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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 ±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.

**TO-92**

1. Output 2. GND 3. Input

**SOT-89**

**8-SOIC**

1. Output 2. GND
3. GND 4. NC
5. NC 6. GND
7. GND 8. Input

## Ordering Information

| Product Number | Package | Packing Method | Output Voltage Tolerance | Operating Temperature |
|---|---|---|---|---|
| LM78L05ACZ | TO-92 | Bulk | ±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 | Rail | | |
| MC78L05ACDX | | Tape & Reel | | |
| MC78L05ACHX | SOT-89 | Tape & Reel | | |
| MC78L08ACHX | | Tape & Reel | | |

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## Block Diagram

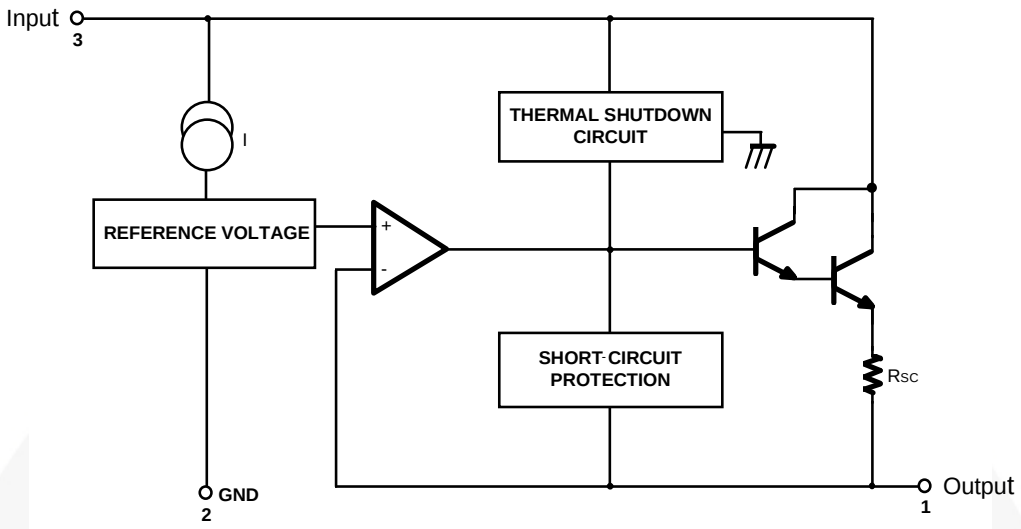


**Figure 1. Block Diagram**

## 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°C unless otherwise noted.

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_I$ | Input Voltage | $V_O$ = 5 V to 8 V | 30 | V |
| | | $V_O$ = 12 V to 15 V | 35 | V |
| $T_{OPR}$ | Operating Temperature Range | | -40 to +125°C | °C |
| $T_{J(MAX)}$ | Maximum Junction Temperature | | 150 | °C |
| $T_{STG}$ | Storage Temperature Range | | -65 to +150 | °C |
| $R_{\theta JC}$ | Thermal Resistance, Junction-Case | TO-92 | 50 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-Air | TO-92 | 150 | °C/W |
| | | SOT-89 | 225 | °C/W |
| | | 8-SOIC | 160 | °C/W |

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## Electrical Characteristics (MC78L05A / LM78L05A)

