# MC78LXXA/LM78LXXA/MC78L05AA

## 3-Terminal 0.1A Positive Voltage Regulator

### Features

- Maximum Output Current of 100mA
- Output Voltage of 5V, 8V, 12V, 15V, 18V and 24V
- Thermal Overload Protection
- Short Circuit Current Limiting
- Output Voltage Offered in ±5% Tolerance

### Description

The MC78LXXA/LM78LXXA/MC78L05AA series of fixed voltage monolithic integrated circuit voltage regulators are suitable for application that required supply current up to 100mA.

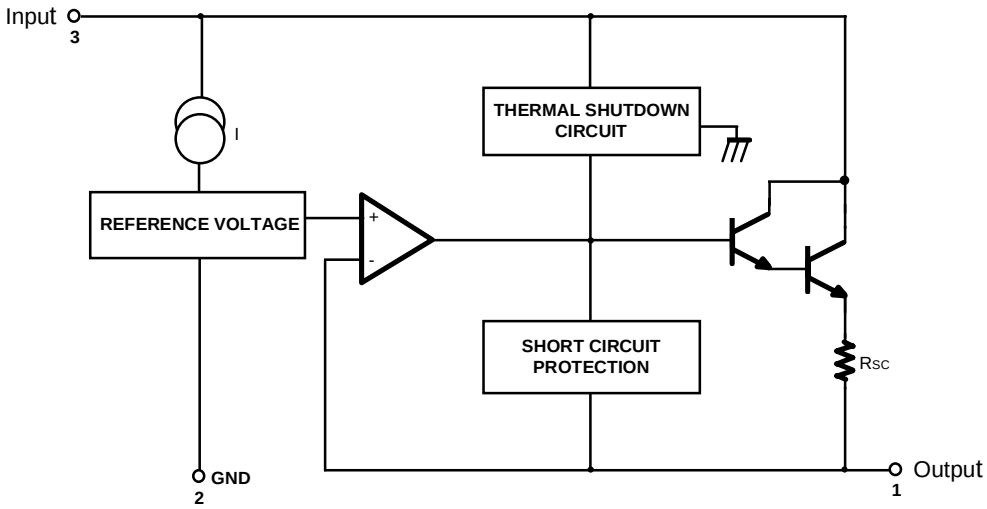
**TO-92** **SOT-89**


1. Output 2. GND 3. Input

**8-SOP**


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

### Internal Block Diagram




Rev. 1.0.4

## Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Input Voltage (for $V_O$ = 5V, 8V)<br>(for $V_O$ = 12V to 18V)<br>(for $V_O$ = 24V) | $V_I$ | 30<br>35<br>40 | V<br>V<br>V |
| Operating Junction Temperature Range | $T_J$ | 0 ~ +150 | °C |
| Storage Temperature Range | $T_{STG}$ | -65 ~ +150 | °C |

## Electrical Characteristics(MC78L05A/LM78L05A)

($V_I$ = 10V, $I_O$ = 40mA, 0°C ≤ $T_J$ ≤ 125°C, $C_I$ = 0.33μF, $C_O$ = 0.1μF, unless otherwise specified. (Note 1)

