

MC78LXXA / LM78LXXA

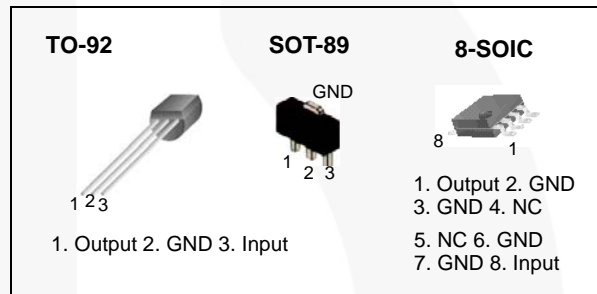
3-Terminal 0.1 A Positive Voltage Regulator

Features

- Maximum Output Current of 100 mA
- Output Voltage of 5 V, 6 V, 8 V, 12 V, and 15 V
- Thermal Overload Protection
- Short-Circuit Current Limiting
- Output Voltage Offered in $\pm 5\%$ Tolerance

Description

The MC78LXXA / LM78LXXA series of fixed-voltage monolithic integrated circuit voltage regulators are suitable for applications that required supply current up to 100 mA.



Ordering Information

| Product Number | Package | Packing Method | Output Voltage Tolerance | Operating Temperature |
|----------------|-------------|----------------|--------------------------|-----------------------|
| LM78L05ACZ | TO-92 | Bulk | $\pm 5\%$ | 0 to +125°C |
| LM78L05ACZX | | Tape & Reel | | |
| LM78L05ACZXA | | Ammo | | |
| LM78L12ACZ | | Bulk | | |
| LM78L12ACZX | | Tape & Reel | | |
| MC78L05ACP | | Bulk | | |
| MC78L05ACPXA | | Ammo | | |
| MC78L06ACP | | Bulk | | |
| MC78L08ACP | | Bulk | | |
| MC78L15ACP | | Bulk | | |
| MC78L15ACPXA | | Ammo | | |
| MC78L05ACD | | 8-SOIC | | |
| MC78L05ACDX | Tape & Reel | | | |
| MC78L05ACHX | SOT-89 | Tape & Reel | | |
| MC78L08ACHX | | Tape & Reel | | |

Block Diagram

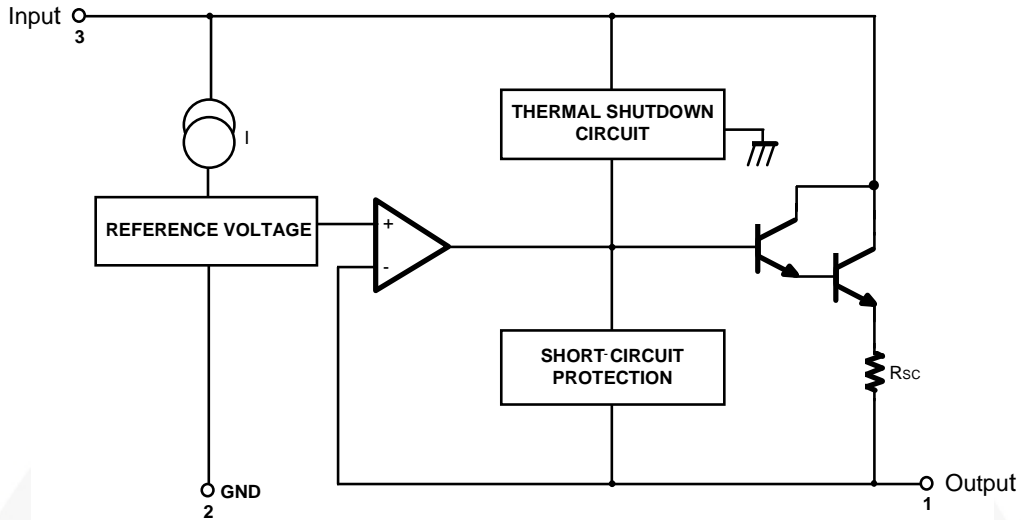


Figure 1. Block Diagram

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at $T_A = 25^\circ\text{C}$ unless otherwise noted.

