

# MC78L00A Series, NCV78L00A

## 100 mA Positive Voltage Regulators

The MC78L00A Series of positive voltage regulators are inexpensive, easy-to-use devices suitable for a multitude of applications that require a regulated supply of up to 100 mA. Like their higher powered MC7800 and MC78M00 Series cousins, these regulators feature internal current limiting and thermal shutdown making them remarkably rugged. No external components are required with the MC78L00 devices in many applications.

These devices offer a substantial performance advantage over the traditional zener diode-resistor combination, as output impedance and quiescent current are substantially reduced.

### Features

- Wide Range of Available, Fixed Output Voltages
- Low Cost
- Internal Short Circuit Current Limiting
- Internal Thermal Overload Protection
- No External Components Required
- Complementary Negative Regulators Offered (MC79L00A Series)
- Pb-Free Packages are Available
- NCV Prefix for Automotive and Other Applications Requiring Site and Control Changes

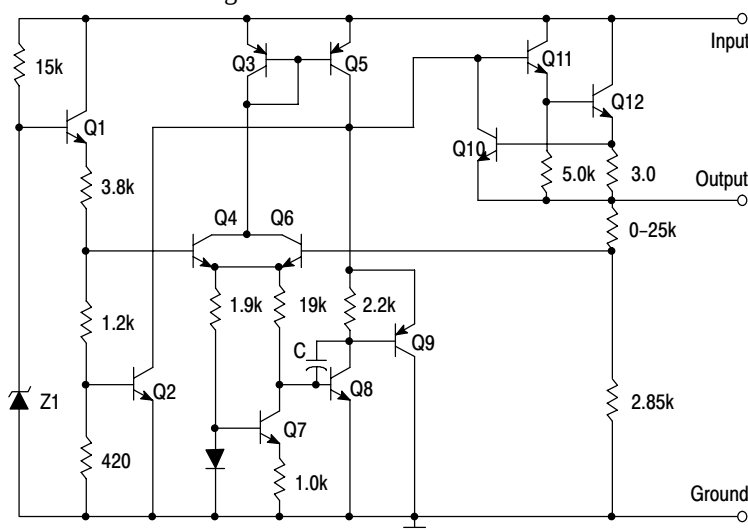


Figure 1. Representative Schematic Diagram

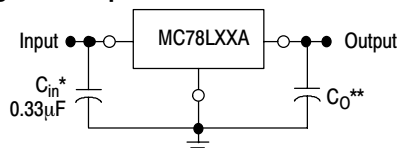


Figure 2. Standard Application

A common ground is required between the input and the output voltages. The input voltage must remain typically 2.0 V above the output voltage even during the low point on the input ripple voltage.

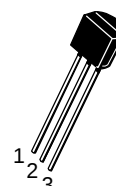
\* $C_{in}$  is required if regulator is located an appreciable distance from power supply filter.

\*\* $C_o$  is not needed for stability; however, it does improve transient response.



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**TO-92  
P SUFFIX  
CASE 029**

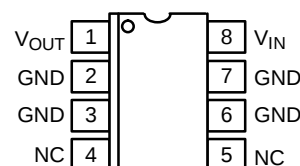
Pin: 1. Output  
2. Ground  
3. Input



**SOIC-8\*  
D SUFFIX  
CASE 751**

\*SOIC-8 is an internally modified SO-8 package. Pins 2, 3, 6, and 7 are electrically common to the die attach flag. This internal lead frame modification decreases package thermal resistance and increases power dissipation capability when appropriately mounted on a printed circuit board. SOIC-8 conforms to all external dimensions of the standard SO-8 package.

### PIN CONNECTIONS



(Top View)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 9 of this data sheet.

### DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 13 of this data sheet.

## MC78L00A Series, NCV78L00A

### MAXIMUM RATINGS (T<sub>A</sub> = +125°C, unless otherwise noted.)

| Rating                                               | Symbol           | Value          | Unit |
|------------------------------------------------------|------------------|----------------|------|
| Input Voltage (2.6 V–8.0 V)<br>(12 V–18 V)<br>(24 V) | V <sub>I</sub>   | 30<br>35<br>40 | Vdc  |
| Storage Temperature Range                            | T <sub>stg</sub> | –65 to +150    | °C   |
| Operating Junction Temperature Range                 | T <sub>J</sub>   | 0 to +150      | °C   |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

