 27V			**1**	
		1mA ≤ I_O ≤ 40mA			**0.1**	
V_n	Output Noise Voltage			80		µV
$\Delta V_{IN}/\Delta V_{OUT}$	Ripple Rejection	f = 120 Hz 15V ≤ V_{IN} ≤ 25	40	54		dB
I_{PK}	Peak Output Current			140		mA
$\Delta V_O/\Delta T$	Average Output Voltage Tempco	I_O = 5mA		−1.0		mV/°C
V_{IN} (Min)	Minimum Value of Input Voltage Required to Maintain Line Regulation			13.7	14.5	V

(1) Power dissipation ≤ 0.75W.

LM78LXX Electrical Characteristics LM78L15AC

Unless otherwise specified, V_{IN} = 23V

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_O	Output Voltage		14.4	15.0	15.6	V
		17.5V ≤ V_{IN} ≤ 30V 1mA ≤ I_O ≤ 40mA (1)	**14.25**		**15.75**	
		1mA ≤ I_O ≤ 70mA (1)	**14.25**		**15.75**	
ΔV_O	Line Regulation	17.5V ≤ V_{IN} ≤ 30V		37	250	mV
		20V ≤ V_{IN} ≤ 30V		25	140	
ΔV_O	Load Regulation	1mA ≤ I_O ≤ 100mA		35	150	
		1mA ≤ I_O ≤ 40mA		12	75	
I_Q	Quiescent Current			3	5	mA
ΔI_Q	Quiescent Current Change	20V ≤ V_{IN} ≤ 30V			**1**	
		1mA ≤ I_O ≤ 40mA			**0.1**	
V_n	Output Noise Voltage			90		µV
$\Delta V_{IN}/\Delta V_{OUT}$	Ripple Rejection	f = 120 Hz 18.5V ≤ V_{IN} ≤ 28.5V	37	51		dB
I_{PK}	Peak Output Current			140		mA
$\Delta V_O/\Delta T$	Average Output Voltage Tempco	I_O = 5mA		−1.3		mV/°C
V_{IN} (Min)	Minimum Value of Input Voltage Required to Maintain Line Regulation			16.7	17.5	V

(1) Power dissipation ≤ 0.75W.

Typical Performance Characteristics

Maximum Average Power Dissipation (LP Package)

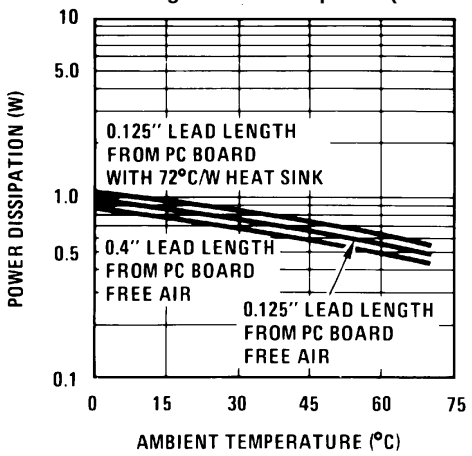


Figure 4.

Peak Output Current

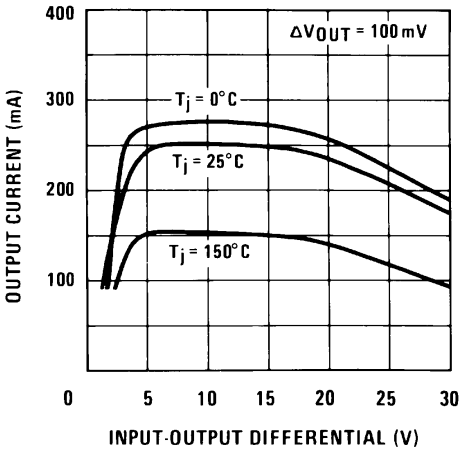


Figure 5.

Dropout Voltage

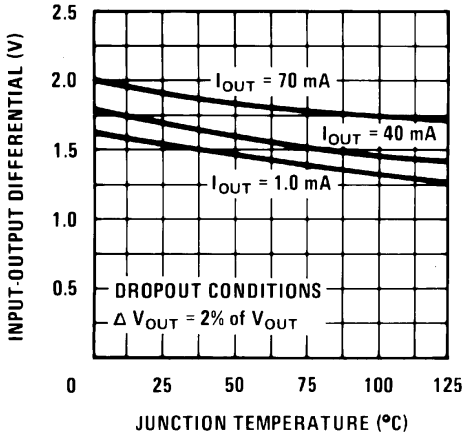


Figure 6.

Ripple Rejection

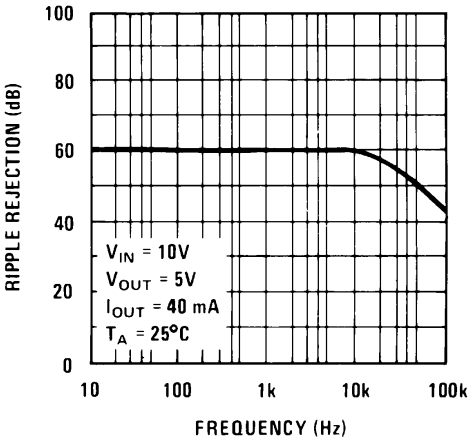


Figure 7.