| Parameter | | Symbol | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Output Voltage | | $V_O$ | $T_J$ = 25°C | | 4.8 | 5.0 | 5.2 | V |
| Line Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 7V ≤ $V_I$ ≤ 20V | - | 8 | 150 | mV |
| | | | | 8V ≤ $V_I$ ≤ 20V | - | 6 | 100 | mV |
| Load Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 1mA ≤ $I_O$ ≤ 100mA | - | 11 | 60 | mV |
| | | | | 1mA ≤ $I_O$ ≤ 40mA | - | 5.0 | 30 | mV |
| Output Voltage | | $V_O$ | 7V ≤ $V_I$ ≤ 20V | 1mA ≤ $I_O$ ≤ 40mA | - | - | 5.25 | V |
| | | | 7V ≤ $V_I$ ≤ $V_{MAX}$ (Note 2) | 1mA ≤ $I_O$ ≤ 70mA | 4.75 | - | 5.25 | V |
| Quiescent Current | | $I_Q$ | $T_J$ = 25°C | | - | 2.0 | 5.5 | mA |
| Quiescent Current Change | With Line | $\Delta I_Q$ | 8V ≤$V_I$ ≤ 20V | | - | - | 1.5 | mA |
| | With Load | $\Delta I_Q$ | 1mA ≤ $I_O$ ≤ 40 mA | | - | - | 0.1 | mA |
| Output Noise Voltage | | $V_N$ | $T_A$ = 25°C, 10Hz ≤ f ≤ 100kHz | | - | 40 | - | μV/Vo |
| Temperature Coefficient of $V_O$ | | $\Delta V_O/\Delta T$ | $I_O$ = 5mA | | - | -0.65 | - | mV/°C |
| Ripple Rejection | | RR | f = 120Hz, 8V ≤ $V_I$ ≤ 18V, $T_J$ = 25°C | | 41 | 80 | - | dB |
| Dropout Voltage | | $V_D$ | $T_J$ = 25°C | | - | 1.7 | - | V |

**Note:**

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 represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $P_D$ ≤ 0.75W.

## Electrical Characteristics(MC78L08A) (Continued)

($V_I$ = 14V, $I_O$ = 40mA, 0°C ≤ $T_J$ ≤ 125°C, $C_I$ = 0.33μF, $C_O$ = 0.1μF, unless otherwise specified. (Note 1)

| Parameter | | Symbol | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Output Voltage | | $V_O$ | $T_J$ = 25°C | | 7.7 | 8.0 | 8.3 | V |
| Line Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 10.5V ≤ $V_I$ ≤ 23V | - | 10 | 175 | mV |
| | | | | 11V ≤ $V_I$ ≤ 23V | - | 8 | 125 | mV |
| Load Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 1mA ≤ $I_O$ ≤ 100mA | - | 15 | 80 | mV |
| | | | | 1mA ≤ $I_O$ ≤ 40mA | - | 8.0 | 40 | mV |
| Output Voltage | | $V_O$ | 10.5V ≤ $V_I$ ≤ 23V | 1mA ≤ $I_O$ ≤ 40mA | 7.6 | - | 8.4 | V |
| | | | 10.5V ≤ $V_I$ ≤ $V_{MAX}$ (Note 2) | 1mA ≤ $I_O$ ≤ 70mA | 7.6 | - | 8.4 | V |
| Quiescent Current | | $I_Q$ | $T_J$ = 25°C | | - | 2.0 | 5.5 | mA |
| Quiescent Current Change | With Line | $\Delta I_Q$ | 11V ≤ $V_I$ ≤ 23V | | - | - | 1.5 | mA |
| | With Load | $\Delta I_Q$ | 1mA ≤ $I_O$ ≤ 40mA | | - | - | 0.1 | mA |
| Output Noise Voltage | | $V_N$ | $T_A$ = 25°C, 10Hz ≤ f ≤100kHz | | - | 60 | - | μV/Vo |
| Temperature Coefficient of $V_O$ | | $\Delta V_O/\Delta T$ | $I_O$ = 5mA | | - | -0.8 | - | mV/ °C |
| Ripple Rejection | | RR | f = 120Hz, 11V ≤ $V_I$ ≤ 21V, $T_J$ = 25°C | | 39 | 70 | - | dB |
| Dropout Voltage | | $V_D$ | $T_J$ = 25°C | | - | 1.7 | - | V |

**Note:**

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 represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $P_D$ ≤ 0.75W.

