

**3-TERMINAL POSITIVE LINEAR REGULATOR****AZ78LXX****General Description**

The AZ78LXX series are three terminal positive regulators with several fixed output voltages. These regulators can provide local on card regulation, eliminating the distribution problems associated with single point regulation. The AZ78LXX can be used in logic systems, instrumentation, HiFi, and other solid state electronic equipment. When used as a Zener diode/resistor combination replacement, the AZ78LXX usually results an effective output impedance improvement of two orders of magnitude, and lower quiescent current.

With adequate heat sinking the AZ78LXX can deliver 100 mA output current. Current limiting is included to limit the peak output current to a safe value. Thermal protection is also provided. If internal power dissipation becomes too high for the heat sinking provided, the thermal shutdown circuit takes over preventing the IC from overheating.

The AZ78LXX are available in the plastic TO-92, SOIC-8, SOT-223 and SOT-89 packages.

**Features**

- Output Current up to 100 mA
- Fixed Output Voltage of 5V, 8V, 9V and 12V
- Output Voltage Tolerances of  $\pm 5\%$  over the Full Temperature Range
- Internal Short Circuit Current-Limiting
- Internal Thermal Overload Protection
- No External Components

**Applications**

- High Efficiency Linear Regulator
- Post Regulation for Switching Supply
- Microprocessor Power Supply
- Mother Board I/O Power Supply

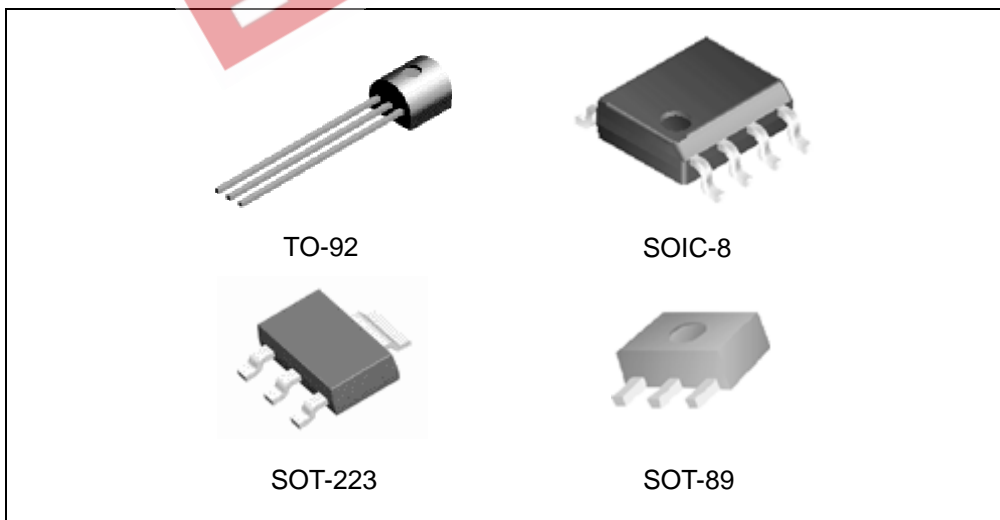


Figure 1. Package Types of the AZ78LXX

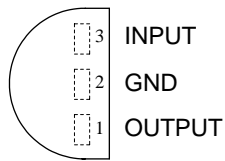


**3-TERMINAL POSITIVE LINEAR REGULATOR**

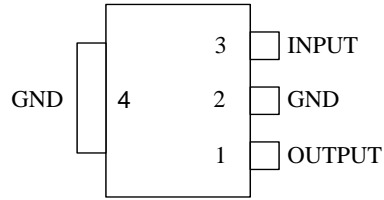
**AZ78LXX**

**Pin Configuration**

Z Package  
(TO-92)

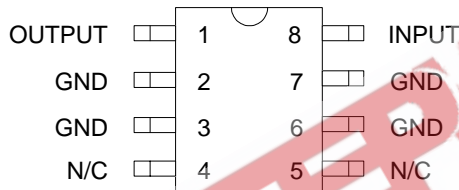


H Package  
(SOT-223)



Connect pin 4 to pin 2 or leave pin 4 electrically isolated

M Package  
(SOIC-8)



R Package  
(SOT-89)