Output Impedance

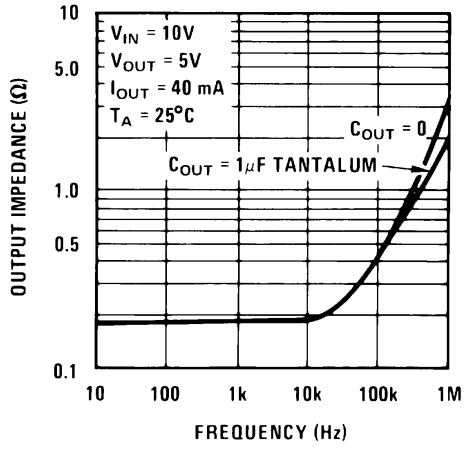


Figure 8.

Quiescent Current

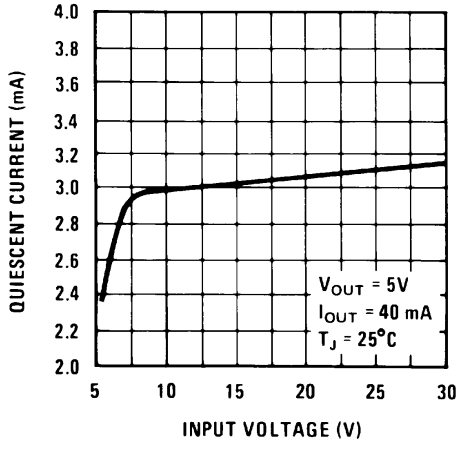


Figure 9.

Typical Performance Characteristics (continued)

Quiescent Current

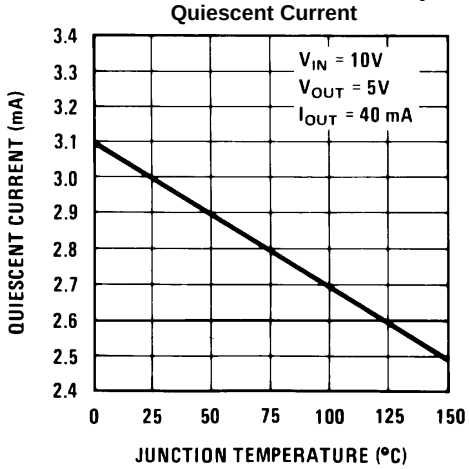


Figure 10.

EQUIVALENT CIRCUIT

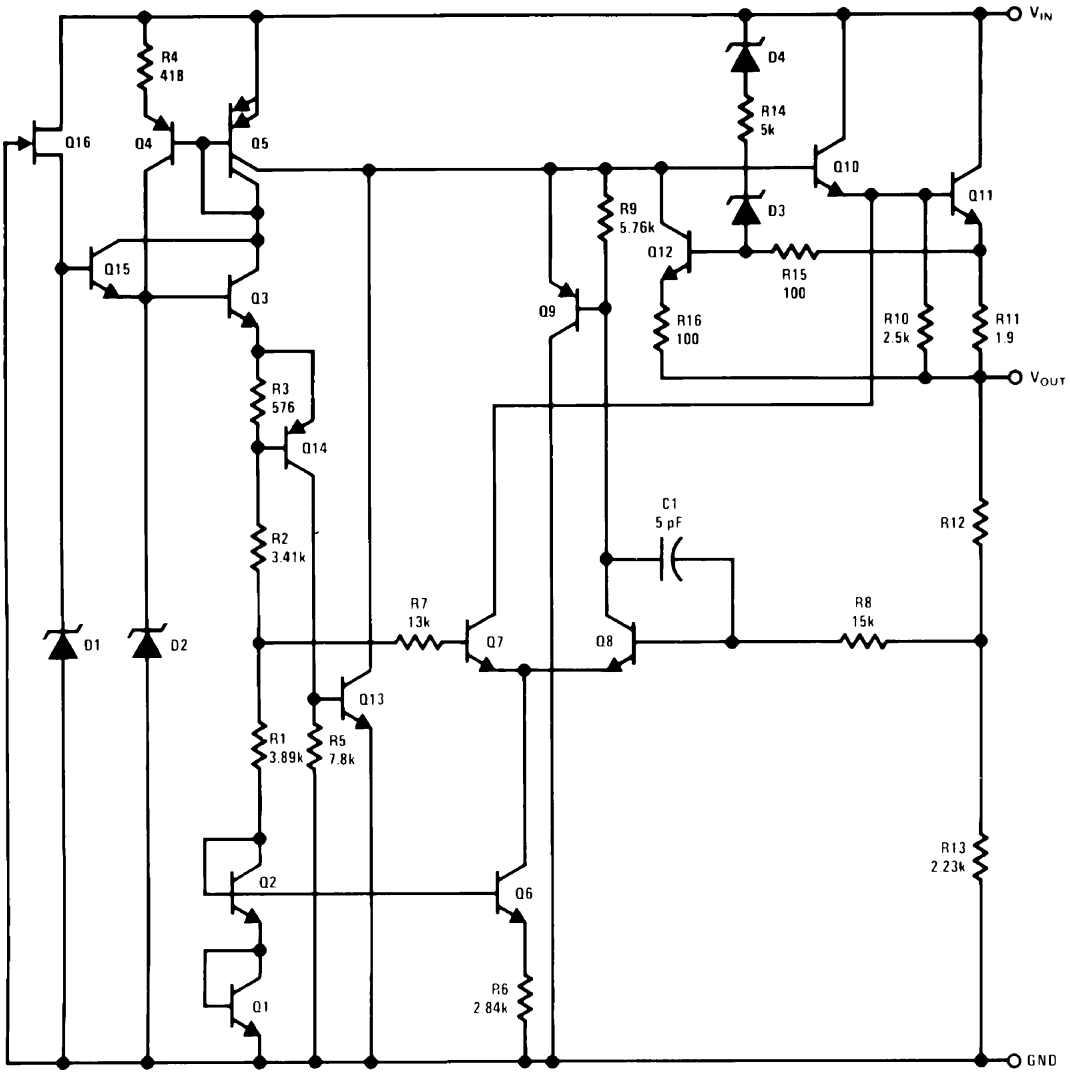
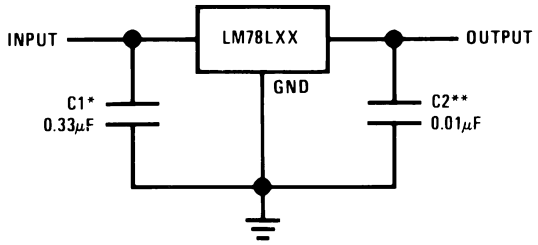