## Electrical Characteristics(MC78L12A/LM78L12A) (Continued)

($V_I$ = 19V, $I_O$ = 40mA, 0°C ≤ $T_J$ ≤ 125°C, $C_I$ = 0.33 μF, $C_O$ = 0.1μF, unless otherwise specified. (Note 1)

| Parameter | | Symbol | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Output Voltage | | $V_O$ | $T_J$ = 25°C | | 11.5 | 12 | 12.5 | V |
| Line Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 14.5V ≤ $V_I$ ≤ 27V | - | 20 | 250 | mV |
| | | | | 16V ≤ $V_I$ ≤ 27V | - | 15 | 200 | mV |
| Load Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 1mA ≤ $I_O$ ≤ 100mA | - | 20 | 100 | mV |
| | | | | 1mA ≤ $I_O$ ≤ 40mA | - | 10 | 50 | mV |
| Output Voltage | | $V_O$ | 14.5V ≤ $V_I$ ≤ 27V | 1mA ≤ $I_O$ ≤ 40mA | 11.4 | - | 12.6 | V |
| | | | 14.5V ≤ $V_I$ ≤ $V_{MAX}$ (Note 2) | 1mA ≤ $I_O$ ≤ 70mA | 11.4 | - | 12.6 | V |
| Quiescent Current | | $I_Q$ | $T_J$ = 25°C | | - | 2.1 | 6.0 | mA |
| Quiescent Current Change | With Line | $\Delta I_Q$ | 16V ≤ $V_I$ ≤ 27V | | - | - | 1.5 | mA |
| | With Load | $\Delta I_Q$ | 1mA ≤ $I_O$ ≤ 40mA | | - | - | 0.1 | mA |
| Output Noise Voltage | | $V_N$ | $T_A$ = 25°C, 10Hz ≤ f ≤ 100kHz | | - | 80 | - | μV/Vo |
| Temperature Coefficient of $V_O$ | | $\Delta V_O/\Delta T$ | $I_O$ = 5mA | | - | -1.0 | - | mV/°C |
| Ripple Rejection | | RR | f = 120Hz, 15V ≤ $V_I$ ≤ 25V, $T_J$ = 25°C | | 37 | 65 | - | dB |
| Dropout Voltage | | $V_D$ | $T_J$ = 25°C | | - | 1.7 | - | V |

**Note:**

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 represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $P_D$ ≤ 0.75W.

## Electrical Characteristics(MC78L15A) (Continued)

($V_I$ = 23V, $I_O$ = 40mA, 0°C ≤ $T_J$ ≤ 125°C, $C_I$ = 0.33 μF, $C_O$ = 0.1μF, unless otherwise specified. (Note 1)

| Parameter | | Symbol | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Output Voltage | | $V_O$ | $T_J$ = 25°C | | 14.4 | 15 | 15.6 | V |
| Line Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 17.5V ≤ $V_I$ ≤ 30V | - | 25 | 300 | mV |
| | | | | 20V ≤ $V_I$ ≤ 30V | - | 20 | 250 | mV |
| Load Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 1mA ≤ $I_O$ ≤ 100mA | - | 25 | 150 | mV |
| | | | | 1mA ≤ $I_O$ ≤ 40mA | - | 12 | 75 | mV |
| Output Voltage | | $V_O$ | 17.5V ≤ $V_I$ ≤ 30V | 1mA ≤ $I_O$ ≤ 40mA | 14.25 | - | 15.75 | V |
| | | | 17.5V ≤ $V_I$ ≤ $V_{MAX}$ (Note 2) | 1mA ≤ $I_O$ ≤ 70mA | 14.25 | - | 15.75 | V |
| Quiescent Current | | $I_Q$ | $T_J$ = 25°C | | - | 2.1 | 6.0 | mA |
| Quiescent Current Change | With Line | $\Delta I_Q$ | 20V ≤ $V_I$ ≤ 30V | | - | - | 1.5 | mA |
| | With Load | $\Delta I_Q$ | 1mA ≤ $I_O$ ≤ 40mA | | - | - | 0.1 | mA |
| Output Noise Voltage | | $V_N$ | $T_A$ = 25°C, 10Hz ≤ f ≤ 100kHz | | - | 90 | - | μV/Vo |
| Temperature Coefficient of $V_O$ | | $\Delta V_O/\Delta T$ | $I_O$ = 5mA | | - | -1.3 | - | mV/°C |
| Ripple Rejection | | RR | f = 120Hz, 18.5V≤$V_I$ ≤28.5V, $T_J$ = 25°C | | 34 | 60 | - | dB |
| Dropout Voltage | | $V_D$ | $T_J$ = 25°C | | - | 1.7 | - | V |

**Note:**

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 represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $P_D$ ≤ 0.75W.