$V_I$ = 10 V, $I_O$ = 40 mA, -40°C ≤ $T_J$ ≤ 125°C, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | | $T_J$ = 25°C | | 4.8 | 5.0 | 5.2 | V |
| $\Delta V_O$ | Line Regulation(1) | | $T_J$ = 25°C | 7 V ≤ $V_I$ ≤ 20 V | | 8 | 150 | mV |
| | | | | 8 V ≤ $V_I$ ≤ 20 V | | 6 | 100 | mV |
| $\Delta V_O$ | Load Regulation(1) | | $T_J$ = 25°C | 1 mA ≤ $I_O$ ≤ 100 mA | | 11 | 60 | mV |
| | | | | 1 mA ≤ $I_O$ ≤ 40 mA | | 5.0 | 30.0 | mV |
| $V_O$ | Output Voltage | | 7 V ≤ $V_I$ ≤ 20 V | 1 mA ≤ $I_O$ ≤ 40 mA | | | 5.25 | V |
| | | | 7 V ≤ $V_I$ ≤ $V_{MAX}$(2) | 1 mA ≤ $I_O$ ≤ 70 mA | 4.75 | | 5.25 | V |
| $I_Q$ | Quiescent Current | | $T_J$ = 25°C | | | 2.0 | 5.5 | mA |
| $\Delta I_Q$ | Quiescent Current Change | With Line | 8 V ≤ $V_I$ ≤ 20 V | | | | 1.5 | mA |
| $\Delta I_Q$ | | With Load | 1 mA ≤ $I_O$ ≤ 40 mA | | | | 0.1 | mA |
| $V_N$ | Output Noise Voltage | | $T_A$ = 25°C, 10 Hz ≤ f ≤ 100 kHz | | | 40 | | µV/Vo |
| $\Delta V_O/\Delta T$ | Temperature Coefficient of $V_O$ | | $I_O$ = 5 mA | | | -0.65 | | mV/°C |
| RR | Ripple Rejection | | f = 120 Hz, 8 V ≤ $V_I$ ≤ 18 V, $T_J$ = 25°C | | 41 | 80 | | dB |
| $V_D$ | Dropout Voltage | | $T_J$ = 25°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 $P_D$ ≤ 0.75 W.

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## Electrical Characteristics (MC78L06A)

$V_I$ = 12 V, $I_O$ = 40 mA, -40°C ≤ $T_J$ ≤ 125°C, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

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

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## Electrical Characteristics (MC78L08A)

$V_I$ = 14 V, $I_O$ = 40 mA, -40°C ≤ $T_J$ ≤ 125°C, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | | $T_J$ = 25°C | | 7.7 | 8.0 | 8.3 | V |
| $\Delta V_O$ | Line Regulation(5) | | $T_J$ = 25°C | 10.5 V ≤ $V_I$ ≤ 23 V | | 10 | 175 | mV |
| | | | | 11 V ≤ $V_I$ ≤ 23 V | | 8 | 125 | mV |
| $\Delta V_O$ | Load Regulation(5) | | $T_J$ = 25°C | 1 mA ≤ $I_O$ ≤ 100 mA | | 15 | 80 | mV |
| | | | | 1 mA ≤ $I_O$ ≤ 40 mA | | 8 | 40 | mV |
| $V_O$ | Output Voltage | | 10.5V ≤ $V_I$ ≤ 23V | 1 mA ≤ $I_O$ ≤ 40 mA | 7.6 | | 8.4 | V |
| | | | 10.5V ≤ $V_I$ ≤ $V_{MAX}$(6) | 1 mA ≤ $I_O$ ≤ 70 mA | 7.6 | | 8.4 | V |
| $I_Q$ | Quiescent Current | | $T_J$ = 25°C | | | 2.0 | 5.5 | mA |
| $\Delta I_Q$ | Quiescent Current Change | With Line | 11 V ≤ $V_I$ ≤ 23 V | | | | 1.5 | mA |
| $\Delta I_Q$ | | With Load | 1 mA ≤ $I_O$ ≤ 40 mA | | | | 0.1 | mA |
| $V_N$ | Output Noise Voltage | | $T_A$ = 25°C, 10 Hz ≤ f ≤100 kHz | | | 60 | | µV/Vo |
| $\Delta V_O/\Delta T$ | Temperature Coefficient of $V_O$ | | $I_O$ = 5 mA | | | -0.8 | | mV/°C |
| RR | Ripple Rejection | | f = 120 Hz, 11 V ≤ $V_I$ ≤ 21 V, $T_J$ = 25°C | | 39 | 70 | | dB |
| $V_D$ | Dropout Voltage | | $T_J$ = 25°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 $P_D$ ≤ 0.75 W.