| Symbol | Parameter | | Value | Unit |
|-----------------|--------------------------------------|------------------------------------|-------------|--------------------|
| V_I | Input Voltage | $V_O = 5\text{ V to }8\text{ V}$ | 30 | V |
| | | $V_O = 12\text{ V to }15\text{ V}$ | 35 | V |
| T_J | Operating Junction Temperature Range | | 0 to +150 | $^\circ\text{C}$ |
| T_{STG} | Storage Temperature Range | | -65 to +150 | $^\circ\text{C}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-Case | TO-92 | 50 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-Air | TO-92 | 150 | $^\circ\text{C/W}$ |
| | | SOT-89 | 225 | $^\circ\text{C/W}$ |
| | | 8-SOIC | 160 | $^\circ\text{C/W}$ |

Electrical Characteristics (MC78L05A / LM78L05A)

$V_I = 10\text{ V}$, $I_O = 40\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$, unless otherwise specified.

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit | |
|-----------------------|----------------------------------|---|---|-------|------|----------------------------|----|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | 4.8 | 5.0 | 5.2 | V | |
| ΔV_O | Line Regulation ⁽¹⁾ | $T_J = 25^\circ\text{C}$ | $7\text{ V} \leq V_I \leq 20\text{ V}$ | | 8 | 150 | mV |
| | | | $8\text{ V} \leq V_I \leq 20\text{ V}$ | | 6 | 100 | mV |
| ΔV_O | Load Regulation ⁽¹⁾ | $T_J = 25^\circ\text{C}$ | $1\text{ mA} \leq I_O \leq 100\text{ mA}$ | | 11 | 60 | mV |
| | | | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | | 5.0 | 30.0 | mV |
| V_O | Output Voltage | $7\text{ V} \leq V_I \leq 20\text{ V}$ | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | | | 5.25 | V |
| | | $7\text{ V} \leq V_I \leq V_{MAX}^{(2)}$ | $1\text{ mA} \leq I_O \leq 70\text{ mA}$ | 4.75 | | 5.25 | V |
| I_Q | Quiescent Current | $T_J = 25^\circ\text{C}$ | | 2.0 | 5.5 | mA | |
| ΔI_Q | Quiescent Current Change | With Line | $8\text{ V} \leq V_I \leq 20\text{ V}$ | | | 1.5 | mA |
| ΔI_Q | | With Load | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | | | 0.1 | mA |
| V_N | Output Noise Voltage | $T_A = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 40 | | $\mu\text{V}/V_O$ | |
| $\Delta V_O/\Delta T$ | Temperature Coefficient of V_O | $I_O = 5\text{ mA}$ | | -0.65 | | $\text{mV}/^\circ\text{C}$ | |
| RR | Ripple Rejection | $f = 120\text{ Hz}$, $8\text{ V} \leq V_I \leq 18\text{ V}$, $T_J = 25^\circ\text{C}$ | 41 | 80 | | dB | |
| V_D | Dropout Voltage | $T_J = 25^\circ\text{C}$ | | 1.7 | | V | |

Notes:

- The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
- Power dissipation $P_D \leq 0.75\text{ W}$.

Electrical Characteristics (MC78L06A)

$V_I = 12\text{ V}$, $I_O = 40\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$, unless otherwise specified.

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit | |
|-----------------------|----------------------------------|--|---|------|------|----------------------------|----|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | 5.75 | 6.0 | 6.25 | V | |
| ΔV_O | Line Regulation ⁽³⁾ | $T_J = 25^\circ\text{C}$ | $8.5\text{ V} \leq V_I \leq 20\text{ V}$ | | 64 | 175 | mV |
| | | | $9\text{ V} \leq V_I \leq 20\text{ V}$ | | 54 | 125 | mV |
| ΔV_O | Load Regulation ⁽³⁾ | $T_J = 25^\circ\text{C}$ | $1\text{ mA} \leq I_O \leq 100\text{ mA}$ | | 12.8 | 80.0 | mV |
| | | | $1\text{ mA} \leq I_O \leq 70\text{ mA}$ | | 5.8 | 40.0 | mV |
| V_O | Output Voltage | $8.5\text{ V} \leq V_I \leq 20\text{ V}$, $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | 5.7 | | 6.3 | V | |
| | | $8.5\text{ V} \leq V_I \leq V_{\text{MAX}}^{(4)}$, $1\text{ mA} \leq I_O \leq 70\text{ mA}$ | 5.7 | | 6.3 | V | |
| I_Q | Quiescent Current | $T_J = 25^\circ\text{C}$ | | | 5.5 | mA | |
| | | $T_J = 125^\circ\text{C}$ | | 3.9 | 6.0 | mA | |
| ΔI_Q | Quiescent Current Change | With Line | $9\text{ V} \leq V_I \leq 20\text{ V}$ | | | 1.5 | mA |
| ΔI_Q | | With Load | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | | | 0.1 | mA |
| V_N | Output Noise Voltage | $T_A = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 40 | | $\mu\text{V}/V_O$ | |
| $\Delta V_O/\Delta T$ | Temperature Coefficient of V_O | $I_O = 5\text{ mA}$ | | 0.75 | | $\text{mV}/^\circ\text{C}$ | |
| RR | Ripple Rejection | $f = 120\text{ Hz}$, $10\text{ V} \leq V_I \leq 20\text{ V}$, $T_J = 25^\circ\text{C}$ | 40 | 46 | | dB | |
| V_D | Dropout Voltage | $T_J = 25^\circ\text{C}$ | | 1.7 | | V | |