## Electrical Characteristics(MC78L18A) (Continued)

($V_I$ = 27V, $I_O$ = 40mA, 0°C ≤ $T_J$ ≤ 125°C, $C_I$ = 0.33μF, $C_O$ = 0.1μF, unless otherwise specified. (Note 1)

| Parameter | | Symbol | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Output Voltage | | $V_O$ | $T_J$ = 25°C | | 17.3 | 18 | 18.7 | V |
| Line Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 21V ≤ $V_I$ ≤ 33V | - | 145 | 300 | mV |
| | | | | 22V ≤ $V_I$ ≤ 33V | - | 135 | 250 | mV |
| Load Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 1mA ≤ $I_O$≤100mA | - | 30 | 170 | mV |
| | | | | 1mA ≤ $I_O$ ≤ 40mA | - | 15 | 85 | mV |
| Output Voltage | | $V_O$ | 21V ≤ $V_I$ ≤ 33V | 1mA ≤ $I_O$ ≤ 40mA | 17.1 | - | 18.9 | V |
| | | | 21V ≤ $V_I$ ≤ $V_{MAX}$ (Note 2) | 1mA ≤ $I_O$ ≤ 70mA | 17.1 | - | 18.9 | V |
| Quiescent Current | | $I_Q$ | $T_J$ = 25°C | | - | 2.2 | 6.0 | mA |
| Quiescent Current Change | With Line | $\Delta I_Q$ | 21V ≤ $V_I$ ≤ 33V | | - | - | 1.5 | mA |
| | With Load | $\Delta I_Q$ | 1mA ≤ $I_O$ ≤ 40mA | | - | - | 0.1 | mA |
| Output Noise Voltage | | $V_N$ | $T_A$ = 25°C, 10Hz ≤ f ≤ 100kHz | | - | 150 | - | μV/Vo |
| Temperature Coefficient of $V_O$ | | $\Delta V_O/\Delta T$ | $I_O$ = 5mA | | - | -1.8 | - | mV/°C |
| Ripple Rejection | | RR | f = 120Hz, 23V ≤ $V_I$ ≤ 33V, $T_J$ = 25°C | | 34 | 48 | - | dB |
| Dropout Voltage | | $V_D$ | $T_J$ = 25°C | | - | 1.7 | - | V |

**Note:**

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 represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $P_D$ ≤ 0.75W.

## Electrical Characteristics(MC78L24A) (Continued)

($V_I$ = 33V, $I_O$ = 40mA, 0°C ≤ $T_J$ ≤ 125°C, $C_I$ = 0.33μF, $C_O$ = 0.1μF, unless otherwise specified. (Note 1)

| Parameter | | Symbol | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Output Voltage | | $V_O$ | $T_J$ = 25°C | | 23 | 24 | 25 | V |
| Line Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 27V ≤ $V_I$ ≤ 38V | - | 160 | 300 | mV |
| | | | | 28V ≤ $V_I$ ≤ 38V | - | 150 | 250 | mV |
| Load Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 1mA ≤ $I_O$ ≤ 100mA | - | 40 | 200 | mV |
| | | | | 1mA ≤ $I_O$ ≤ 40mA | - | 20 | 100 | mV |
| Output Voltage | | $V_O$ | 27V ≤ $V_I$ ≤ 38V | 1mA ≤ $I_O$ ≤ 40mA | 22.8 | - | 25.2 | V |
| | | | 27V ≤ $V_I$ ≤ $V_{MAX}$ (Note 2) | 1mA ≤ $I_O$ ≤ 70mA | 22.8 | - | 25.2 | V |
| Quiescent Current | | $I_Q$ | $T_J$ = 25°C | | - | 2.2 | 6.0 | mA |
| Quiescent Current Change | With Line | $\Delta I_Q$ | 28V ≤ $V_I$ ≤ 38V | | - | - | 1.5 | mA |
| | With Load | $\Delta I_Q$ | 1mA ≤ $I_O$ ≤ 40mA | | - | - | 0.1 | mA |
| Output Noise Voltage | | $V_N$ | $T_A$ = 25°C, 10Hz ≤ f ≤ 100kHz | | - | 200 | - | μV/Vo |
| Temperature Coefficient of $V_O$ | | $\Delta V_O/\Delta T$ | $I_O$ = 5mA | | - | -2.0 | - | mV/°C |
| Ripple Rejection | | RR | f = 120Hz, 28V ≤ $V_I$ ≤ 38V, $T_J$ = 25°C | | 34 | 45 | - | dB |
| Dropout Voltage | | $V_D$ | $T_J$ = 25°C | | - | 1.7 | - | V |

