

MC78LXXA/LM78LXXA/MC78L05AA

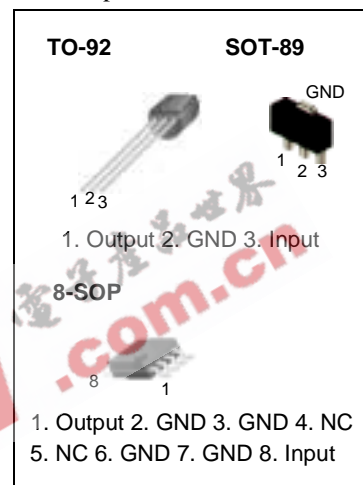
3-Terminal 0.1A Positive Voltage Regulator

Features

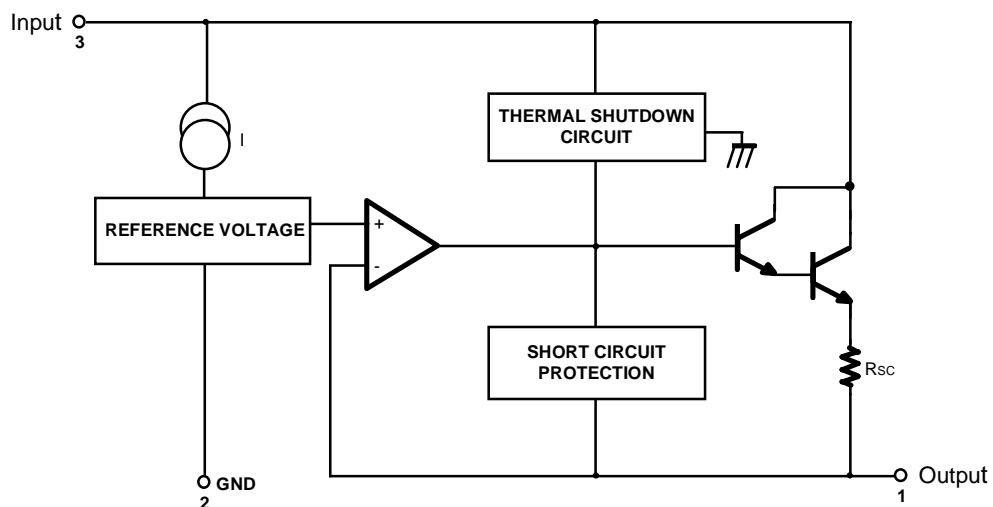
- Maximum Output Current of 100mA
- Output Voltage of 5V, 8V, 12V, 15V, 18V and 24V
- Thermal Overload Protection
- Short Circuit Current Limiting
- Output Voltage Offered in $\pm 5\%$ Tolerance

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.



Internal Block Diagram



Absolute Maximum Ratings

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

Electrical Characteristics(MC78L05A/LM78L05A)

($V_I = 10V$, $I_O = 40mA$, $0^\circ C \leq T_J \leq 125^\circ C$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified. (Note 1))

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

Note:

- 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.
- Power dissipation $P_D \leq 0.75W$.