Notes:

- The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
- Power dissipation $P_D \leq 0.75\text{ W}$.

Electrical Characteristics (MC78L08A)

$V_I = 14\text{ V}$, $I_O = 40\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\text{ }\mu\text{F}$, $C_O = 0.1\text{ }\mu\text{F}$, unless otherwise specified.

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit | |
|-----------------------|----------------------------------|--|---|------|------|----------------------------|----|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | 7.7 | 8.0 | 8.3 | V | |
| ΔV_O | Line Regulation ⁽⁵⁾ | $T_J = 25^\circ\text{C}$ | $10.5\text{ V} \leq V_I \leq 23\text{ V}$ | | 10 | 175 | mV |
| | | | $11\text{ V} \leq V_I \leq 23\text{ V}$ | | 8 | 125 | mV |
| ΔV_O | Load Regulation ⁽⁵⁾ | $T_J = 25^\circ\text{C}$ | $1\text{ mA} \leq I_O \leq 100\text{ mA}$ | | 15 | 80 | mV |
| | | | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | | 8 | 40 | mV |
| V_O | Output Voltage | $10.5\text{ V} \leq V_I \leq 23\text{ V}$ | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | 7.6 | | 8.4 | V |
| | | $10.5\text{ V} \leq V_I \leq V_{\text{MAX}}^{(6)}$ | $1\text{ mA} \leq I_O \leq 70\text{ mA}$ | 7.6 | | 8.4 | V |
| I_Q | Quiescent Current | $T_J = 25^\circ\text{C}$ | | 2.0 | 5.5 | mA | |
| ΔI_Q | Quiescent Current Change | With Line | $11\text{ V} \leq V_I \leq 23\text{ V}$ | | | 1.5 | mA |
| ΔI_Q | | With Load | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | | | 0.1 | mA |
| V_N | Output Noise Voltage | $T_A = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 60 | | $\mu\text{V}/V_O$ | |
| $\Delta V_O/\Delta T$ | Temperature Coefficient of V_O | $I_O = 5\text{ mA}$ | | -0.8 | | $\text{mV}/^\circ\text{C}$ | |
| RR | Ripple Rejection | $f = 120\text{ Hz}$, $11\text{ V} \leq V_I \leq 21\text{ V}$, $T_J = 25^\circ\text{C}$ | 39 | 70 | | dB | |
| V_D | Dropout Voltage | $T_J = 25^\circ\text{C}$ | | 1.7 | | V | |

Notes:

- The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
- Power dissipation $P_D \leq 0.75\text{ W}$.

Electrical Characteristics (MC78L12A / LM78L12A)

$V_I = 19\text{ V}$, $I_O = 40\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$, unless otherwise specified.