**Note:**

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 represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $P_D$ ≤ 0.75W.

## Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Input Voltage (for $V_O$ = 5V, 8V)<br>(for $V_O$ = 12V to 18V)<br>(for $V_O$ = 24V) | $V_I$ | 30<br>35<br>40 | V<br>V<br>V |
| Operating Junction Temperature Range | $T_J$ | 0 ~ +150 | °C |
| Storage Temperature Range | $T_{STG}$ | -65 ~ +150 | °C |

## Electrical Characteristics(MC78L05AA) (Continued)

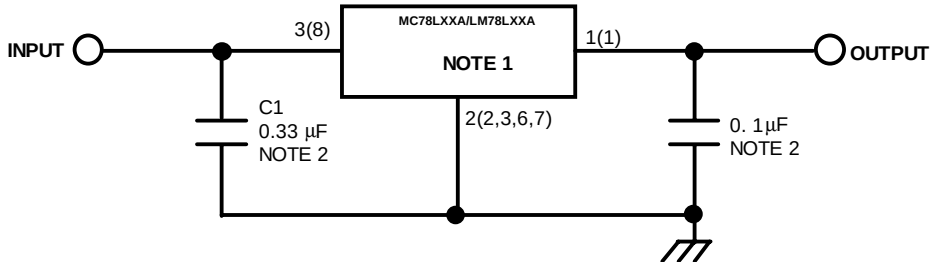
($V_I$ = 10V, $I_O$ = 40mA, 0°C ≤ $T_J$ ≤ 125°C, $C_I$ = 0.33μF, $C_O$ = 0.1μF, unless otherwise specified. (Note 1)

| Parameter | | Symbol | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Output Voltage | | $V_O$ | $T_J$ = 25°C | | 4.9 | 5.0 | 5.1 | V |
| Line Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 7V ≤ $V_I$ ≤ 20V | - | 8 | 150 | mV |
| | | | | 8V ≤ $V_I$ ≤ 20V | - | 6 | 100 | mV |
| Load Regulation (Note1) | | $\Delta V_O$ | $T_J$ = 25°C | 1mA ≤ $I_O$ ≤ 100mA | - | 11 | 50 | mV |
| | | | | 1mA ≤ $I_O$ ≤ 40mA | - | 5.0 | 25 | mV |
| Output Voltage | | $V_O$ | 7V ≤$V_I$ ≤20V | 1mA ≤ $I_O$ ≤ 40mA | - | - | 5.15 | V |
| | | | 7V ≤$V_I$ ≤ $V_{MAX}$ (Note 2) | 1mA ≤ $I_O$ ≤ 70mA | 4.75 | - | 5.15 | V |
| Quiescent Current | | $I_Q$ | $T_J$ = 25°C | | - | 2.0 | 5.5 | mA |
| Quiescent Current Change | With Line | $\Delta I_Q$ | 8V ≤$V_I$ ≤ 20V | | - | - | 1.5 | mA |
| | With Load | $\Delta I_Q$ | 1mA ≤ $I_O$ ≤ 40 mA | | - | - | 0.1 | mA |
| Output Noise Voltage | | $V_N$ | $T_A$ = 25°C, 10Hz ≤ f ≤ 100kHz | | - | 40 | - | μV/Vo |
| Temperature Coefficient of $V_O$ | | $\Delta V_O/\Delta T$ | $I_O$ = 5mA | | - | -0.65 | - | mV/°C |
| Ripple Rejection | | RR | f = 120Hz, 8V ≤ $V_I$ ≤ 18V, $T_J$ = 25°C | | 41 | 80 | - | dB |
| Dropout Voltage | | $V_D$ | $T_J$ = 25°C | | - | 1.7 | - | V |

**Note:**

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 represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation $P_D$ ≤ 0.75W.

