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July 2015

MC78LXXA / LM78LXXA

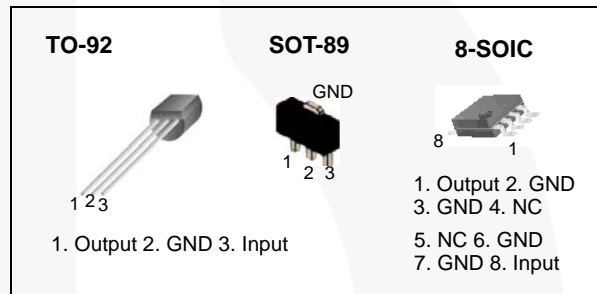
3-Terminal 0.1 A Positive Voltage Regulator

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 | $\pm 5\%$ | -40 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 | | |

MC78LXXA / LM78LXXA — 3-Terminal 0.1 A Positive Voltage Regulator

Block Diagram

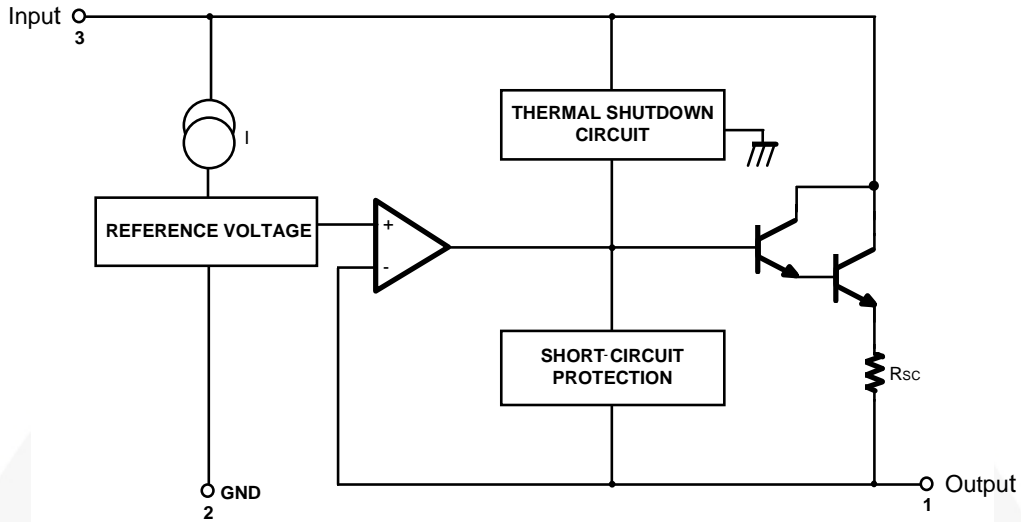


Figure 1. Block Diagram

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_{OPR} | Operating Temperature Range | | -40 to +125°C | °C |
| $T_{\text{J(MAX)}}$ | Maximum Junction Temperature | | 150 | °C |
| T_{STG} | Storage Temperature Range | | -65 to +150 | °C |
| $R_{\theta\text{JC}}$ | Thermal Resistance, Junction-Case | TO-92 | 50 | °C/W |
| $R_{\theta\text{JA}}$ | Thermal Resistance, Junction-Air | TO-92 | 150 | °C/W |
| | | SOT-89 | 225 | °C/W |
| | | 8-SOIC | 160 | °C/W |

Electrical Characteristics (MC78L05A / LM78L05A)

$V_I = 10\text{ V}$, $I_O = 40\text{ mA}$, $-40^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$, 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 |
| | | $7\text{ V} \leq V_I \leq V_{\text{MAX}}^{(2)}$ | $1\text{ mA} \leq I_O \leq 70\text{ mA}$ | 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:

1. 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.
2. Power dissipation $P_D \leq 0.75\text{ W}$.