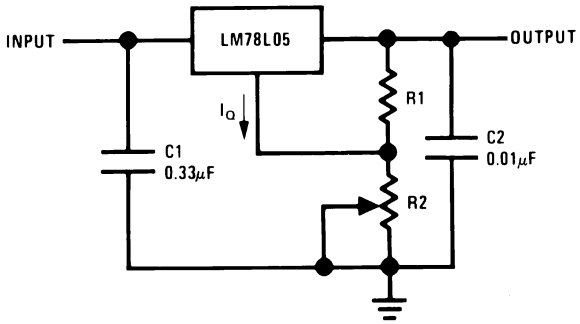
Figure 11. LM78LXX

Typical Applications



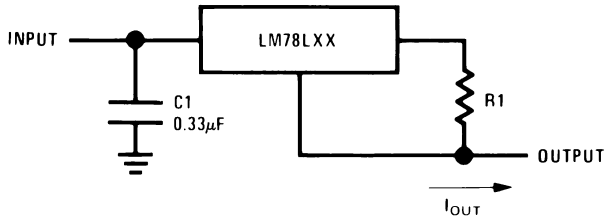
*Required if the regulator is located more than 3″ from the power supply filter.
**See (1) in the electrical characteristics table.

Figure 12. Fixed Output Regulator



V_{OUT} = 5V + (5V/R1 + I_Q) R2
5V/R1 > 3 I_Q, load regulation (L_r) ≈ [(R1 + R2)/R1] (L_r of LM78L05)

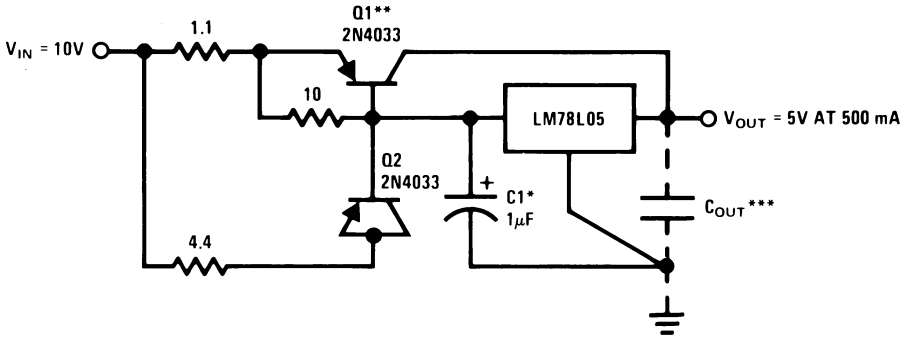
Figure 13. Adjustable Output Regulator



I_{OUT} = (V_{OUT}/R1) + I_Q
>I_Q = 1.5mA over line and load changes

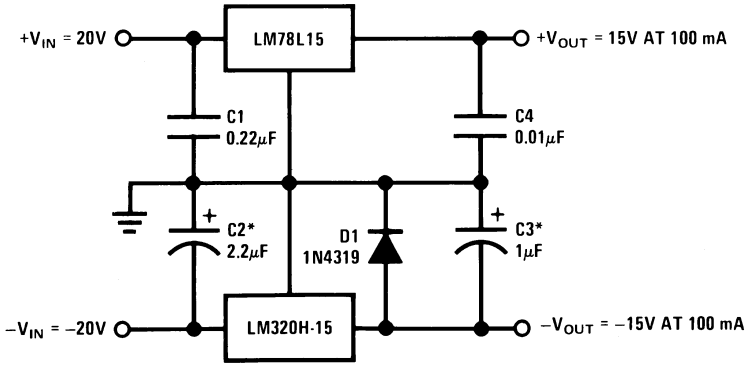
Figure 14. Current Regulator

(1) Recommended minimum load capacitance of 0.01μF to limit high frequency noise.