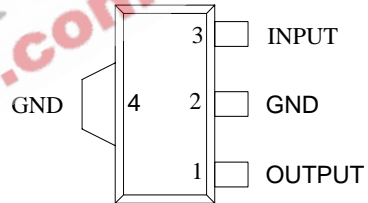


Figure 2. Pin Configuration of the AZ78LXX (Top View)



**3-TERMINAL POSITIVE LINEAR REGULATOR**

**AZ78LXX**

**Functional Block Diagram**



Figure 3. Functional Block Diagram of the AZ78LXX



**3-TERMINAL POSITIVE LINEAR REGULATOR**

**AZ78LXX**

**Ordering Information**



| Package | Temperature Range | Part Number |                | Marking ID |             | Packing Type |
|---------|-------------------|-------------|----------------|------------|-------------|--------------|
|         |                   | Tin Lead    | Lead Free      | Tin Lead   | Lead Free   |              |
| TO-92   | 0 to 125°C        | AZ78L05Z    | AZ78L05Z-E1    | AZ78L05Z   | AZ78L05Z-E1 | Bulk         |
|         |                   | AZ78L05ZTR  | AZ78L05ZTR-E1  | AZ78L05Z   | AZ78L05Z-E1 | Ammo         |
|         |                   | AZ78L08Z    | AZ78L08Z-E1    | AZ78L08Z   | AZ78L08Z-E1 | Bulk         |
|         |                   | AZ78L08ZTR  | AZ78L08ZTR-E1  | AZ78L08Z   | AZ78L08Z-E1 | Ammo         |
|         |                   | AZ78L09Z    | AZ78L09Z-E1    | AZ78L09Z   | AZ78L09Z-E1 | Bulk         |
|         |                   | AZ78L09ZTR  | AZ78L09ZTR-E1  | AZ78L09Z   | AZ78L09Z-E1 | Ammo         |
|         |                   | AZ78L12Z    | AZ78L12Z-E1    | AZ78L12Z   | AZ78L12Z-E1 | Bulk         |
|         |                   | AZ78L12ZTR  | AZ78L12ZTR-E1  | AZ78L12Z   | AZ78L12Z-E1 | Ammo         |
| SOIC-8  | 0 to 125°C        | AZ78L05M    | AZ78L05M-E1    | 78L05M     | 78L05M-E1   | Tube         |
|         |                   | AZ78L05MTR  | AZ78L05MTR-E1  | 78L05M     | 78L05M-E1   | Tape & Reel  |
|         |                   | AZ78L08M    | AZ78L08M-E1    | 78L08M     | 78L08ZM-E1  | Tube         |
|         |                   | AZ78L08MTR  | AZ78L08MTR-E1  | 78L08M     | 78L08M-E1   | Tape & Reel  |
|         |                   | AZ78L09M    | AZ78L09M-E1    | 78L09M     | 78L09M-E1   | Tube         |
|         |                   | AZ78L09MTR  | AZ78L09MTR-E1  | 78L09M     | 78L09M-E1   | Tape & Reel  |
|         |                   | AZ78L12M    | AZ78L12M-E1    | 78L12M     | 78L12M-E1   | Tube         |
|         |                   | AZ78L12MTR  | AZ78L12ZMTR-E1 | 78L12M     | 78L12M-E1   | Tape & Reel  |
| SOT-89  | 0 to 125°C        | AZ78L05RTR  | AZ78L05RTR-E1  | R78A       | E78A        | Tape & Reel  |
|         |                   | AZ78L08RTR  | AZ78L08RTR-E1  | R78B       | E78B        | Tape & Reel  |
|         |                   | AZ78L09RTR  | AZ78L09RTR-E1  | R78C       | E78C        | Tape & Reel  |
|         |                   | AZ78L12RTR  | AZ78L12RTR-E1  | R78D       | E78D        | Tape & Reel  |
| SOT-223 | 0 to 125°C        | AZ78L05HTR  | AZ78L05HTR-E1  | H78A       | EH78A       | Tape & Reel  |
|         |                   | AZ78L08HTR  | AZ78L08HTR-E1  | H78B       | EH78B       | Tape & Reel  |
|         |                   | AZ78L09HTR  | AZ78L09HTR-E1  | H78C       | EH78C       | Tape & Reel  |
|         |                   | AZ78L12HTR  | AZ78L12HTR-E1  | H78D       | EH78D       | Tape & Reel  |

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.