Electrical Characteristics (MC78L06A)

$V_I = 12\text{ V}$, $I_O = 40\text{ mA}$, $-40^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$, 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 |
| | | $8.5\text{ V} \leq V_I \leq V_{MAX}^{(4)}$, $1\text{ mA} \leq I_O \leq 70\text{ mA}$ | 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:

3. 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.
4. Power dissipation $P_D \leq 0.75\text{ W}$.

Electrical Characteristics (MC78L08A)

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

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit | |
|-----------------------|----------------------------------|--|---|------|------|----------------------------|----|
| V_O | Output Voltage | $T_J = 25^\circ\text{C}$ | 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:

5. 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.
6. Power dissipation $P_D \leq 0.75\text{ W}$.

Electrical Characteristics (MC78L12A / LM78L12A)

$V_I = 19\text{ V}$, $I_O = 40\text{ mA}$, $-40^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$, 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)

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

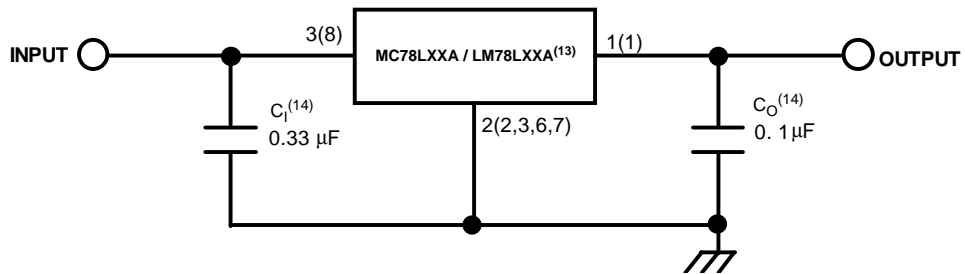
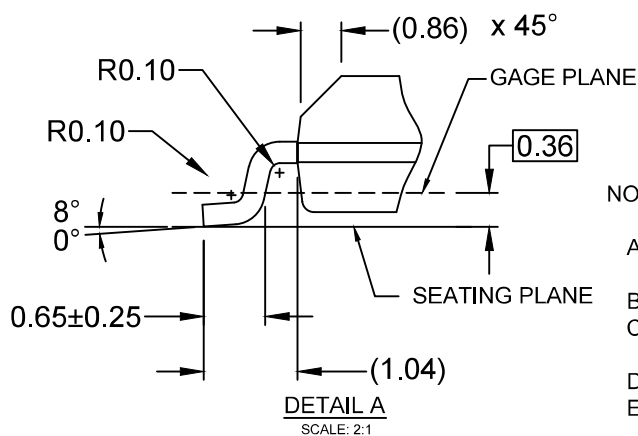
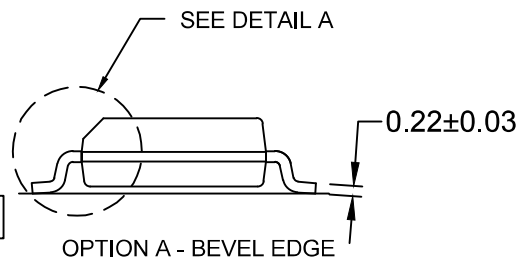
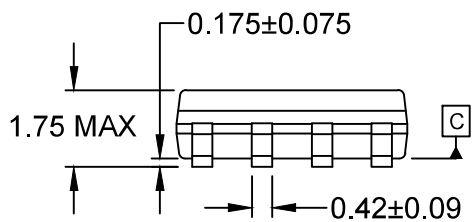
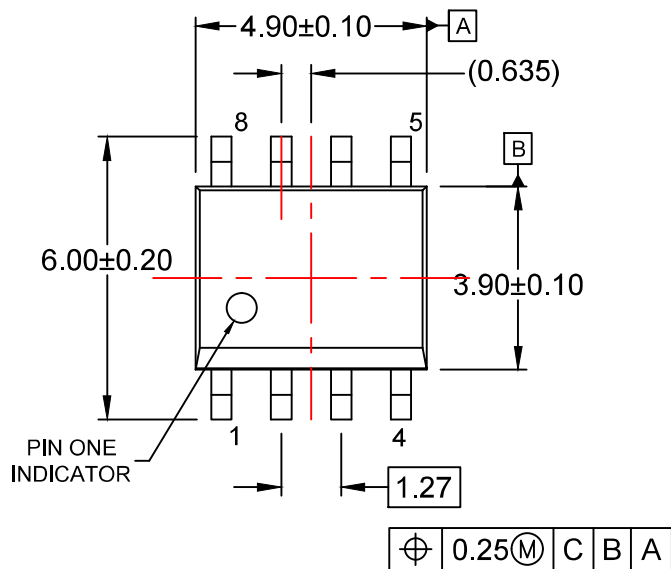


