

# LM78LXX Series

## 3-Terminal Positive Regulators

### General 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 (Z) package, the plastic SO-8 (M) package and a chip sized package (8-Bump micro SMD) using National's micro SMD 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 inter-

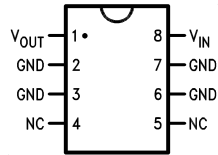
nal power dissipation. If internal power dissipation becomes too high for the heat sinking provided, the thermal shutdown circuit takes over preventing the IC from overheating.

### Features

- LM78L05 in micro SMD package
- Output voltage tolerances of  $\pm 5\%$  over the temperature range
- Output current of 100mA
- Internal thermal overload protection
- Output transistor safe area protection
- Internal short circuit current limit
- Available in plastic TO-92 and plastic SO-8 low profile packages
- No external components
- Output voltages of 5.0V, 6.2V, 8.2V, 9.0V, 12V, 15V
- See AN-1112 for micro SMD considerations

### Connection Diagrams

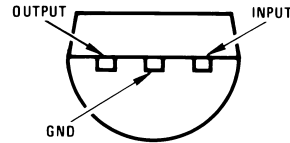
**SO-8 Plastic (M)  
(Narrow Body)**



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**Top View**

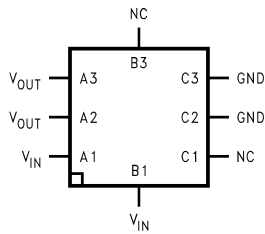
**(TO-92)  
Plastic Package (Z)**



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**Bottom View**

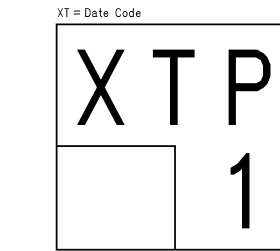
**8-Bump micro SMD**



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**Top View  
(Bump Side Down)**

**micro SMD Marking Orientation**



Pin A1 Corner  
Pin A1 is identified by lower left corner with respect to the text.

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**Top View**

## Ordering Information

| Package        | NSC Drawing | Output Voltage | Order Number | Supplied As  |
|----------------|-------------|----------------|--------------|--------------|
| micro SMD      | BPA08AAB    | 5V             | LM78L05IBP   | Reel of 250  |
|                |             |                | LM78L05IBPX  | Reel of 3000 |
| Thin micro SMD | TPA08AAA    | 5V             | LM78L05ITP   | Reel of 250  |
|                |             |                | LM78L05ITPX  | Reel of 3000 |
|                |             | 9V             | LM78L09ITP   | Reel of 250  |
|                |             |                | LM78L09ITPX  | Reel of 3000 |
| SOIC Narrow    | M08A        | 5V             | LM78L05ACM   | Rail of 95   |
|                |             |                | LM78L05ACMX  | Reel of 2500 |
|                |             | 12V            | LM78L12ACM   | Rail of 95   |
|                |             |                | LM78L12ACMX  | Reel of 2500 |
|                |             | 15V            | LM78L15ACM   | Rail of 95   |
|                |             |                | LM78L15ACMX  | Reel of 2500 |
| TO-92          | Z03A        | 5V             | LM78L05ACZ   | Box of 1800  |
|                |             | 6.2V           | LM78L62ACZ   | Box of 1800  |
|                |             | 8.2V           | LM78L82ACZ   | Box of 1800  |
|                |             | 9V             | LM78L09ACZ   | Box of 1800  |
|                |             | 12V            | LM78L12ACZ   | Box of 1800  |
|                |             | 15V            | LM78L15ACZ   | Box of 1800  |

**Absolute Maximum Ratings** (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

|                             |                    |
|-----------------------------|--------------------|
| Power Dissipation (Note 5)  | Internally Limited |
| Input Voltage               | 35V                |
| Storage Temperature         | -65°C to +150°C    |
| ESD Susceptibility (Note 2) | 1kV                |

Operating Junction Temperature

|             |               |
|-------------|---------------|
| SO-8, TO-92 | 0°C to 125°C  |
| micro SMD   | -40°C to 85°C |

Soldering Information

|                                  |                   |
|----------------------------------|-------------------|
| Infrared or Convection (20 sec.) | 235°C             |
| Wave Soldering (10 sec.)         | 260°C (lead time) |

**LM78LXX Electrical Characteristics** Limits in standard typeface are for  $T_J = 25^\circ\text{C}$ , **Bold typeface applies over  $0^\circ\text{C}$  to  $125^\circ\text{C}$  for SO-8 and TO-92 packages, and  $-40^\circ\text{C}$  to  $85^\circ\text{C}$  for micro SMD package.** Limits are guaranteed by production testing or correlation techniques using standard Statistical Quality Control (SQC) methods. Unless otherwise specified:  $I_O = 40\text{mA}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ .

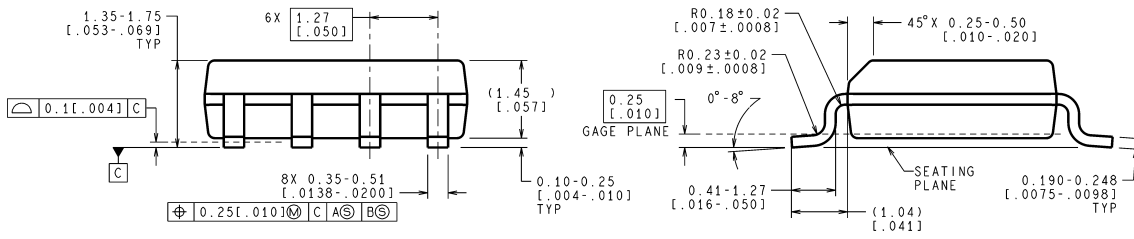
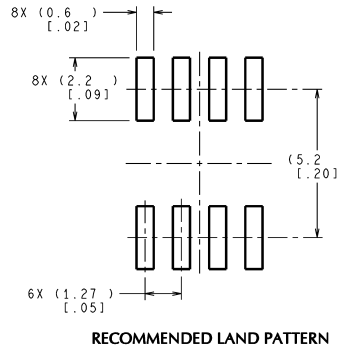
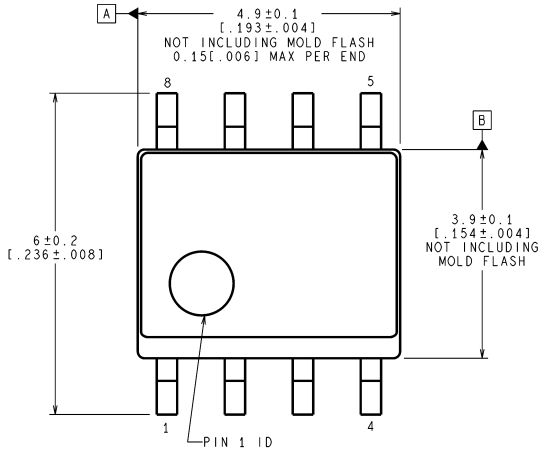
**LM78L05**Unless otherwise specified,  $V_{IN} = 10\text{V}$ 

| Symbol                                 | Parameter   | Conditions  | Min         | Typ   | Max         | Units                      |
|--|---|---|-------------|-------|-------------|----------------------------|
| $V_O$                                  | Output Voltage  |   | 4.8         | 5     | 5.2         | V                          |
|  |   | $7\text{V} \leq V_{IN} \leq 20\text{V}$<br>$1\text{mA} \leq I_O \leq 40\text{mA}$<br>(Note 3) | <b>4.75</b> |       | <b>5.25</b> |                            |
|  |   | $1\text{mA} \leq I_O \leq 70\text{mA}$<br>(Note 3)  | <b>4.75</b> |       | <b>5.25</b> |                            |
| $\Delta V_O$                           | Line Regulation   | $7\text{V} \leq V_{IN} \leq 20\text{V}$   |             | 18    | 75          | mV                         |
|  |   | $8\text{V} \leq V_{IN} \leq 20\text{V}$   |             | 10    | 54          |                            |
| $\Delta V_O$                           | Load Regulation   | $1\text{mA} \leq I_O \leq 100\text{mA}$   |             | 20    | 60          | mV                         |
|  |   | $1\text{mA} \leq I_O \leq 40\text{mA}$  |             | 5     | 30          |                            |
| $I_Q$                                  | Quiescent Current   |   |             | 3     | 5           | mA                         |
| $\Delta I_Q$                           | Quiescent Current Change  | $8\text{V} \leq V_{IN} \leq 20\text{V}$   |             |       | <b>1.0</b>  |                            |
|  |   | $1\text{mA} \leq I_O \leq 40\text{mA}$  |             |       | <b>0.1</b>  |                            |
| $V_n$                                  | Output Noise Voltage  | $f = 10\text{ Hz to } 100\text{ kHz}$<br>(Note 4)   |             | 40    |             | $\mu\text{V}$              |
| $\frac{\Delta V_{IN}}{\Delta V_{OUT}}$ | Ripple Rejection  | $f = 120\text{ Hz}$<br>$8\text{V} \leq V_{IN} \leq 16\text{V}$                                | 47          | 62    |             | dB                         |
| $I_{PK}$                               | Peak Output Current   |   |             | 140   |             | mA                         |
| $\frac{\Delta V_O}{\Delta T}$          | Average Output Voltage Tempco                                       | $I_O = 5\text{mA}$  |             | -0.65 |             | $\text{mV}/^\circ\text{C}$ |
| $V_{IN}(\text{Min})$                   | Minimum Value of Input Voltage Required to Maintain Line Regulation |   |             | 6.7   | 7           | V                          |
| $\theta_{JA}$                          | Thermal Resistance<br>(8-Bump micro SMD)                            |   |             | 230.9 |             | $^\circ\text{C}/\text{W}$  |