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## Electrical Characteristics (MC78L12A / LM78L12A)

$V_I$ = 19 V, $I_O$ = 40 mA, -40°C ≤ $T_J$ ≤ 125°C, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

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

**Notes:**

7. 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.
8. Power dissipation $P_D$ ≤ 0.75 W.

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## Electrical Characteristics (MC78L15A)

$V_I$ = 23 V, $I_O$ = 40 mA, -40°C ≤ $T_J$ ≤ 125°C, $C_I$ = 0.33 µF, $C_O$ = 0.1 µF, unless otherwise specified.

| Symbol | Parameter | | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | | $T_J$ = 25°C | | 14.4 | 15.0 | 15.6 | V |
| $\Delta V_O$ | Line Regulation(9) | | $T_J$ = 25°C | 17.5 V ≤ $V_I$ ≤ 30 V | | 25 | 300 | mV |
| | | | | 20 V ≤ $V_I$ ≤ 30 V | | 20 | 250 | mV |
| $\Delta V_O$ | Load Regulation(9) | | $T_J$ = 25°C | 1 mA ≤ $I_O$ ≤ 100 mA | | 25 | 150 | mV |
| | | | | 1 mA ≤ $I_O$ ≤ 40 mA | | 12 | 75 | mV |
| $V_O$ | Output Voltage | | 17.5 V ≤ $V_I$ ≤ 30 V | 1 mA ≤ $I_O$ ≤ 40 mA | 14.25 | | 15.75 | V |
| | | | 17.5 V ≤ $V_I$ ≤ $V_{MAX}$(10) | 1 mA ≤ $I_O$ ≤ 70 mA | 14.25 | | 15.75 | V |
| $I_Q$ | Quiescent Current | | $T_J$ = 25°C | | | 2.1 | 6.0 | mA |
| $\Delta I_Q$ | Quiescent Current Change | With Line | 20 V ≤ $V_I$ ≤ 30 V | | | | 1.5 | mA |
| $\Delta I_Q$ | | With Load | 1 mA ≤ $I_O$ ≤ 40 mA | | | | 0.1 | mA |
| $V_N$ | Output Noise Voltage | | $T_A$ = 25°C, 10 Hz ≤ f ≤ 100 kHz | | | 90 | | µV/Vo |
| $\Delta V_O/\Delta T$ | Temperature Coefficient of $V_O$ | | $I_O$ = 5 mA | | | -1.3 | | mV/°C |
| RR | Ripple Rejection | | f = 120 Hz, 18.5 V ≤ $V_I$ ≤28.5 V, $T_J$ = 25°C | | 34 | 60 | | dB |
| $V_D$ | Dropout Voltage | | $T_J$ = 25°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 $P_D$ ≤ 0.75 W.

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## Typical Application

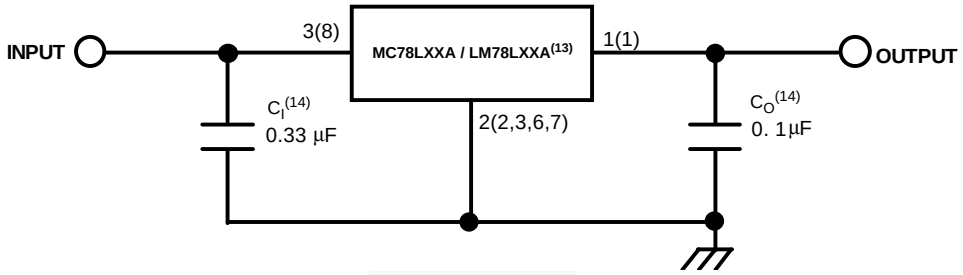


**Figure 2. Typical Application**

**Notes:**

13. To specify an output voltage, substitute voltage value for “XX”.
14. $C_I$ 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.