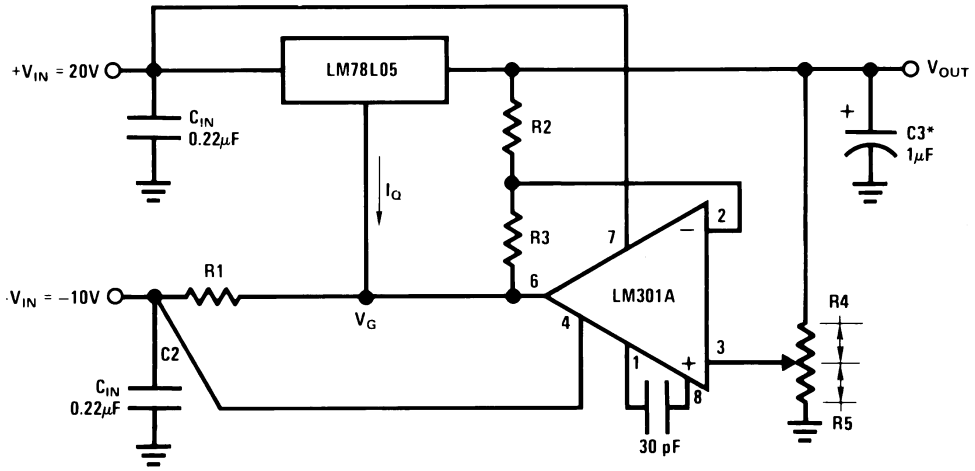
*Solid tantalum.
**Heat sink Q1.
***Optional: Improves ripple rejection and transient response.
Load Regulation: 0.6% $0 \le I_L \le 250$mA pulsed with t_{ON} = 50ms.

Figure 15. 5V, 500mA Regulator with Short Circuit Protection



*Solid tantalum.

Figure 16. ±15V, 100mA Dual Power Supply



*Solid tantalum.
$V_{OUT} = V_G + 5V$, $R1 = (-V_{IN}/I_{Q\ LM78L05})$
V_{OUT} = 5V (R2/R4) for (R2 + R3) = (R4 + R5)
A 0.5V output will correspond to (R2/R4) = 0.1 (R3/R4) = 0.9

Figure 17. Variable Output Regulator 0.5V-18V

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
LM78L05ACM	ACTIVE	SOIC	D	8	95	TBD	Call TI	Call TI	-40 to 85	LM78L 05ACM	Samples
LM78L05ACM/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM78L 05ACM	Samples
LM78L05ACMX	ACTIVE	SOIC	D	8	2500	TBD	Call TI	Call TI	-40 to 85	LM78L 05ACM	Samples
LM78L05ACMX/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM78L 05ACM	Samples
LM78L05ACZ/LFT1	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		LM78L 05ACZ	Samples
LM78L05ACZ/LFT3	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		LM78L 05ACZ	Samples
LM78L05ACZ/LFT4	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		LM78L 05ACZ	Samples
LM78L05ACZ/LFT7	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		LM78L 05ACZ	Samples
LM78L05ACZ/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM	-40 to 85	LM78L 05ACZ	Samples
LM78L05AIM/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		LM78L 05AM	Samples
LM78L05AIMX/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM		LM78L 05AM	Samples
LM78L05ITP/NOPB	ACTIVE	DSBGA	YPB	8	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM		P 03	Samples
LM78L05ITPX/NOPB	ACTIVE	DSBGA	YPB	8	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM		P 03	Samples
LM78L09ITPX/NOPB	ACTIVE	DSBGA	YPB	8	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM		P 02	Samples
LM78L12ACM	ACTIVE	SOIC	D	8	95	TBD	Call TI	Call TI	-40 to 85	LM78L 12ACM	Samples
LM78L12ACM/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM78L 12ACM	Samples
LM78L12ACMX	ACTIVE	SOIC	D	8	2500	TBD	Call TI	Call TI	-40 to 85	LM78L 12ACM	Samples

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
LM78L12ACMX/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM78L 12ACM	Samples
LM78L12ACZ/LFT3	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		LM78L 12ACZ	Samples
LM78L12ACZ/LFT4	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		LM78L 12ACZ	Samples
LM78L12ACZ/LFT7	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		LM78L 12ACZ	Samples
LM78L12ACZ/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM	-40 to 85	LM78L 12ACZ	Samples
LM78L15ACM	ACTIVE	SOIC	D	8	95	TBD	Call TI	Call TI	-40 to 85	LM78L 15ACM	Samples
LM78L15ACM/NOPB	ACTIVE	SOIC	D	8	95	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM78L 15ACM	Samples
LM78L15ACMX	ACTIVE	SOIC	D	8	2500	TBD	Call TI	Call TI	-40 to 85	LM78L 15ACM	Samples
LM78L15ACMX/NOPB	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 85	LM78L 15ACM	Samples
LM78L15ACZ/LFT4	ACTIVE	TO-92	LP	3	2000	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM		LM78L 15ACZ	Samples
LM78L15ACZ/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM	-40 to 85	LM78L 15ACZ	Samples
LM78L62ACZ/NOPB	ACTIVE	TO-92	LP	3	1800	Green (RoHS & no Sb/Br)	SNCU	Level-1-NA-UNLIM	-40 to 85	LM78L 62ACZ	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.