### ELECTRICAL CHARACTERISTICS (V<sub>I</sub> = 10 V, I<sub>O</sub> = 40 mA, C<sub>I</sub> = 0.33 µF, C<sub>O</sub> = 0.1 µF, –40°C < T<sub>J</sub> < +125°C (for MC78LXXAB, NCV78L05A), 0°C < T<sub>J</sub> < +125°C (for MC78LXXAC), unless otherwise noted.)

| Characteristics                                                                                                                                    | Symbol                          | MC78L05AC, AB, NCV78L05A |           |              | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------|-----------|--------------|------|
|                                                                                                                                                    |                                 | Min                      | Typ       | Max          |      |
| Output Voltage (T <sub>J</sub> = +25°C)                                                                                                            | V <sub>O</sub>                  | 4.8                      | 5.0       | 5.2          | Vdc  |
| Line Regulation<br>(T <sub>J</sub> = +25°C, I <sub>O</sub> = 40 mA)<br>7.0 Vdc ≤ V <sub>I</sub> ≤ 20 Vdc<br>8.0 Vdc ≤ V <sub>I</sub> ≤ 20 Vdc      | Reg <sub>line</sub>             | –<br>–                   | 55<br>45  | 150<br>100   | mV   |
| Load Regulation<br>(T <sub>J</sub> = +25°C, 1.0 mA ≤ I <sub>O</sub> ≤ 100 mA)<br>(T <sub>J</sub> = +25°C, 1.0 mA ≤ I <sub>O</sub> ≤ 40 mA)         | Reg <sub>load</sub>             | –<br>–                   | 11<br>5.0 | 60<br>30     | mV   |
| Output Voltage<br>(7.0 Vdc ≤ V <sub>I</sub> ≤ 20 Vdc, 1.0 mA ≤ I <sub>O</sub> ≤ 40 mA)<br>(V <sub>I</sub> = 10 V, 1.0 mA ≤ I <sub>O</sub> ≤ 70 mA) | V <sub>O</sub>                  | 4.75<br>4.75             | –<br>–    | 5.25<br>5.25 | Vdc  |
| Input Bias Current<br>(T <sub>J</sub> = +25°C)<br>(T <sub>J</sub> = +125°C)                                                                        | I <sub>IB</sub>                 | –<br>–                   | 3.8<br>–  | 6.0<br>5.5   | mA   |
| Input Bias Current Change<br>(8.0 Vdc ≤ V <sub>I</sub> ≤ 20 Vdc)<br>(1.0 mA ≤ I <sub>O</sub> ≤ 40 mA)                                              | ΔI <sub>IB</sub>                | –<br>–                   | –<br>–    | 1.5<br>0.1   | mA   |
| Output Noise Voltage<br>(T <sub>A</sub> = +25°C, 10 Hz ≤ f ≤ 100 kHz)                                                                              | V <sub>n</sub>                  | –                        | 40        | –            | µV   |
| Ripple Rejection (I <sub>O</sub> = 40 mA,<br>f = 120 Hz, 8.0 Vdc ≤ V <sub>I</sub> ≤ 18 V, T <sub>J</sub> = +25°C)                                  | RR                              | 41                       | 49        | –            | dB   |
| Dropout Voltage (T <sub>J</sub> = +25°C)                                                                                                           | V <sub>I</sub> – V <sub>O</sub> | –                        | 1.7       | –            | Vdc  |

NOTE: NCV78L05A: T<sub>low</sub> = –40°C, T<sub>high</sub> = +125°C. Guaranteed by design. NCV prefix is for automotive and other applications requiring site and change control.

## MC78L00A Series, NCV78L00A

**ELECTRICAL CHARACTERISTICS** ( $V_I = 14\text{ V}$ ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  $-40^\circ\text{C} < T_J < +125^\circ\text{C}$  (for MC78LXXAB),  $0^\circ\text{C} < T_J < +125^\circ\text{C}$  (for MC78LXXAC), unless otherwise noted.)