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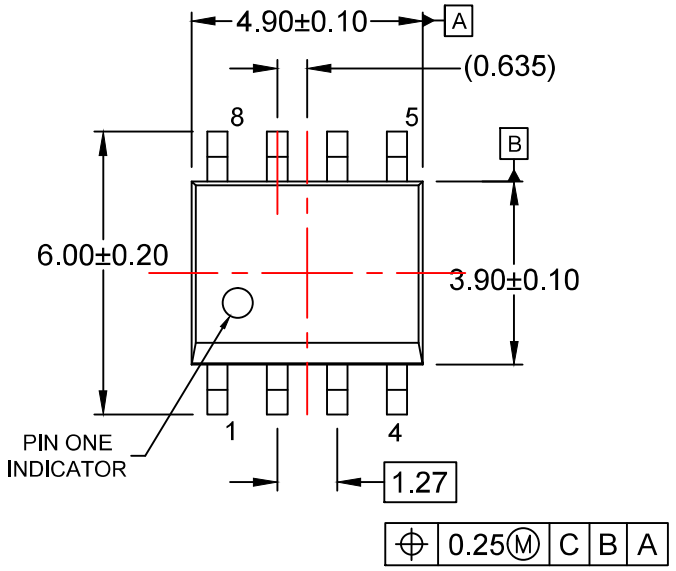
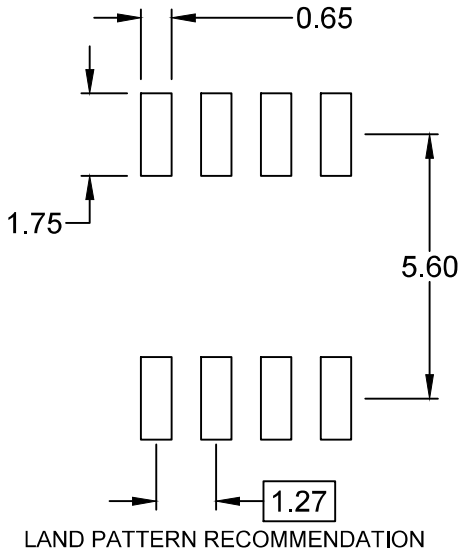
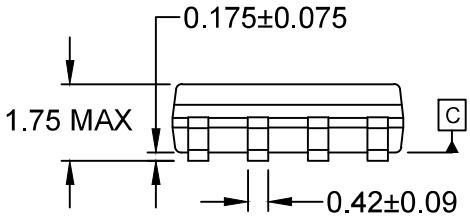
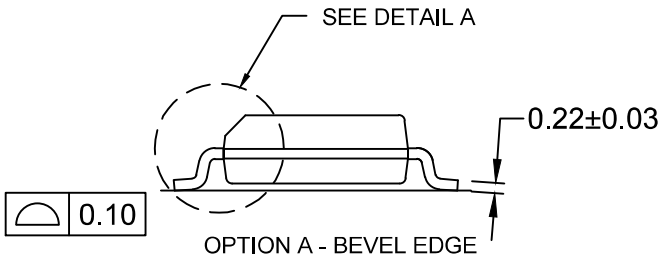