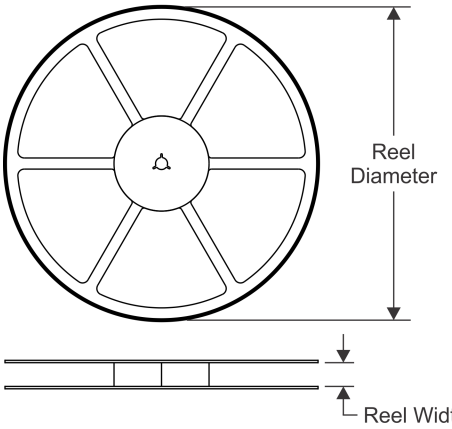
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & 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.

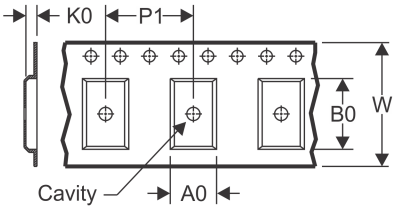
(4) Only one of markings shown within the brackets will appear on the physical device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

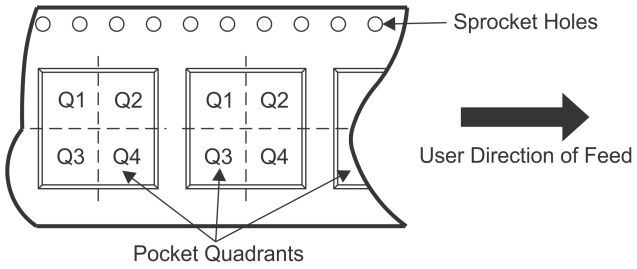


TAPE DIMENSIONS



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

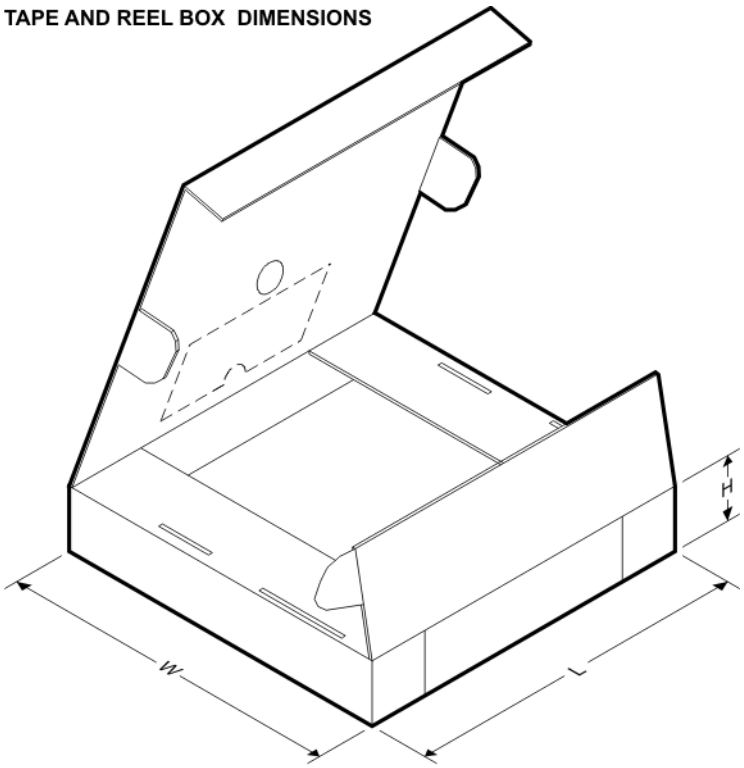
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
LM78L05ACMX	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM78L05ACMX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM78L05AIMX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM78L05ITP/NOPB	DSBGA	YPB	8	250	178.0	8.4	1.5	1.5	0.66	4.0	8.0	Q1
LM78L05ITPX/NOPB	DSBGA	YPB	8	3000	178.0	8.4	1.5	1.5	0.66	4.0	8.0	Q1
LM78L09ITPX/NOPB	DSBGA	YPB	8	3000	178.0	8.4	1.5	1.5	0.66	4.0	8.0	Q1
LM78L12ACMX	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM78L12ACMX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM78L15ACMX	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1
LM78L15ACMX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1