Figure 2. Typical Application

Notes:

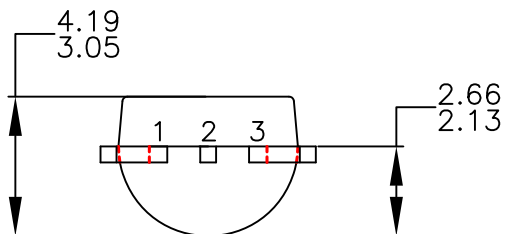
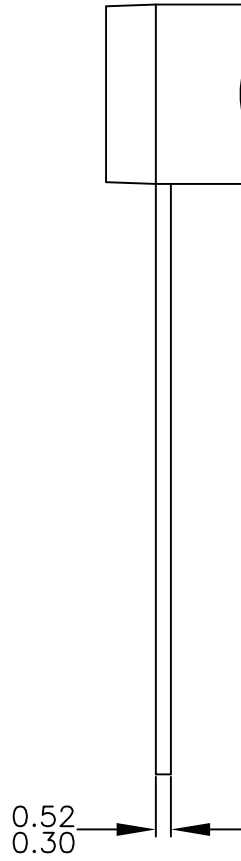
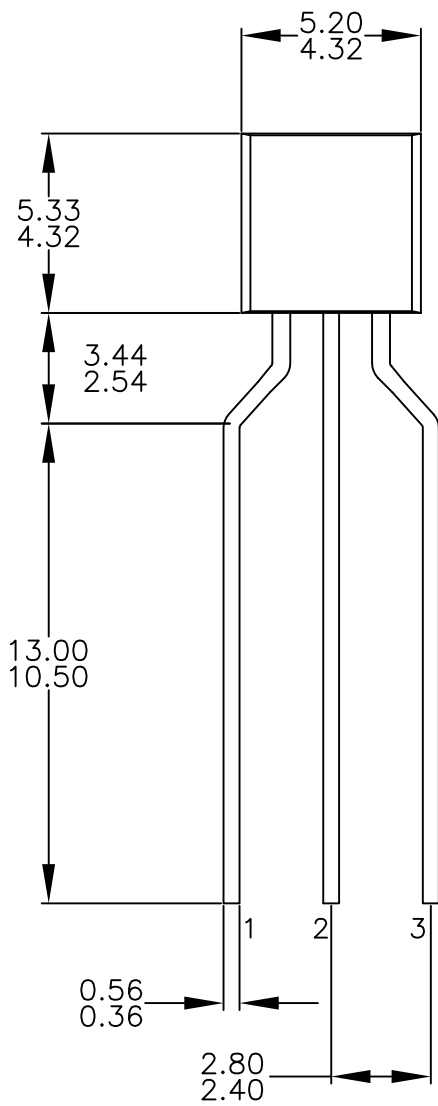
13. To specify an output voltage, substitute voltage value for "XX".
14. C_1 is required if the regulator is located an appreciable distance from the power supply filter. Though C_0 is not needed for stability, it improves transient response. Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulator.