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) | ΔV _O | T _J = 25°C | 10.5V ≤ V _I ≤ 23V | - | 10 | 175 | mV |
| | | | 11V ≤ V _I ≤ 23V | - | 8 | 125 | mV |
| Load Regulation (Note1) | ΔV _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 | ΔI _Q | 11V ≤ V _I ≤ 23V | - | - | 1.5 | mA |
| | With Load | ΔI _Q | 1mA ≤ I _O ≤ 40mA | - | - | 0.1 | mA |
| Output Noise Voltage | V _N | T _A = 25°C, 10Hz ≤ f ≤ 100kHz | - | 60 | - | μV/V _O | |
| Temperature Coefficient of V _O | ΔV _O /ΔT | 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) | ΔV _O | T _J = 25°C | 14.5V ≤ V _I ≤ 27V | - | 20 | 250 | mV |
| | | | 16V ≤ V _I ≤ 27V | - | 15 | 200 | mV |
| Load Regulation (Note1) | ΔV _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 | ΔI _Q | 16V ≤ V _I ≤ 27V | - | - | 1.5 | mA |
| | With Load | ΔI _Q | 1mA ≤ I _O ≤ 40mA | - | - | 0.1 | mA |
| Output Noise Voltage | V _N | T _A = 25°C, 10Hz ≤ f ≤ 100kHz | - | 80 | - | μV/V _O | |
| Temperature Coefficient of V _O | ΔV _O /ΔT | 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) | ΔV _O | T _J = 25°C | 17.5V ≤ V _I ≤ 30V | - | 25 | 300 | mV |
| | | | 20V ≤ V _I ≤ 30V | - | 20 | 250 | mV |
| Load Regulation (Note1) | ΔV _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 | ΔI _Q | 20V ≤ V _I ≤ 30V | - | - | 1.5 | mA |
| | With Load | ΔI _Q | 1mA ≤ I _O ≤ 40mA | - | - | 0.1 | mA |
| Output Noise Voltage | V _N | T _A = 25°C, 10Hz ≤ f ≤ 100kHz | - | 90 | - | μV/V _O | |
| Temperature Coefficient of V _O | ΔV _O /ΔT | 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) | ΔV _O | T _J = 25°C | 21V ≤ V _I ≤ 33V | - | 145 | 300 | mV |
| | | | 22V ≤ V _I ≤ 33V | - | 135 | 250 | mV |
| Load Regulation (Note1) | ΔV _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 | ΔI _Q | 21V ≤ V _I ≤ 33V | - | - | 1.5 | mA |
| | With Load | ΔI _Q | 1mA ≤ I _O ≤ 40mA | - | - | 0.1 | mA |
| Output Noise Voltage | V _N | T _A = 25°C, 10Hz ≤ f ≤ 100kHz | - | 150 | - | μV/V _O | |
| Temperature Coefficient of V _O | ΔV _O /ΔT | 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) | ΔV _O | T _J = 25°C | 27V ≤ V _I ≤ 38V | - | 160 | 300 | mV |
| | | | 28V ≤ V _I ≤ 38V | - | 150 | 250 | mV |
| Load Regulation (Note1) | ΔV _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 | ΔI _Q | 28V ≤ V _I ≤ 38V | - | - | 1.5 | mA |
| | With Load | ΔI _Q | 1mA ≤ I _O ≤ 40mA | - | - | 0.1 | mA |
| Output Noise Voltage | V _N | T _A = 25°C, 10Hz ≤ f ≤ 100kHz | - | 200 | - | μV/V _O | |
| Temperature Coefficient of V _O | ΔV _O /ΔT | 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 $V_O = 5V, 8V$) (for $V_O = 12V$ to $18V$) (for $V_O = 24V$) | V_I | 30 35 40 | V V V |
| Operating Junction Temperature Range | T_J | 0 ~ +150 | °C |
| Storage Temperature Range | TSTG | -65 ~ +150 | °C |

Electrical Characteristics(MC78L05AA) (Continued)

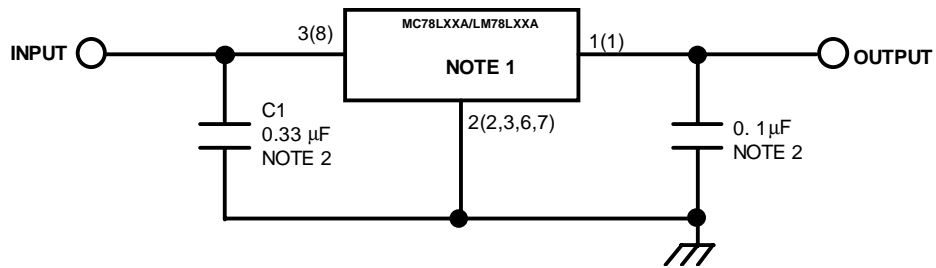
($V_I = 10V$, $I_O = 40mA$, $0^\circ C \leq T_J \leq 125^\circ C$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified. (Note 1))

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

Note:

- 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.
- Power dissipation $P_D \leq 0.75W$.