**LM78L62AC**Unless otherwise specified,  $V_{IN} = 12\text{V}$ 

| Symbol | Parameter      | Conditions  | Min        | Typ | Max        | Units |
|--------|----------------|---|------------|-----|------------|-------|
| $V_O$  | Output Voltage |   | 5.95       | 6.2 | 6.45       | V     |
|        |                | $8.5\text{V} \leq V_{IN} \leq 20\text{V}$<br>$1\text{mA} \leq I_O \leq 40\text{mA}$<br>(Note 3) | <b>5.9</b> |     | <b>6.5</b> |       |
|        |                | $1\text{mA} \leq I_O \leq 70\text{mA}$<br>(Note 3)  | <b>5.9</b> |     | <b>6.5</b> |       |

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)

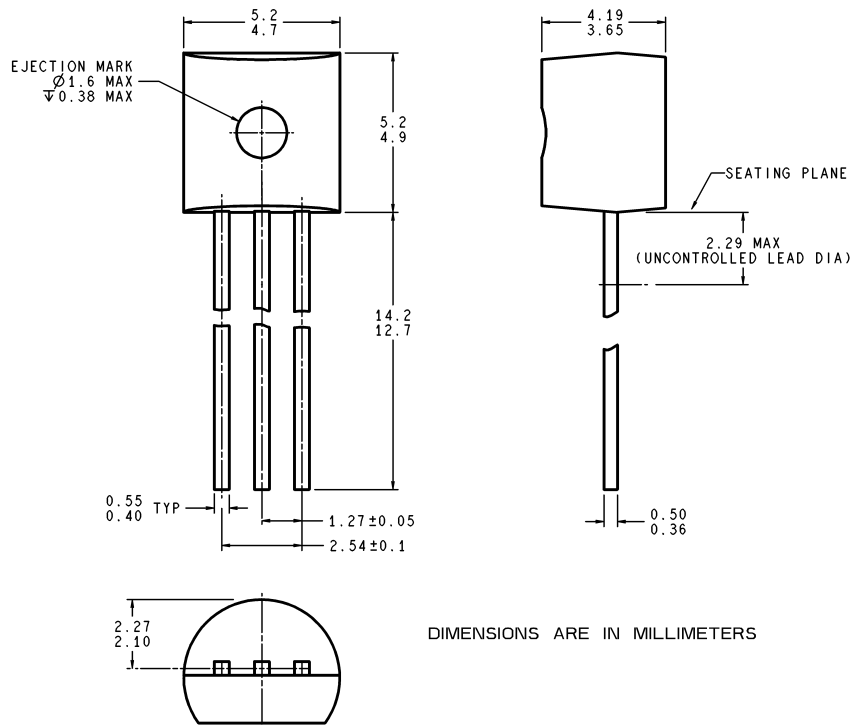


CONTROLLING DIMENSION IS MILLIMETER  
VALUES IN [ ] ARE INCHES  
DIMENSIONS IN ( ) FOR REFERENCE ONLY

M08A (Rev K)

**S.O. Package (M)**  
**NS Package Number M08A**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN MILLIMETERS

Z03A (Rev 6)

**Molded Offset TO-92 (Z)  
NS Package Number Z03A**

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