NOTES:

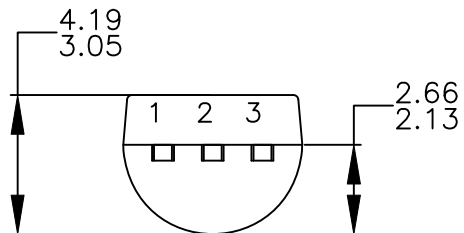
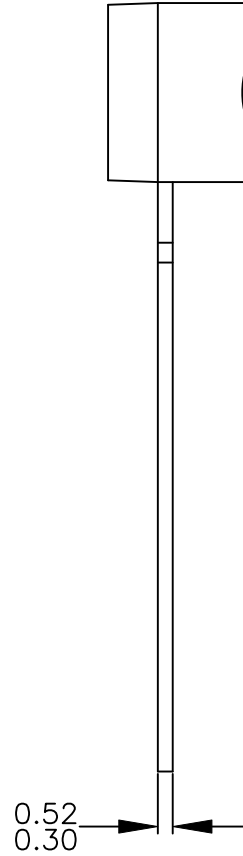
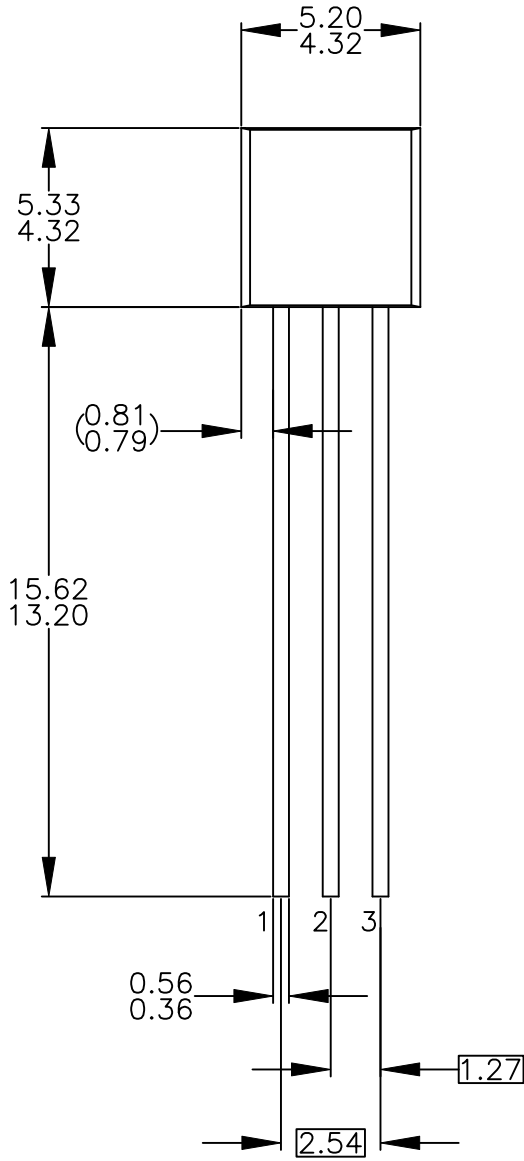
- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M
- E) DRAWING FILENAME: M08Arev16