**3-TERMINAL POSITIVE LINEAR REGULATOR****AZ78LXX****Absolute Maximum Ratings (Note 1)**

| Parameter                                    | Symbol     | Value      |      | Unit |
|--|------------|------------|------|------|
| Input Voltage                                | $V_{CC}$   | 20         |      | V    |
| Operating Junction Temperature Range         | $T_J$      | 0 to 125   |      | °C   |
| Lead Temperature (Soldering, 10sec)          | $T_{LEAD}$ | 265        |      | °C   |
| Power Dissipation ( $T_A=25^\circ\text{C}$ ) | $P_D$      | TO-92      | 0.65 | W    |
|  |            | SOIC-8     | 0.6  |      |
|  |            | SOT-223    | 0.7  |      |
|  |            | SOT-89     | 0.65 |      |
| Storage Temperature Range                    | $T_{STG}$  | -65 to 150 |      | °C   |
| ESD (Machine Model)                          |            | 300        |      | V    |

Note 1: Stresses greater than 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 Ratings" for extended periods may affect device reliability.

**Recommended Operating Conditions**

| Parameter                            | Symbol | Min | Max | Unit |
|--------------------------------------|--------|-----|-----|------|
| Operating Junction Temperature Range | $T_J$  | 0   | 125 | °C   |

**3-TERMINAL POSITIVE LINEAR REGULATOR****AZ78LXX****Electrical Characteristics****AZ78L05 Electrical Characteristics**

Limits in standard typeface are for  $T_J = 25^\circ\text{C}$ , **Bold typeface applies over  $0^\circ\text{C}$  to  $125^\circ\text{C}$** ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ ,  $V_I = 10\text{V}$ , unless otherwise specified.

| Parameter   | Symbol                    | Conditions  | Min         | Typ   | Max         | Unit                       |
|---|---------------------------|---|-------------|-------|-------------|----------------------------|
| Output Voltage  | $V_O$                     |   | 4.8         | 5     | 5.2         | V                          |
|   |                           | $7.0\text{V} \leq V_I \leq 15\text{V}$<br>$1.0\text{mA} \leq I_O \leq 40\text{mA}$ (Note 2) | <b>4.75</b> |       | <b>5.25</b> |                            |
| Line Regulation   | $V_{RLINE}$               | $7.0\text{V} \leq V_I \leq 15\text{V}$  |             | 18    | 75          | mV                         |
| Load Regulation   | $V_{RLOAD}$               | $1.0\text{mA} \leq I_O \leq 100\text{mA}$   |             | 20    | 60          | mV                         |
| Quiescent Current   | $I_Q$                     |   |             | 3     | 5           | mA                         |
| Quiescent Current Change  | $\Delta I_Q$              | $8.0\text{V} \leq V_I \leq 15\text{V}$  |             |       | <b>1.0</b>  | mA                         |
|   |                           | $1.0\text{mA} \leq I_O \leq 40\text{mA}$  |             |       | <b>0.1</b>  |                            |
| Output Noise Voltage  | $N_O$                     | $10\text{Hz} \leq f \leq 100\text{kHz}$ (Note 3)  |             | 40    |             | $\mu\text{V}$              |
| Ripple Rejection  | $\Delta V_I / \Delta V_O$ | $f = 120\text{Hz}$ , $8.0\text{V} \leq V_I \leq 15\text{V}$                                 | 47          | 62    |             | dB                         |
| Peak Output Current   | $I_{PK}$                  |   |             | 150   |             | mA                         |
| Average Temperature Coefficient of Output Voltage                   | $\Delta V_O / \Delta T$   | $I_O = 5.0\text{mA}$  |             | -0.65 |             | $\text{mV}/^\circ\text{C}$ |
| Minimum Value of Input Voltage Required to Maintain Line Regulation | $V_I(\text{Min})$         |   |             | 6.7   | 7           | V                          |

Note 2: Power Dissipation  $\leq 0.6\text{W}$

Note 3: Recommended minimum load capacitance of  $0.01\mu\text{F}$  to limit high frequency noise.