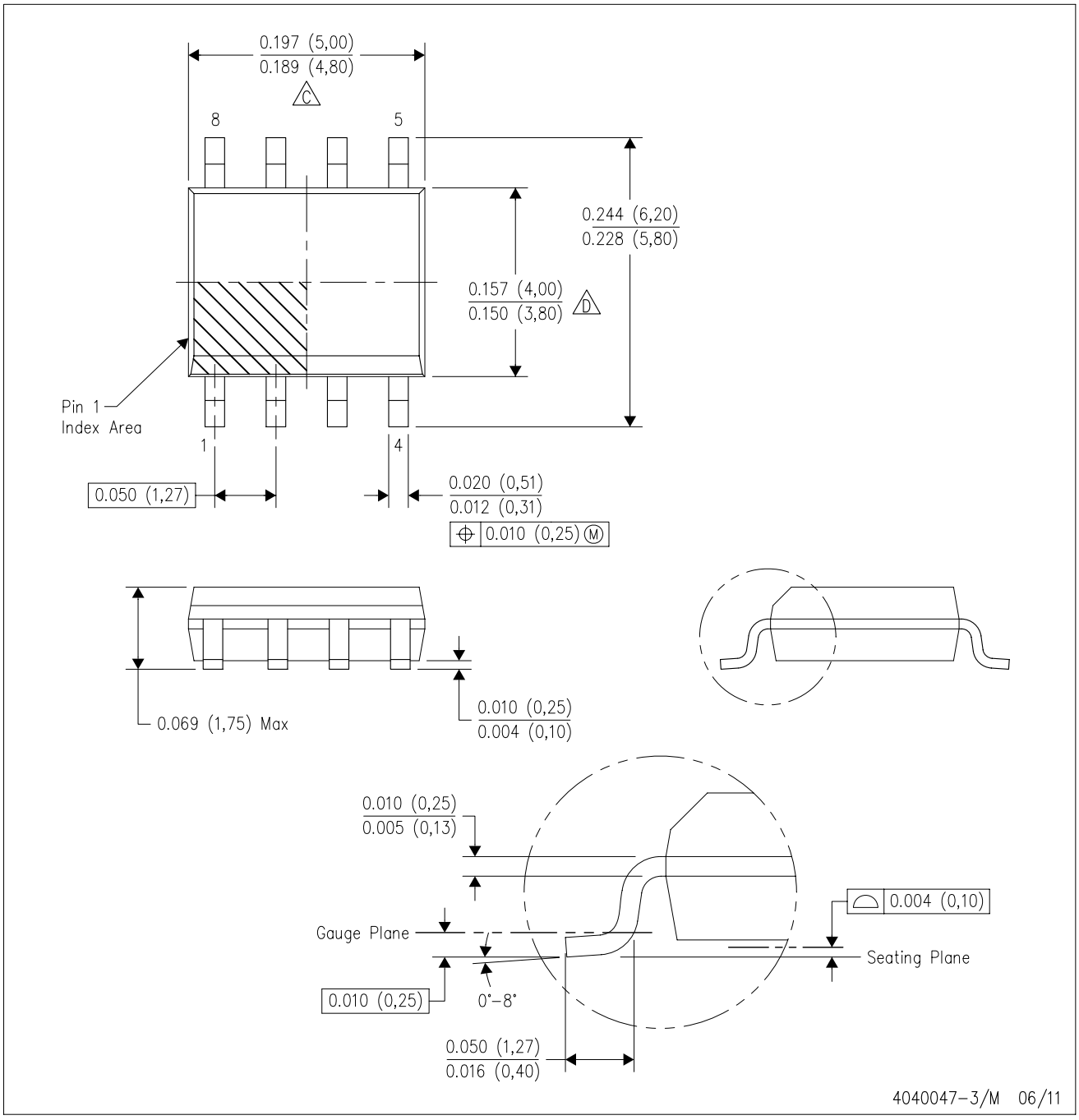
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