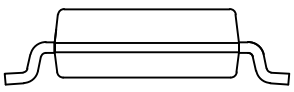




LAND PATTERN RECOMMENDATION

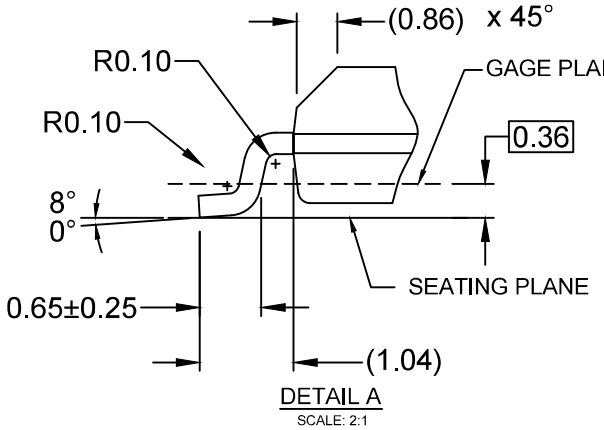



OPTION A - BEVEL EDGE



OPTION B - NO BEVEL EDGE

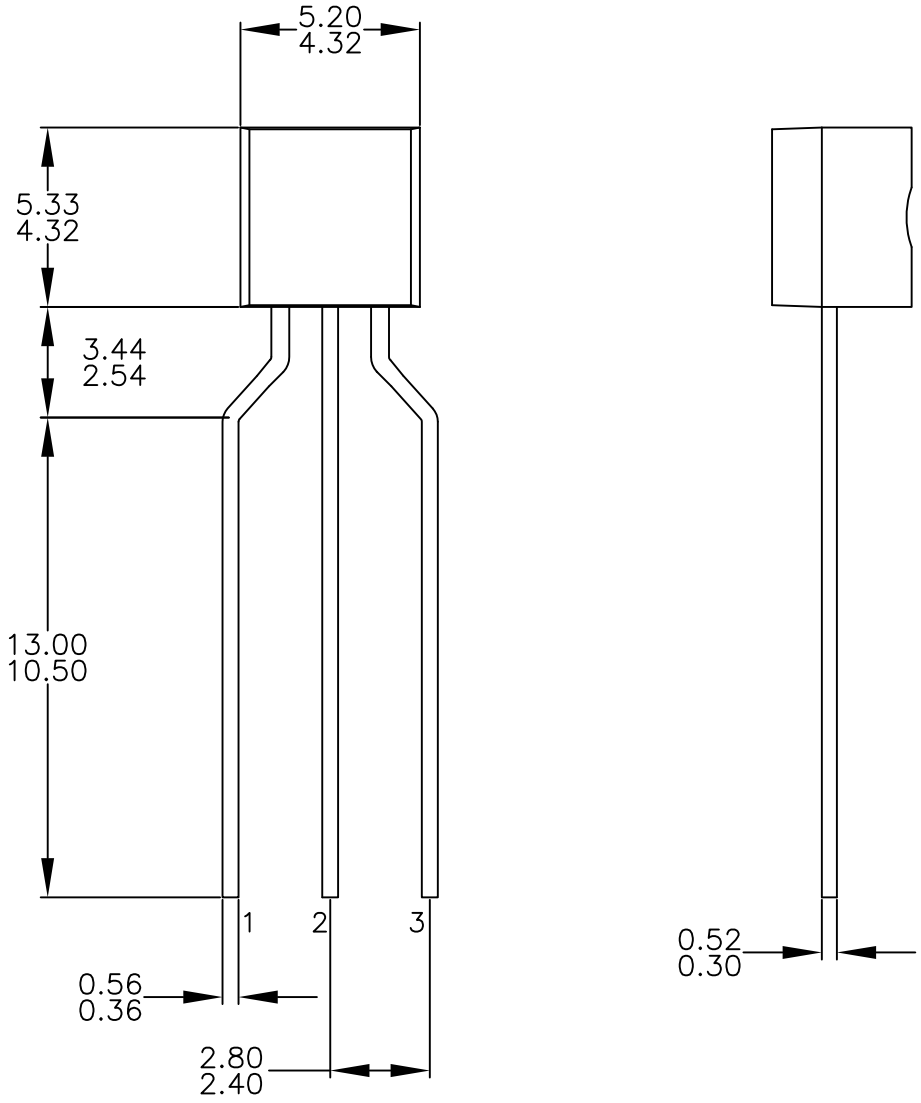


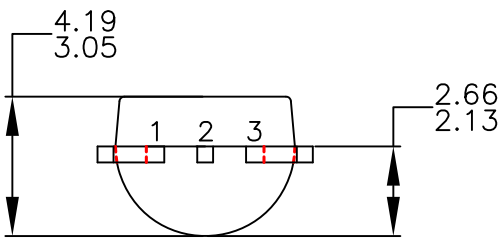

DETAIL A