**3-TERMINAL POSITIVE LINEAR REGULATOR****AZ78LXX****Electrical Characteristics (Continued)****AZ78L08 Electrical Characteristics**

Limits in standard typeface are for  $T_J = 25^\circ\text{C}$ , **Bold typeface applies over  $0^\circ\text{C}$  to  $125^\circ\text{C}$** ,  $I_O = 40\text{ mA}$ ,  $C_1 = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ ,  $V_I = 14\text{V}$ , unless otherwise specified.

| Parameter   | Symbol                    | Conditions   | Min        | Typ  | Max        | Unit                       |
|---|---------------------------|--|------------|------|------------|----------------------------|
| Output Voltage  | $V_O$                     |  | 7.7        | 8.0  | 8.3        | V                          |
|   |                           | $11\text{V} \leq V_I \leq 18\text{V}$<br>$1.0\text{mA} \leq I_O \leq 40\text{mA}$ (Note 2) | <b>7.6</b> |      | <b>8.4</b> |                            |
| Line Regulation   | $V_{RLINE}$               | $11\text{V} \leq V_I \leq 18\text{V}$  |            | 18   | 75         | mV                         |
| Load Regulation   | $V_{RLOAD}$               | $1.0\text{mA} \leq I_O \leq 100\text{mA}$  |            | 20   | 90         | mV                         |
| Quiescent Current   | $I_Q$                     |  |            | 3    | 5          | mA                         |
| Quiescent Current Change  | $\Delta I_Q$              | $11\text{V} \leq V_I \leq 18\text{V}$  |            |      | <b>1.5</b> | mA                         |
|   |                           | $1.0\text{mA} \leq I_O \leq 40\text{mA}$   |            |      | <b>0.1</b> |                            |
| Output Noise Voltage  | $N_O$                     | $10\text{Hz} \leq f \leq 100\text{kHz}$ (Note 3)   |            | 60   |            | $\mu\text{V}$              |
| Ripple Rejection  | $\Delta V_I / \Delta V_O$ | $f = 120\text{Hz}$ , $11\text{V} \leq V_I \leq 18\text{V}$                                 | 39         | 45   |            | dB                         |
| Peak Output Current   | $I_{PK}$                  |  |            | 150  |            | mA                         |
| Average Temperature Coefficient of Output Voltage                   | $\Delta V_O / \Delta T$   | $I_O = 5.0\text{mA}$   |            | -0.8 |            | $\text{mV}/^\circ\text{C}$ |
| Minimum Value of Input Voltage Required to Maintain Line Regulation | $V_{I(\text{Min})}$       |  |            | 9.7  |            | V                          |

Note 2: Power Dissipation  $\leq 0.6\text{W}$

Note 3: Recommended minimum load capacitance of  $0.01\mu\text{F}$  to limit high frequency noise.

**3-TERMINAL POSITIVE LINEAR REGULATOR****AZ78LXX****Electrical Characteristics (Continued)****AZ78L09 Electrical Characteristics**

Limits in standard typeface are for  $T_J = 25^\circ\text{C}$ , **Bold typeface applies over  $0^\circ\text{C}$  to  $125^\circ\text{C}$** ,  $I_O = 40\text{ mA}$ ,  $C_1 = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ ,  $V_I = 15\text{V}$ , unless otherwise specified.

| Parameter   | Symbol                    | Conditions   | Min         | Typ  | Max         | Unit                       |
|---|---------------------------|--|-------------|------|-------------|----------------------------|
| Output Voltage  | $V_O$                     |  | 8.6         | 9    | 9.4         | V                          |
|   |                           | $12\text{V} \leq V_I \leq 18\text{V}$<br>$1.0\text{mA} \leq I_O \leq 40\text{mA}$ (Note 2) | <b>8.55</b> |      | <b>9.45</b> |                            |
| Line Regulation   | $V_{RLINE}$               | $12\text{V} \leq V_I \leq 18\text{V}$  |             | 18   | 75          | mV                         |
| Load Regulation   | $V_{RLOAD}$               | $1.0\text{mA} \leq I_O \leq 100\text{mA}$  |             | 20   | 90          | mV                         |
| Quiescent Current   | $I_Q$                     |  |             | 3    | 5           | mA                         |
| Quiescent Current Change  | $\Delta I_Q$              | $12\text{V} \leq V_I \leq 18\text{V}$  |             |      | <b>1.5</b>  | mA                         |
|   |                           | $1.0\text{mA} \leq I_O \leq 40\text{mA}$   |             |      | <b>0.1</b>  |                            |
| Output Noise Voltage  | $N_O$                     | $10\text{Hz} \leq f \leq 100\text{kHz}$ (Note 3)   |             | 70   |             | $\mu\text{V}$              |
| Ripple Rejection  | $\Delta V_I / \Delta V_O$ | $f = 120\text{Hz}$ , $12\text{V} \leq V_I \leq 18\text{V}$                                 | 38          | 44   |             | dB                         |
| Peak Output Current   | $I_{PK}$                  |  |             | 150  |             | mA                         |
| Average Temperature Coefficient of Output Voltage                   | $\Delta V_O / \Delta T$   | $I_O = 5.0\text{mA}$   |             | -0.9 |             | $\text{mV}/^\circ\text{C}$ |
| Minimum Value of Input Voltage Required to Maintain Line Regulation | $V_I(\text{Min})$         |  |             | 10.7 |             | V                          |