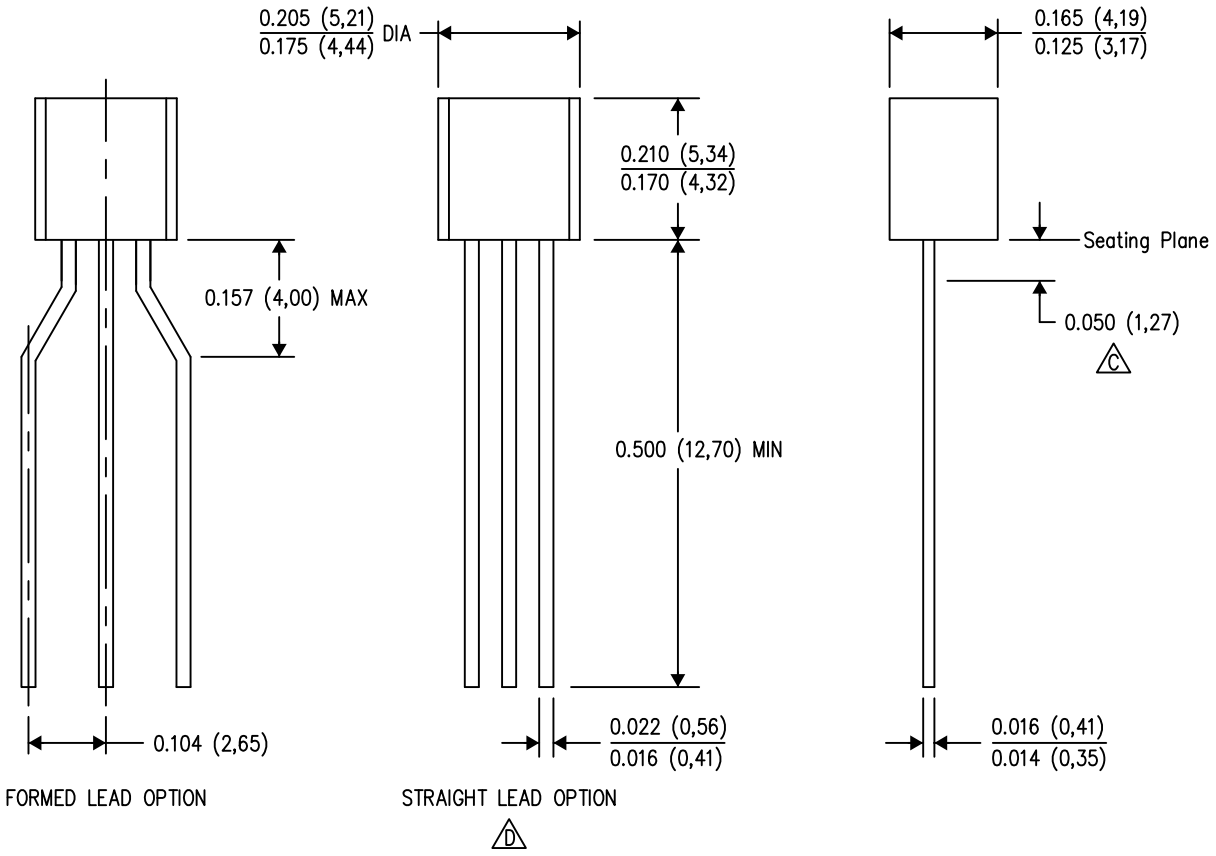
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM78L05ACMX	SOIC	D	8	2500	367.0	367.0	35.0
LM78L05ACMX/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM78L05AIMX/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM78L05ITP/NOPB	DSBGA	YPB	8	250	210.0	185.0	35.0
LM78L05ITPX/NOPB	DSBGA	YPB	8	3000	210.0	185.0	35.0
LM78L09ITPX/NOPB	DSBGA	YPB	8	3000	210.0	185.0	35.0
LM78L12ACMX	SOIC	D	8	2500	367.0	367.0	35.0
LM78L12ACMX/NOPB	SOIC	D	8	2500	367.0	367.0	35.0
LM78L15ACMX	SOIC	D	8	2500	367.0	367.0	35.0
LM78L15ACMX/NOPB	SOIC	D	8	2500	367.0	367.0	35.0

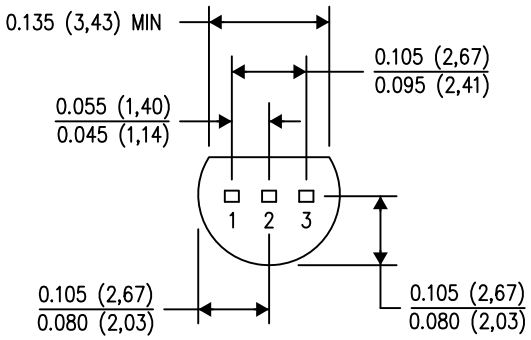
D (R–PDSO–G8) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AA.