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit | |
|-----------------------|----------------------------------|--|---|------|------|----------------------------|----|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | 11.5 | 12.0 | 12.5 | V | |
| ΔV_O | Line Regulation ⁽⁷⁾ | $T_J = 25^\circ\text{C}$ | $14.5\text{ V} \leq V_I \leq 27\text{ V}$ | | 20 | 250 | mV |
| | | | $16\text{ V} \leq V_I \leq 27\text{ V}$ | | 15 | 200 | mV |
| ΔV_O | Load Regulation ⁽⁷⁾ | $T_J = 25^\circ\text{C}$ | $1\text{ mA} \leq I_O \leq 100\text{ mA}$ | | 20 | 100 | mV |
| | | | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | | 10 | 50 | mV |
| V_O | Output Voltage | $14.5\text{ V} \leq V_I \leq 27\text{ V}$ | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | 11.4 | | 12.6 | V |
| | | $14.5\text{ V} \leq V_I \leq V_{\text{MAX}}^{(8)}$ | $1\text{ mA} \leq I_O \leq 70\text{ mA}$ | 11.4 | | 12.6 | V |
| I_Q | Quiescent Current | $T_J = 25^\circ\text{C}$ | | 2.1 | 6.0 | mA | |
| ΔI_Q | Quiescent Current Change | With Line | $16\text{ V} \leq V_I \leq 27\text{ V}$ | | | 1.5 | mA |
| ΔI_Q | | With Load | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | | | 0.1 | mA |
| V_N | Output Noise Voltage | $T_A = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 80 | | $\mu\text{V}/V_O$ | |
| $\Delta V_O/\Delta T$ | Temperature Coefficient of V_O | $I_O = 5\text{ mA}$ | | -1.0 | | $\text{mV}/^\circ\text{C}$ | |
| RR | Ripple Rejection | $f = 120\text{ Hz}$, $15\text{ V} \leq V_I \leq 25\text{ V}$, $T_J = 25^\circ\text{C}$ | 37 | 65 | | dB | |
| V_D | Dropout Voltage | $T_J = 25^\circ\text{C}$ | | 1.7 | | V | |

Notes:

- The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
- Power dissipation $P_D \leq 0.75\text{ W}$.

Electrical Characteristics (MC78L15A)

$V_I = 23\text{ V}$, $I_O = 40\text{ mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$, unless otherwise specified.

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------------|--|---|-------|-------|----------------------------|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | 14.4 | 15.0 | 15.6 | V |
| ΔV_O | Line Regulation ⁽⁹⁾ | $T_J = 25^\circ\text{C}$ | $17.5\text{ V} \leq V_I \leq 30\text{ V}$ | 25 | 300 | mV |
| | | | $20\text{ V} \leq V_I \leq 30\text{ V}$ | 20 | 250 | mV |
| ΔV_O | Load Regulation ⁽⁹⁾ | $T_J = 25^\circ\text{C}$ | $1\text{ mA} \leq I_O \leq 100\text{ mA}$ | 25 | 150 | mV |
| | | | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | 12 | 75 | mV |
| V_O | Output Voltage | $17.5\text{ V} \leq V_I \leq 30\text{ V}$ | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | 14.25 | 15.75 | V |
| | | $17.5\text{ V} \leq V_I \leq V_{\text{MAX}}^{(10)}$ | $1\text{ mA} \leq I_O \leq 70\text{ mA}$ | 14.25 | 15.75 | V |
| I_Q | Quiescent Current | $T_J = 25^\circ\text{C}$ | | 2.1 | 6.0 | mA |
| ΔI_Q | Quiescent Current Change | With Line | $20\text{ V} \leq V_I \leq 30\text{ V}$ | | 1.5 | mA |
| ΔI_Q | | With Load | $1\text{ mA} \leq I_O \leq 40\text{ mA}$ | | 0.1 | mA |
| V_N | Output Noise Voltage | $T_A = 25^\circ\text{C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 90 | | $\mu\text{V}/V_o$ |
| $\Delta V_O/\Delta T$ | Temperature Coefficient of V_O | $I_O = 5\text{ mA}$ | | -1.3 | | $\text{mV}/^\circ\text{C}$ |
| RR | Ripple Rejection | $f = 120\text{ Hz}$, $18.5\text{ V} \leq V_I \leq 28.5\text{ V}$, $T_J = 25^\circ\text{C}$ | 34 | 60 | | dB |
| V_D | Dropout Voltage | $T_J = 25^\circ\text{C}$ | | 1.7 | | V |

Notes:

9. The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
10. Power dissipation $P_D \leq 0.75\text{ W}$.

Typical Application

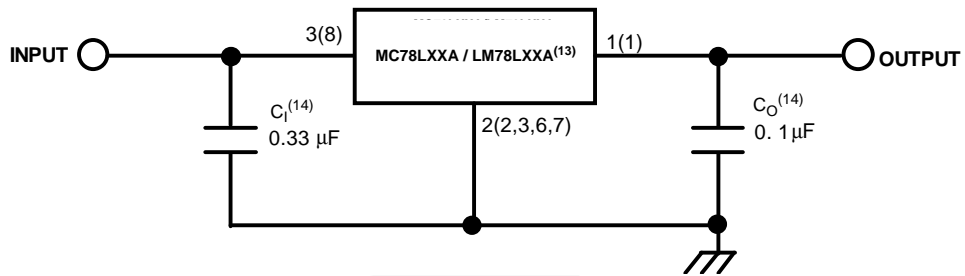


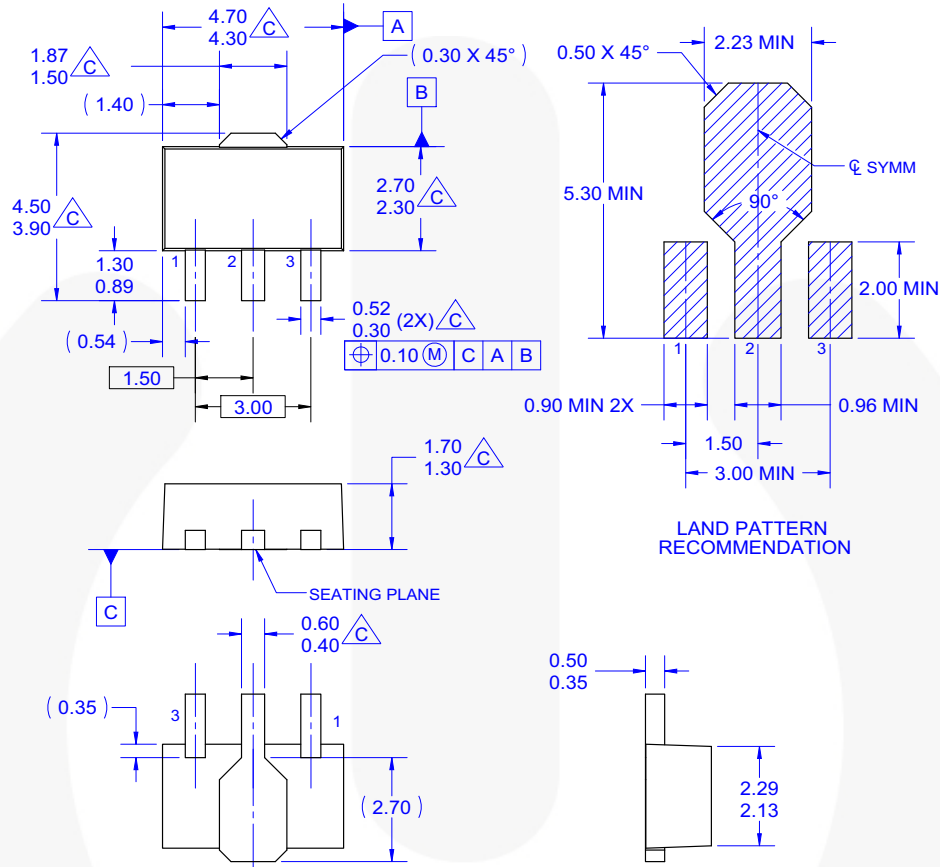
Figure 2. Typical Application

Notes:

- 13. To specify an output voltage, substitute voltage value for "XX".
- 14. C_1 is required if the regulator is located an appreciable distance from the power supply filter. Though C_o is not needed for stability, it improves transient response. Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulator.

Physical Dimensions

SOT-89



- NOTES: UNLESS OTHERWISE SPECIFIED.
- A. REFERENCE TO JEDEC TO-243 VARIATION AA.
 - B. ALL DIMENSIONS ARE IN MILLIMETERS.
 - C. DOES NOT COMPLY JEDEC STANDARD VALUE.
 - D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSION.
 - E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
 - F. DRAWING FILE NAME: MA03CREV2

Figure 3. 3-Lead, SOT-89, JEDEC TO-243, Option AA

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Physical Dimensions (Continued)