## Typical Application




’( )’ : 8SOP Type

**Notes:**

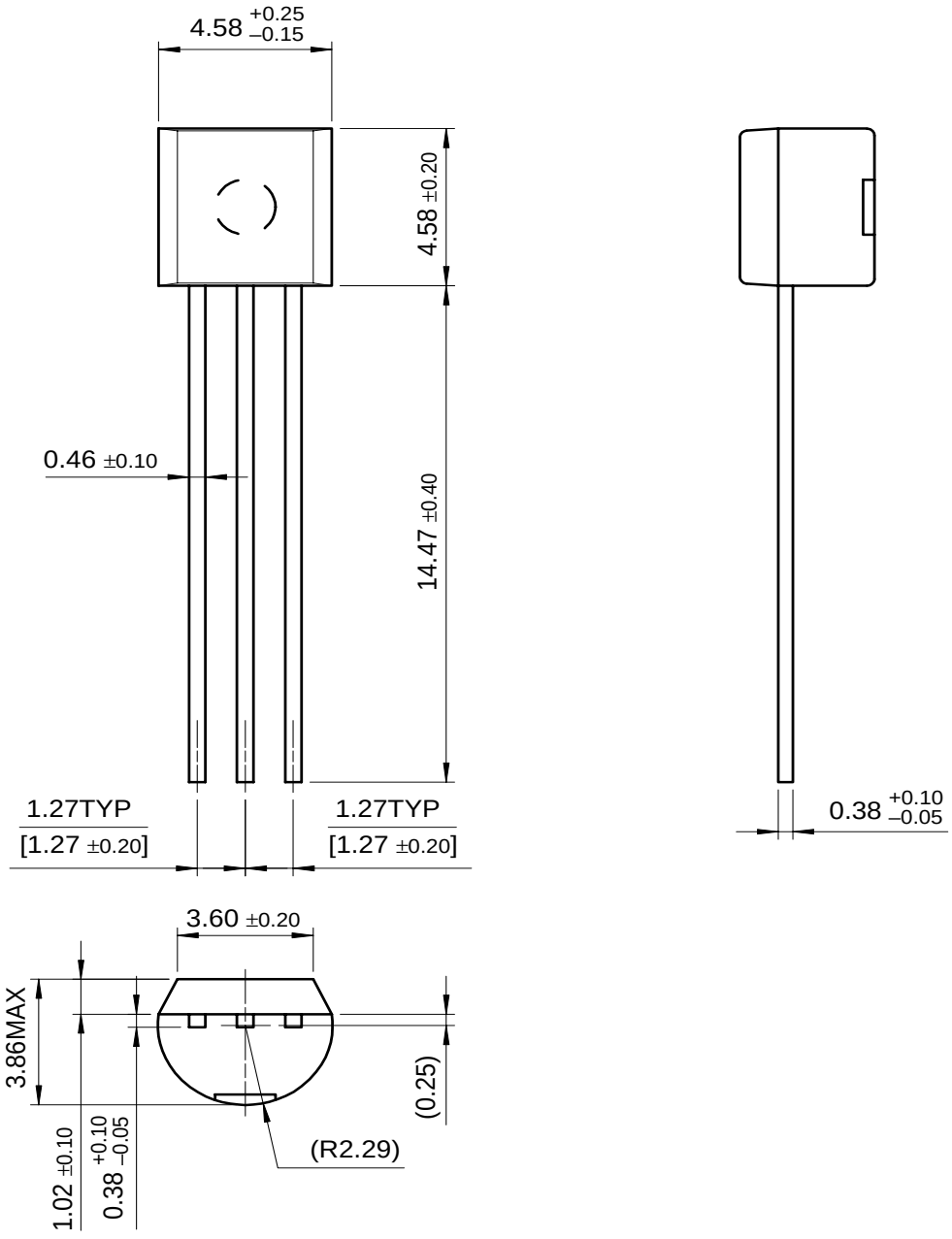
1. To specify an output voltage, substitute voltage value for “XX”.
2. Bypass Capacitors are recommend for optimum stability and transient response and should be located as close as possible to the regulator