Note 2: Power Dissipation  $\leq 0.6\text{W}$

Note 3: Recommended minimum load capacitance of  $0.01\mu\text{F}$  to limit high frequency noise.



**3-TERMINAL POSITIVE LINEAR REGULATOR****AZ78LXX****Electrical Characteristics (Continued)****AZ78L12 Electrical Characteristics**

Limits in standard typeface are for  $T_J = 25^\circ\text{C}$ , **Bold typeface applies over  $0^\circ\text{C}$  to  $125^\circ\text{C}$** ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ ,  $V_I = 18\text{V}$ , unless otherwise specified.

| Parameter   | Symbol                    | Conditions   | Min         | Typ  | Max         | Unit                 |
|---|---------------------------|--|-------------|------|-------------|----------------------|
| Output Voltage  | $V_O$                     |  | 11.5        | 12   | 12.5        | V                    |
|   |                           | $15\text{V} \leq V_I \leq 18\text{V}$<br>$1.0\text{mA} \leq I_O \leq 40\text{mA}$ (Note 2) | <b>11.4</b> |      | <b>12.6</b> |                      |
| Line Regulation   | $V_{RLINE}$               | $15\text{V} \leq V_I \leq 18\text{V}$  |             | 18   | 75          | mV                   |
| Load Regulation   | $V_{RLOAD}$               | $1.0\text{mA} \leq I_O \leq 100\text{mA}$  |             | 20   | 90          | mV                   |
| Quiescent Current   | $I_Q$                     |  |             | 3    | 5           | mA                   |
| Quiescent Current Change  | $\Delta I_Q$              | $15\text{V} \leq V_I \leq 18\text{V}$  |             |      | <b>1.5</b>  | mA                   |
|   |                           | $1.0\text{mA} \leq I_O \leq 40\text{mA}$   |             |      | <b>0.1</b>  |                      |
| Output Noise Voltage  | $N_O$                     | $10\text{Hz} \leq f \leq 100\text{kHz}$ (Note 3)   |             | 80   |             | $\mu\text{V}$        |
| Ripple Rejection  | $\Delta V_I / \Delta V_O$ | $f = 120\text{Hz}$ , $15\text{V} \leq V_I \leq 18\text{V}$                                 | 40          | 54   |             | dB                   |
| Peak Output Current   | $I_{PK}$                  |  |             | 150  |             | mA                   |
| Average Temperature Coefficient of Output Voltage                   | $\Delta V_O / \Delta T$   | $I_O = 5.0\text{mA}$   |             | -1.0 |             | mV/ $^\circ\text{C}$ |
| Minimum Value of Input Voltage Required to Maintain Line Regulation | $V_I(\text{Min})$         |  |             | 13.7 |             | V                    |

Note 2: Power Dissipation  $\leq 0.6\text{W}$

Note 3: Recommended minimum load capacitance of  $0.01\mu\text{F}$  to limit high frequency noise.