TO-92 Straight Lead for Bulk Packing

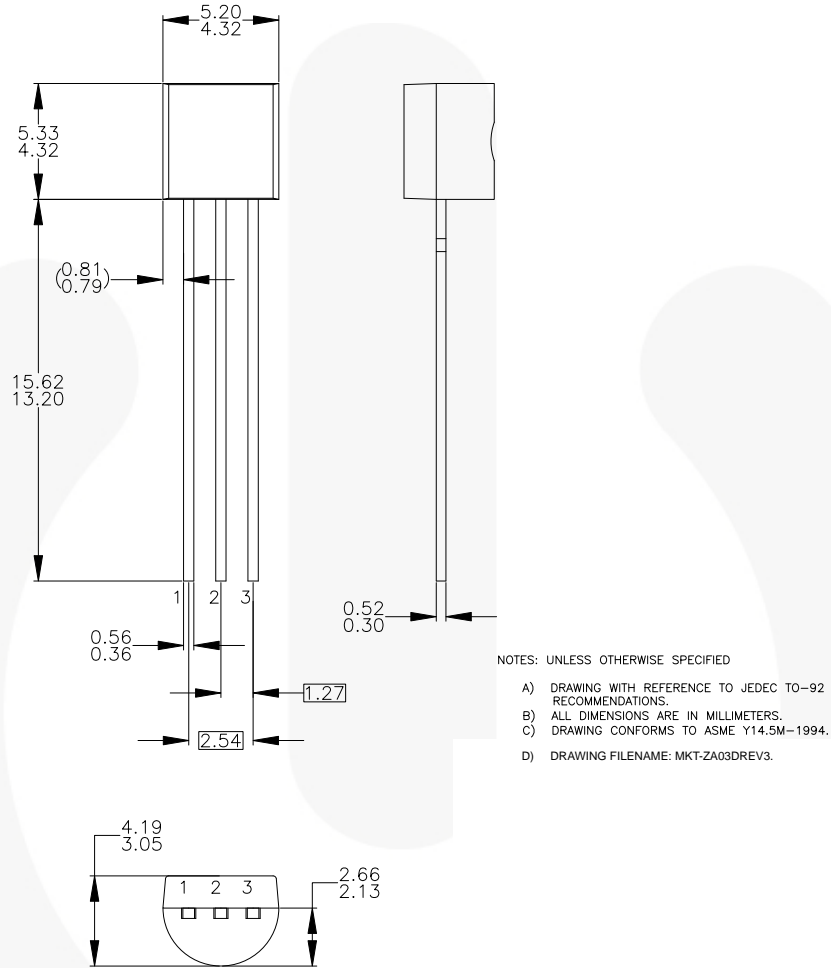


Figure 4. 3-Lead, TO-92, MOLDED STD STRAIGHT LEAD (NO EOL CODE)

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Physical Dimensions (Continued)