NOTES: UNLESS OTHERWISE SPECIFIED

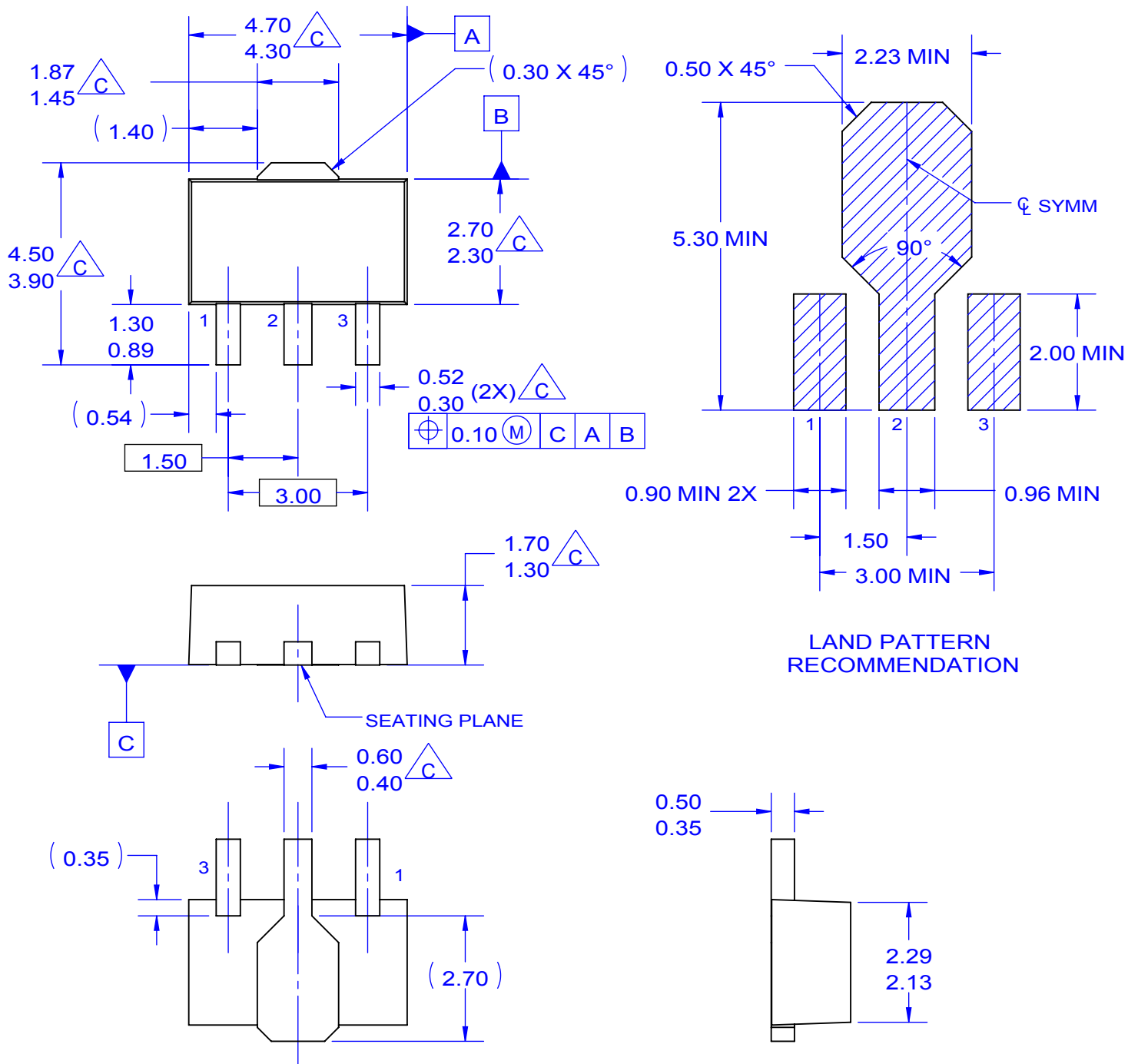
- A. DRAWING CONFORMS TO JEDEC MS-013, VARIATION AC.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5M-2009.
- D. DRAWING FILENAME: MKT-ZA03FREV3.
- E. FAIRCHILD SEMICONDUCTOR.



NOTES: UNLESS OTHERWISE SPECIFIED

- A) DRAWING WITH REFERENCE TO JEDEC TO-92 RECOMMENDATIONS.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DRAWING CONFORMS TO ASME Y14.5M-2009.
- D) DRAWING FILENAME: MKT-ZA03DREV4.





NOTES: UNLESS OTHERWISE SPECIFIED.

A. REFERENCE TO JEDEC TO-243 VARIATION AA.
 B. ALL DIMENSIONS ARE IN MILLIMETERS.

$\triangle C$ 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: MA03CREV3

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