### 3-TERMINAL POSITIVE LINEAR REGULATOR

AZ78LXX

#### Typical Performance Characteristics

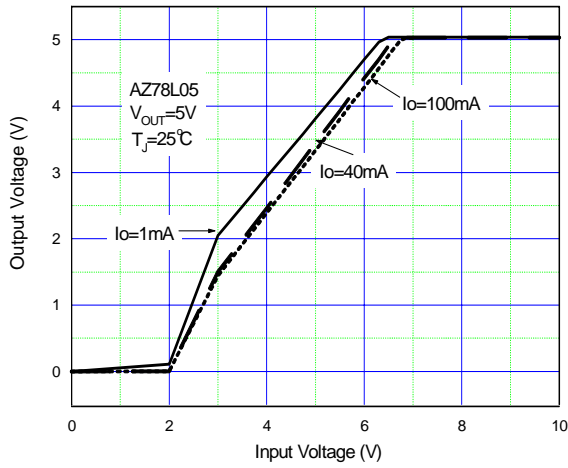


Figure 4. Dropout Characteristics

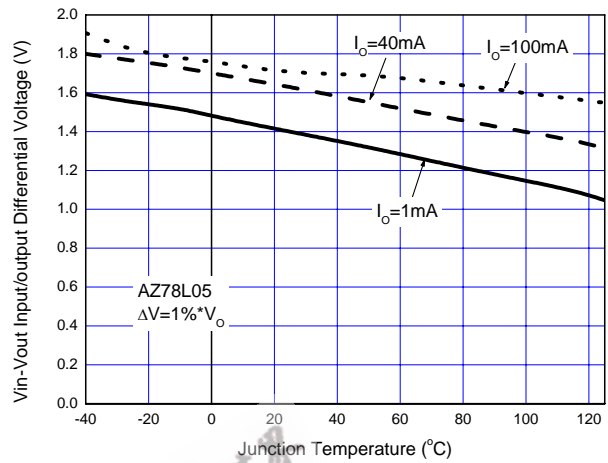


Figure 5. Dropout Voltage vs. Junction Temperature

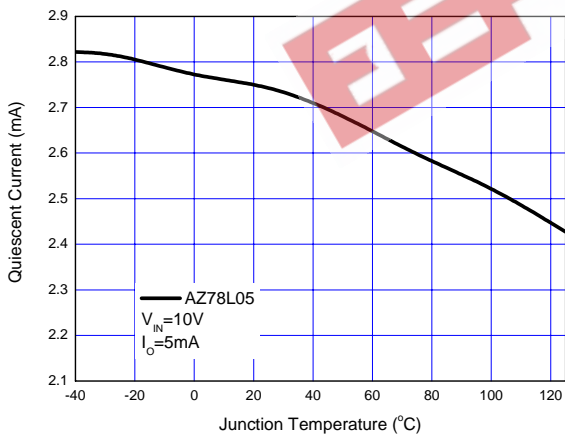


Figure 6. Quiescent Current vs. Junction Temperature

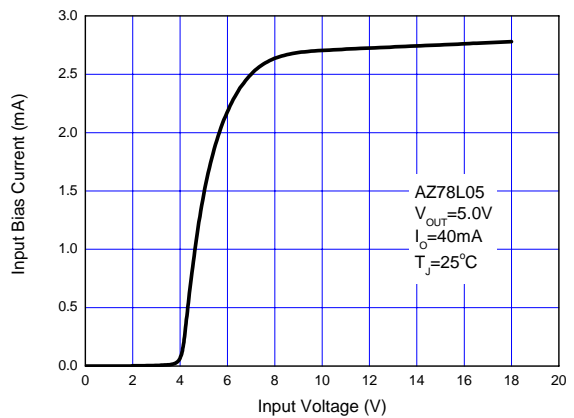


Figure 7. Input Bias Current vs. Input Voltage



**3-TERMINAL POSITIVE LINEAR REGULATOR**

**AZ78LXX**

**Typical Performance Characteristics (Continued)**

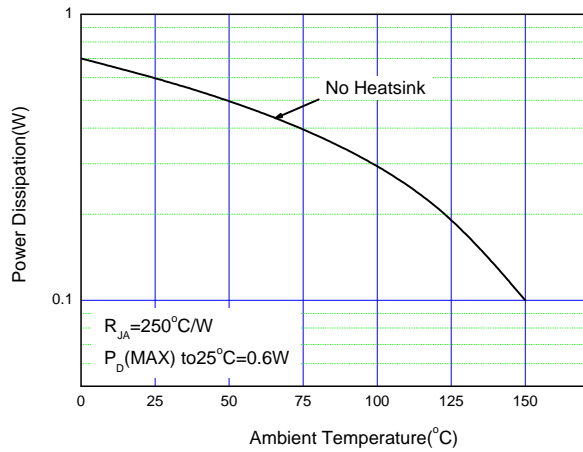


Figure 8. Maximum Power Dissipation vs. Ambient Temperature (SOIC-8 Package)