## Mechanical Dimensions

### Package

**Dimensions in millimeters**

# TO-92

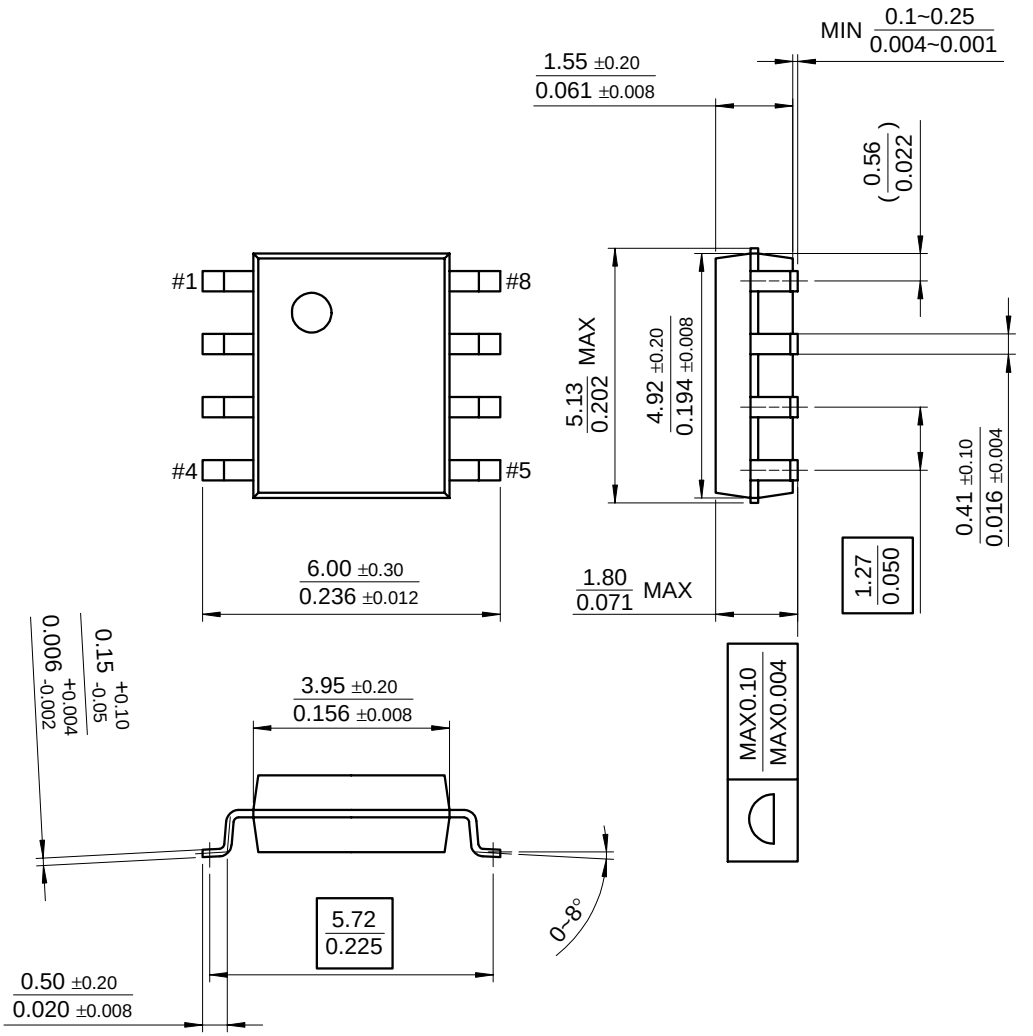


## Mechanical Dimensions (Continued)

### Package

**Dimensions in millimeters**

# 8-SOP

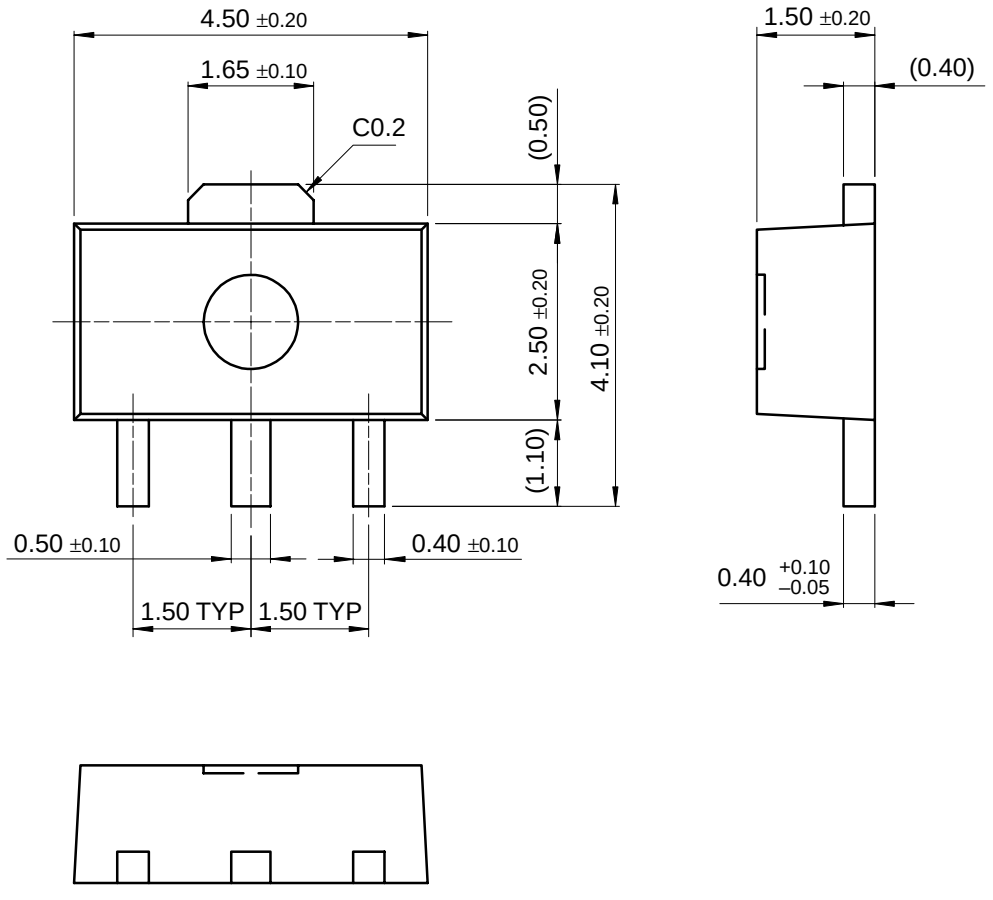


## Mechanical Dimensions (Continued)

### Package

**Dimensions in millimeters**

# SOT-89



## Ordering Information

| Product Number | Package | Output Voltage Tolerance | Operating Temperature |
|---|---|---|---|
| LM78L05ACZ | TO-92 | 5% | 0 ~ +125°C |
| LM78L12ACZ | | | |

| Product Number | Package | Output Voltage Tolerance | Operating Temperature |
|---|---|---|---|
| MC78L05ACP | TO-92 | 5% | 0 ~ +125°C |
| MC78L08ACP | | | |
| MC78L12ACP | | | |
| MC78L15ACP | | | |
| MC78L18ACP | | | |
| MC78L24ACP | | | |
| MC78L05ACD | 8-SOP | | |
| MC78L08ACD | | | |
| MC78L12ACD | | | |
| MC78L05ACH | SOT-89 | | |
| MC78L08ACH | | | |
| MC78L12ACH | | | |
| MC78L05AACP | TO-92 | 2% | |