SCALE: 2:1

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

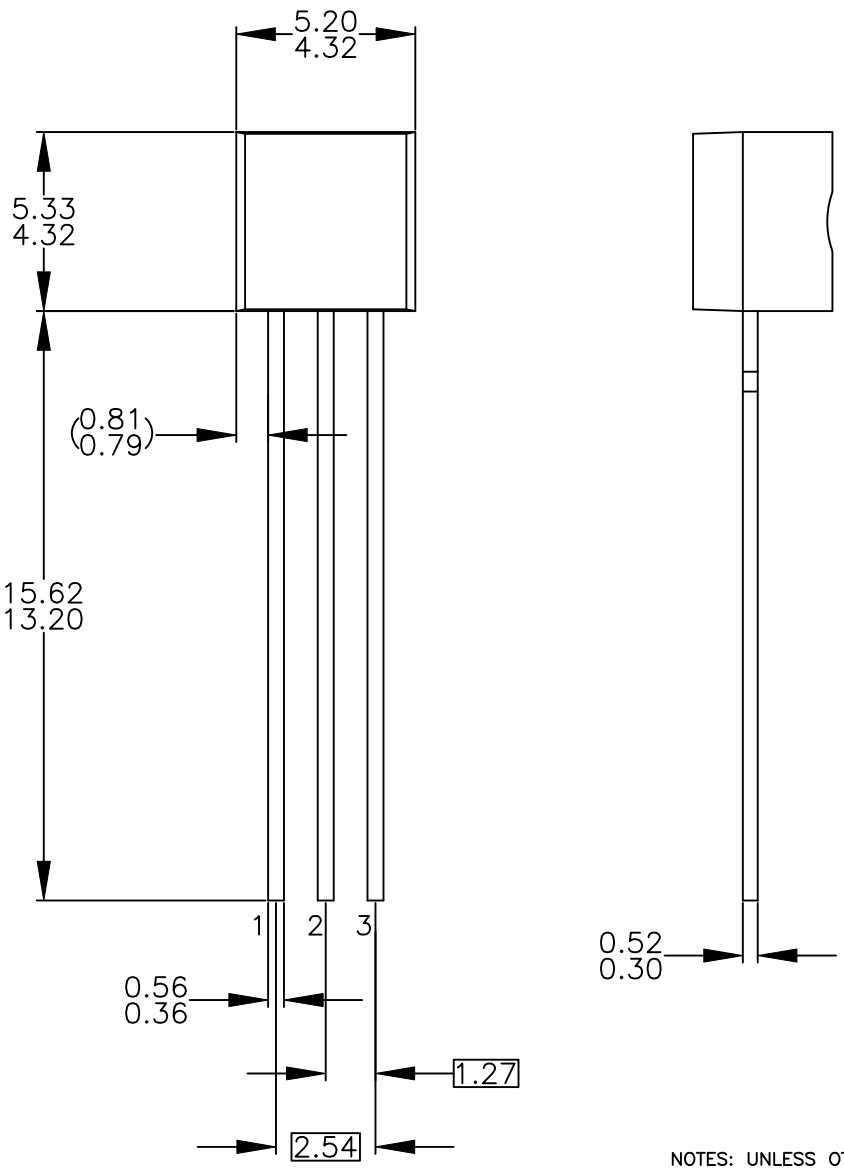
FAIRCHILD.

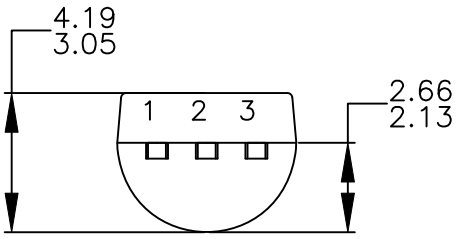



NOTES: UNLESS OTHERWISE SPECIFIED

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.