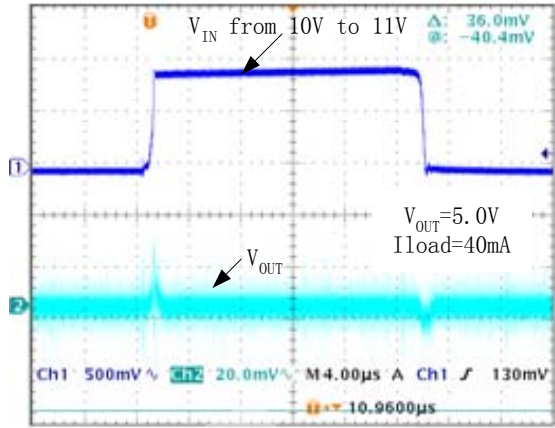


Figure 9. Line Transient Response

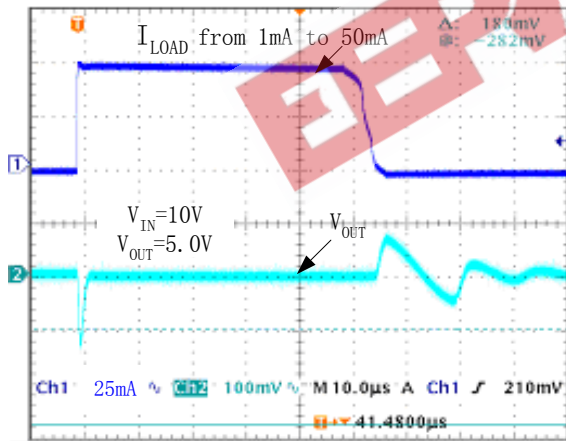


Figure 10. Load Transient Response



**3-TERMINAL POSITIVE LINEAR REGULATOR**

**AZ78LXX**

**Typical Application**



Note 4: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulator.

Figure 11. Typical Application of the AZ78LXX





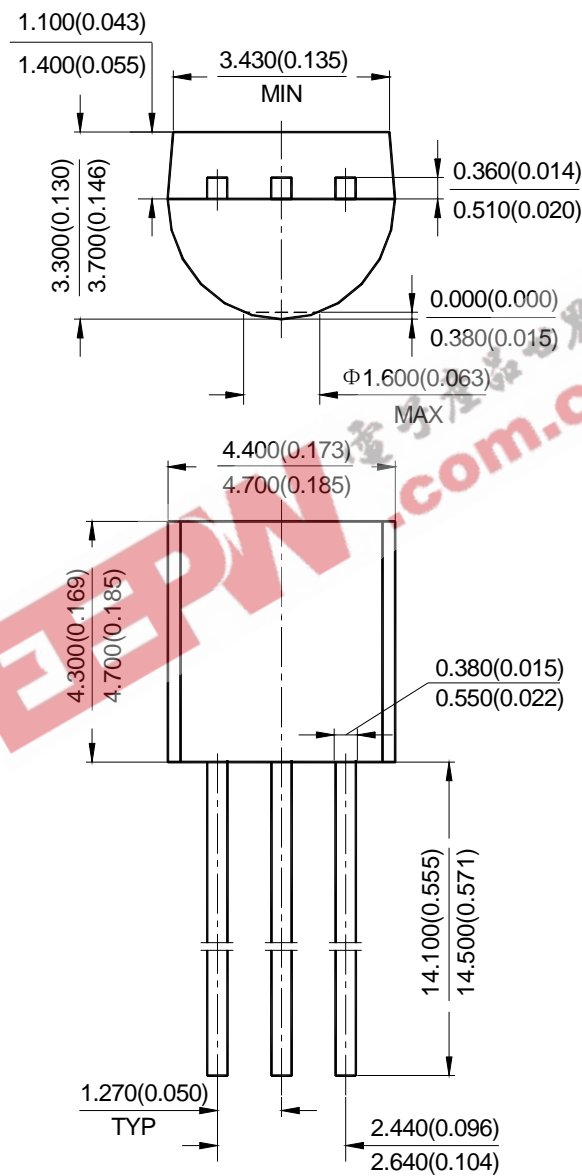
**3-TERMINAL POSITIVE LINEAR REGULATOR**

**AZ78LXX**

**Mechanical Dimensions**

**TO-92**

**Unit: mm(inch)**







**3-TERMINAL POSITIVE LINEAR REGULATOR**

**AZ78LXX**

**Mechanical Dimensions (Continued):**

**SOT-223**

**Unit: mm(inch)**









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