LP (O–PBCY–W3) PLASTIC CYLINDRICAL PACKAGE

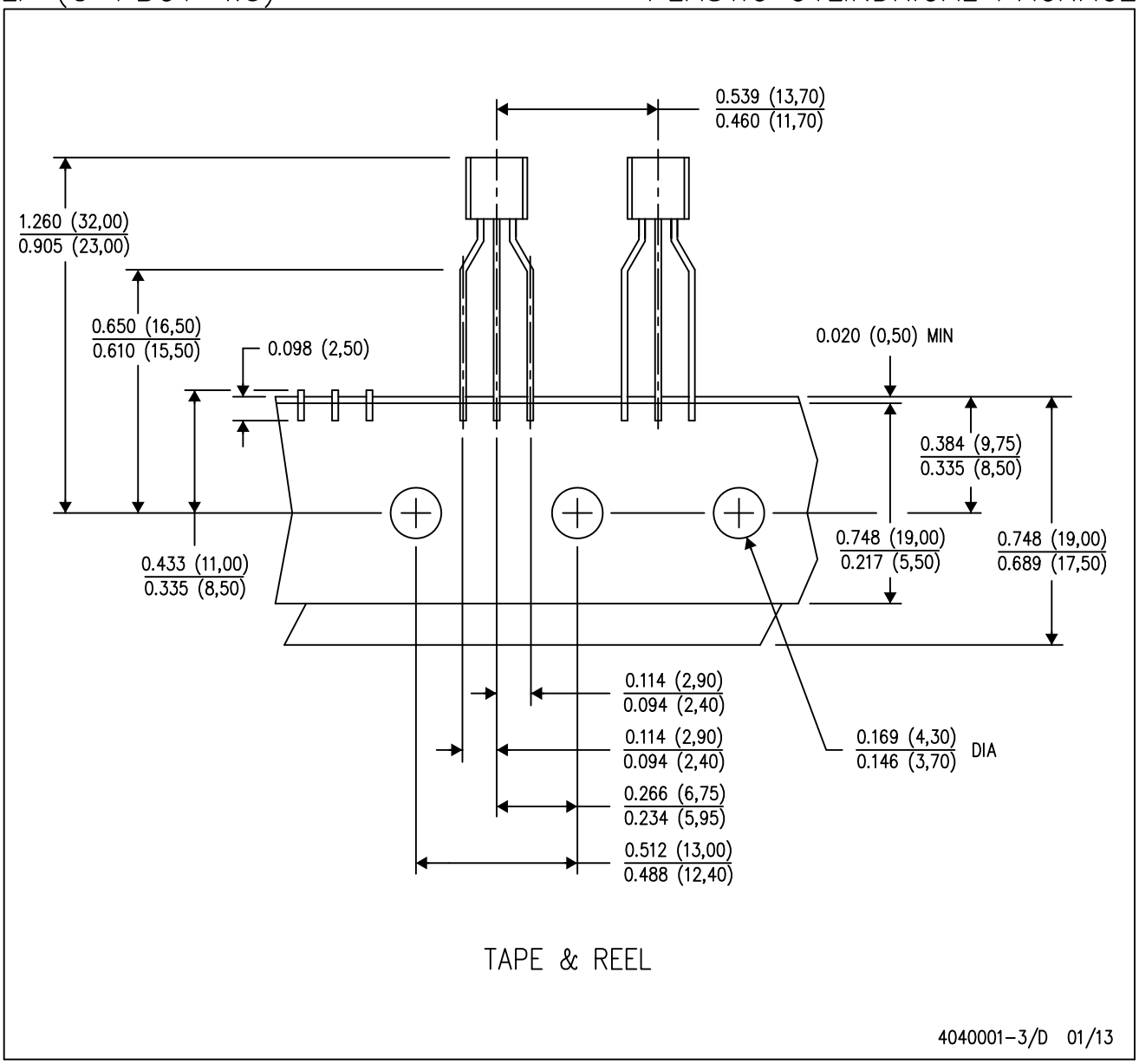




4040001–2/D 01/13

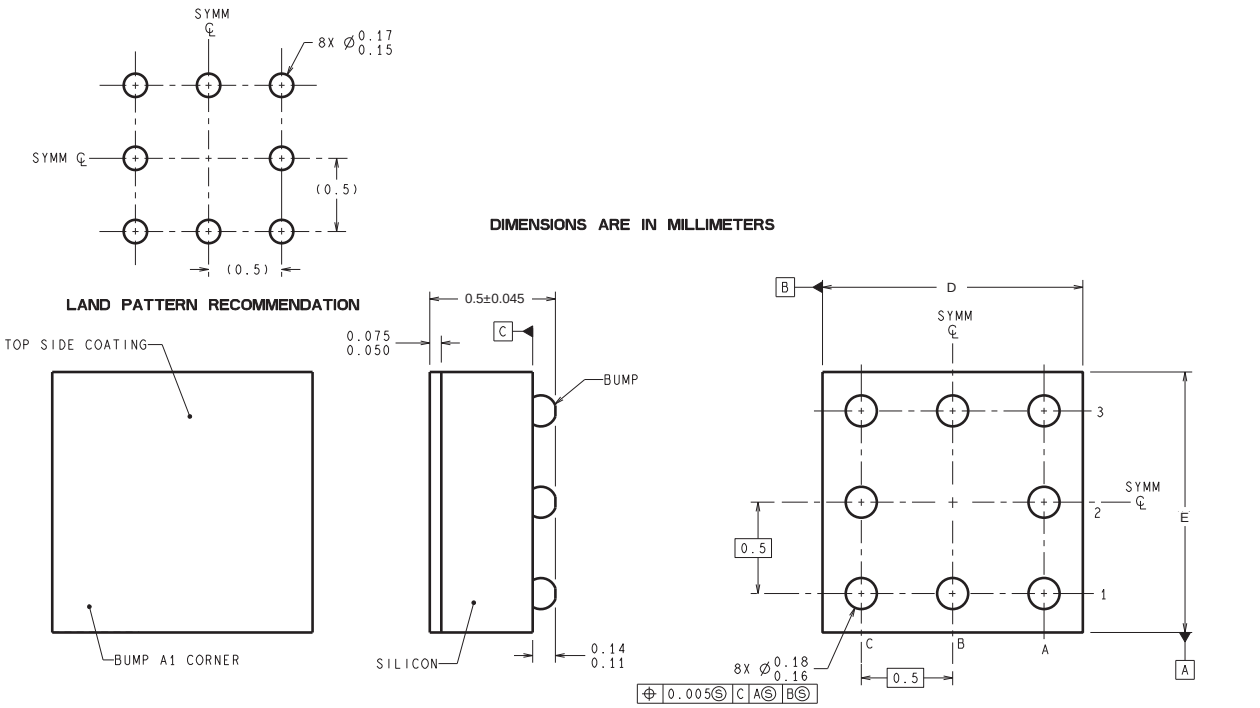
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. Falls within JEDEC TO–226 Variation AA (TO–226 replaces TO–92).
E. Shipping Method:
Straight lead option available in either bulk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

YPB0008



D: Max = 1.357 mm, Min =1.256 mm

E: Max = 1.357 mm, Min =1.256 mm

4215100/A 12/12

NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
B. This drawing is subject to change without notice.

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