TO-92 Formed Lead For T&R and Ammo Packing

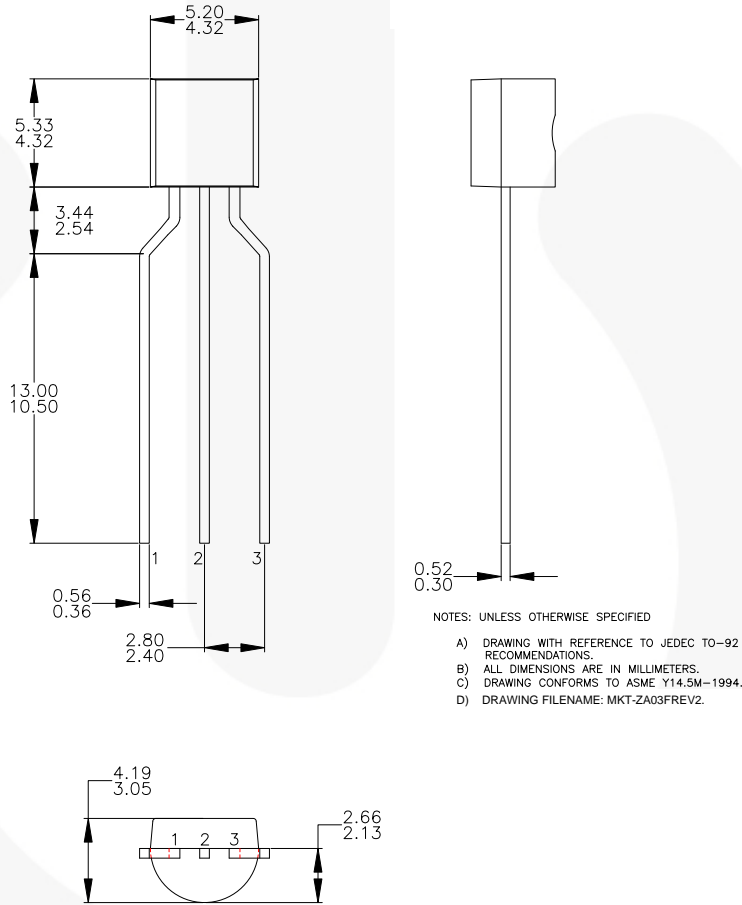


Figure 5. 3-Lead, TO-92, MOLDED 0.200 IN LINE SPACING LD FORM (J61Z OPTION)

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Physical Dimensions (Continued)

8-SOIC

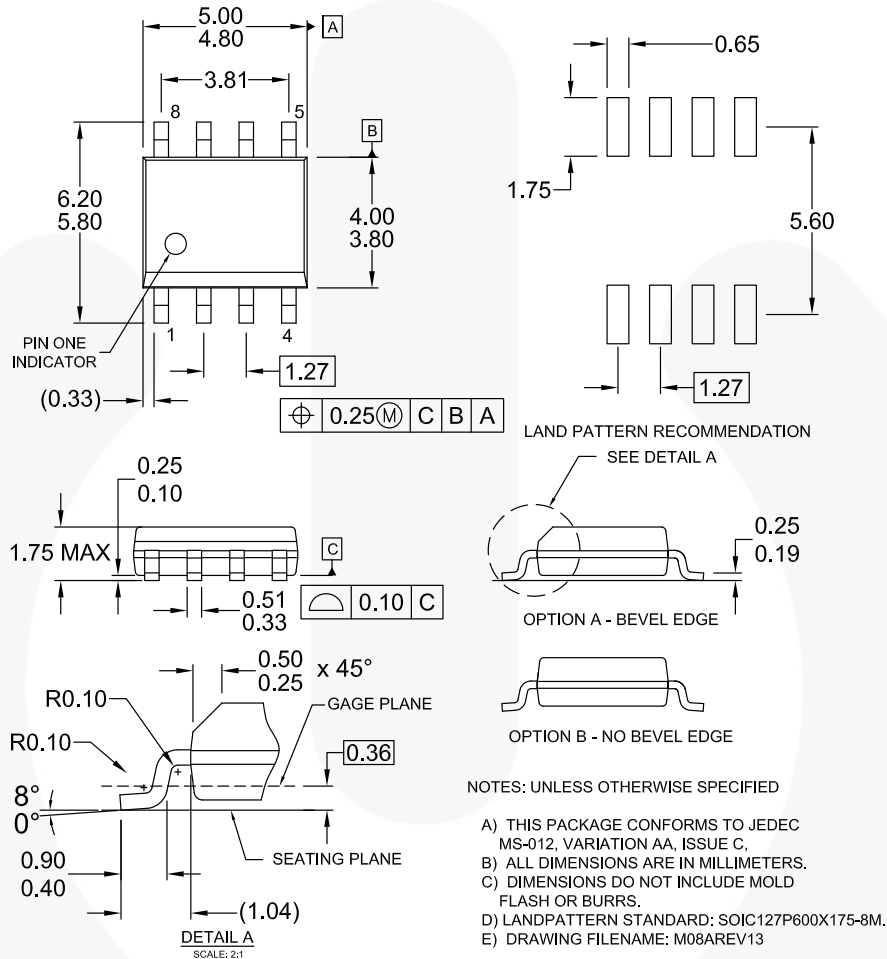


Figure 6. 8-Lead, SOIC, JEDEC MS-012, 0.150" NARROW BODY

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| BitSiC™ | Global Power Resource SM | Programmable Active Droop™ | TinyBuck™ |
| Build it Now™ | GreenBridge™ | QFET® | TinyCalc™ |
| CorePLUS™ | Green FPS™ | QS™ | TinyLogic® |
| CorePOWER™ | Green FPS™ e-Series™ | Quiet Series™ | TINYOPTO™ |
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| CTL™ | GTO™ |  | TinyPWM™ |
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ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

| Datasheet Identification | Product Status | Definition |
|--------------------------|-----------------------|---|
| Advance Information | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice. |
| Preliminary | First Production | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production | Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design. |
| Obsolete | Not In Production | Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only. |