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

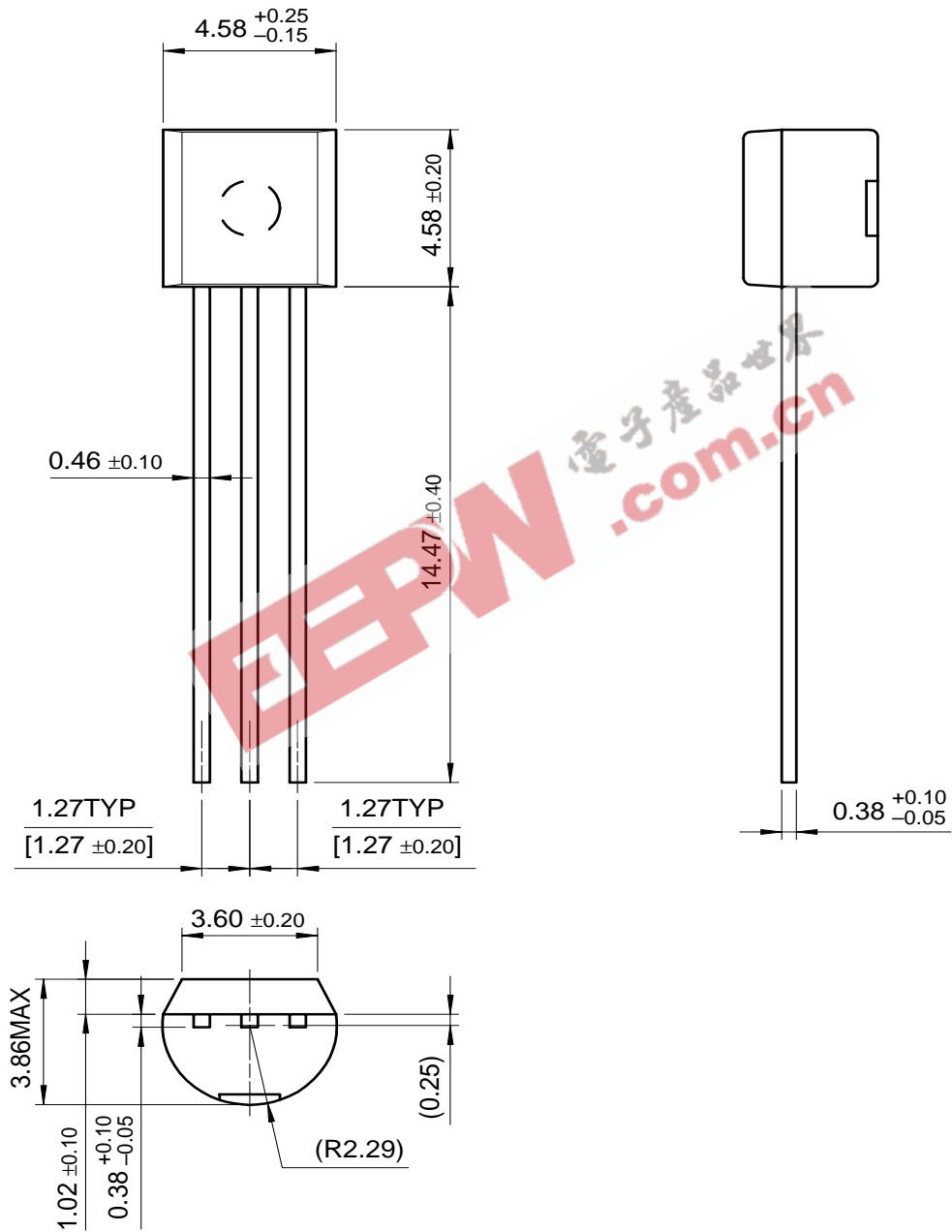
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Mechanical Dimensions