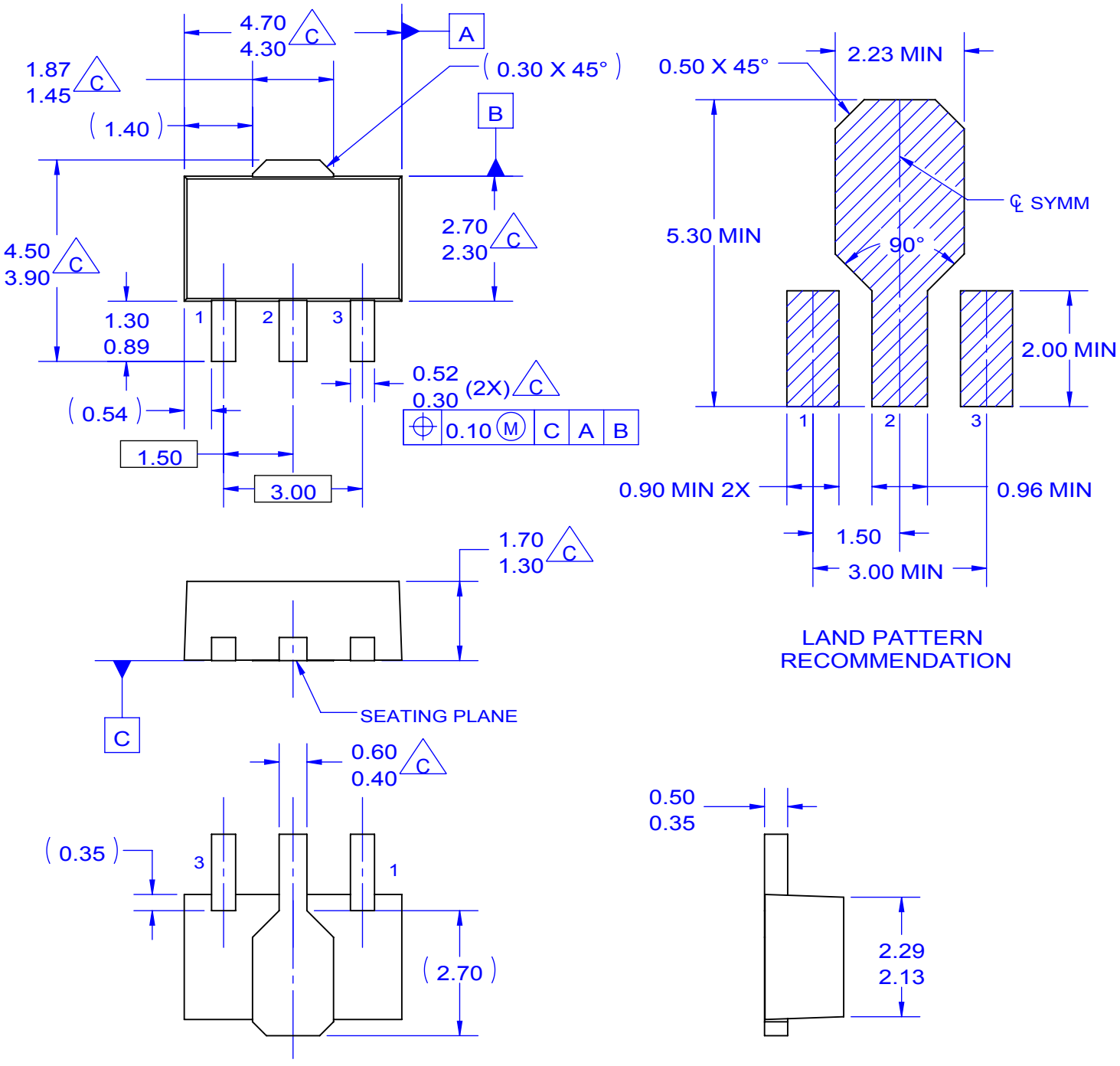



NOTES: UNLESS OTHERWISE SPECIFIED

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.

FAIRCHILD




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: MA03CREV3

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