Package

Dimensions in millimeters

TO-92

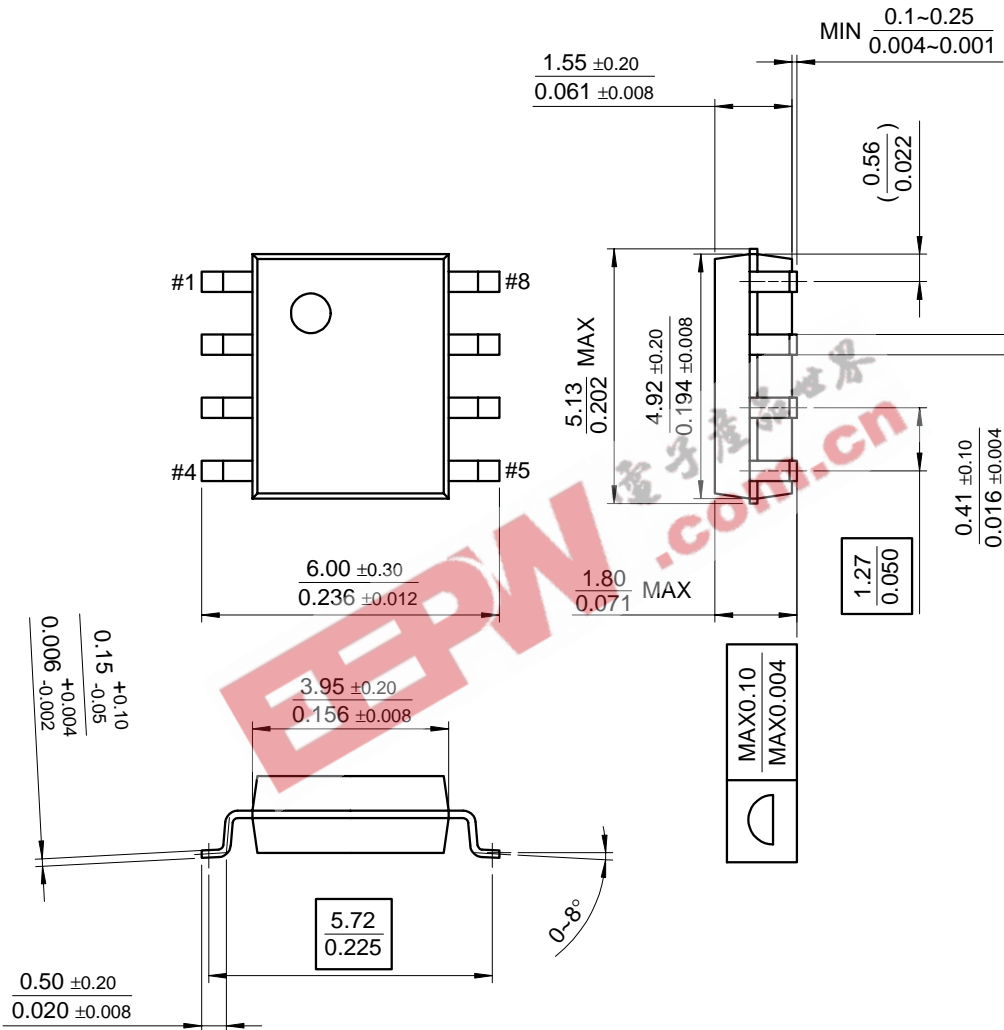


Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

8-SOP

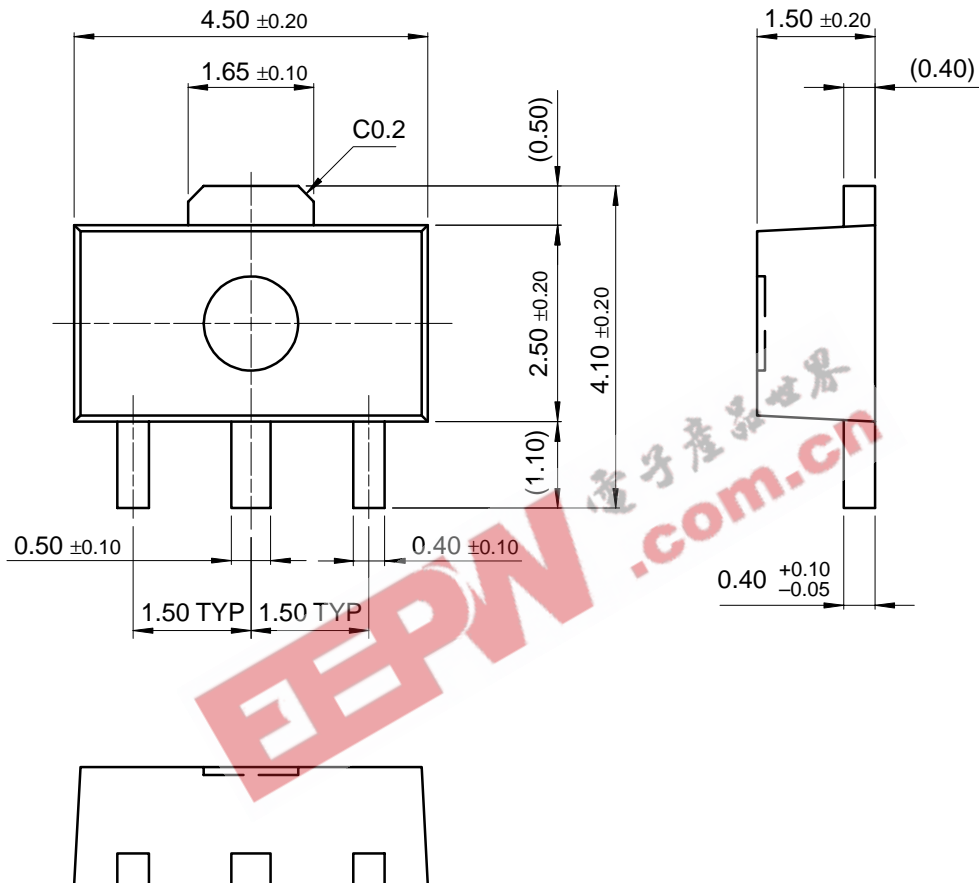


Mechanical Dimensions (Continued)

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 | 5% | 0 ~ +125°C |
| MC78L08ACD | | | |
| MC78L12ACD | | | |
| MC78L05ACH | SOT-89 | 5% | 0 ~ +125°C |
| MC78L08ACH | | | |
| MC78L12ACH | | | |
| MC78L05AACP | TO-92 | 2% | |

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.