| Characteristics                                                                                                                                                                          | Symbol                     | MC78L08AC, AB |           |            | Unit          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------|-----------|------------|---------------|
|                                                                                                                                                                                          |                            | Min           | Typ       | Max        |               |
| Output Voltage ( $T_J = +25^\circ\text{C}$ )                                                                                                                                             | $V_O$                      | 7.7           | 8.0       | 8.3        | Vdc           |
| Line Regulation<br>( $T_J = +25^\circ\text{C}$ , $I_O = 40\text{ mA}$ )<br>$10.5\text{ Vdc} \leq V_I \leq 23\text{ Vdc}$<br>$11\text{ Vdc} \leq V_I \leq 23\text{ Vdc}$                  | $\text{Reg}_{\text{line}}$ | –<br>–        | 20<br>12  | 175<br>125 | mV            |
| Load Regulation<br>( $T_J = +25^\circ\text{C}$ , $1.0\text{ mA} \leq I_O \leq 100\text{ mA}$ )<br>( $T_J = +25^\circ\text{C}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )             | $\text{Reg}_{\text{load}}$ | –<br>–        | 15<br>8.0 | 80<br>40   | mV            |
| Output Voltage<br>( $10.5\text{ Vdc} \leq V_I \leq 23\text{ Vdc}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )<br>( $V_I = 14\text{ V}$ , $1.0\text{ mA} \leq I_O \leq 70\text{ mA}$ ) | $V_O$                      | 7.6<br>7.6    | –<br>–    | 8.4<br>8.4 | Vdc           |
| Input Bias Current<br>( $T_J = +25^\circ\text{C}$ )<br>( $T_J = +125^\circ\text{C}$ )                                                                                                    | $I_{IB}$                   | –<br>–        | 3.0<br>–  | 6.0<br>5.5 | mA            |
| Input Bias Current Change<br>( $11\text{ Vdc} \leq V_I \leq 23\text{ Vdc}$ )<br>( $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )                                                           | $\Delta I_{IB}$            | –<br>–        | –<br>–    | 1.5<br>0.1 | mA            |
| Output Noise Voltage<br>( $T_A = +25^\circ\text{C}$ , $10\text{ Hz} \leq f \leq 100\text{ kHz}$ )                                                                                        | $V_n$                      | –             | 60        | –          | $\mu\text{V}$ |
| Ripple Rejection ( $I_O = 40\text{ mA}$ ,<br>$f = 120\text{ Hz}$ , $12\text{ V} \leq V_I \leq 23\text{ V}$ , $T_J = +25^\circ\text{C}$ )                                                 | RR                         | 37            | 57        | –          | dB            |
| Dropout Voltage ( $T_J = +25^\circ\text{C}$ )                                                                                                                                            | $V_I - V_O$                | –             | 1.7       | –          | Vdc           |

**ELECTRICAL CHARACTERISTICS** ( $V_I = 15\text{ V}$ ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  $-40^\circ\text{C} < T_J < +125^\circ\text{C}$  (for MC78LXXAB),  $0^\circ\text{C} < T_J < +125^\circ\text{C}$  (for MC78LXXAC), unless otherwise noted.)

| Characteristics                                                                                                                                                                          | Symbol                     | MC78L09AC, AB |           |            | Unit          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------|-----------|------------|---------------|
|                                                                                                                                                                                          |                            | Min           | Typ       | Max        |               |
| Output Voltage ( $T_J = +25^\circ\text{C}$ )                                                                                                                                             | $V_O$                      | 8.6           | 9.0       | 9.4        | Vdc           |
| Line Regulation<br>( $T_J = +25^\circ\text{C}$ , $I_O = 40\text{ mA}$ )<br>$11.5\text{ Vdc} \leq V_I \leq 24\text{ Vdc}$<br>$12\text{ Vdc} \leq V_I \leq 24\text{ Vdc}$                  | $\text{Reg}_{\text{line}}$ | –<br>–        | 20<br>12  | 175<br>125 | mV            |
| Load Regulation<br>( $T_J = +25^\circ\text{C}$ , $1.0\text{ mA} \leq I_O \leq 100\text{ mA}$ )<br>( $T_J = +25^\circ\text{C}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )             | $\text{Reg}_{\text{load}}$ | –<br>–        | 15<br>8.0 | 90<br>40   | mV            |
| Output Voltage<br>( $11.5\text{ Vdc} \leq V_I \leq 24\text{ Vdc}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )<br>( $V_I = 15\text{ V}$ , $1.0\text{ mA} \leq I_O \leq 70\text{ mA}$ ) | $V_O$                      | 8.5<br>8.5    | –<br>–    | 9.5<br>9.5 | Vdc           |
| Input Bias Current<br>( $T_J = +25^\circ\text{C}$ )<br>( $T_J = +125^\circ\text{C}$ )                                                                                                    | $I_{IB}$                   | –<br>–        | 3.0<br>–  | 6.0<br>5.5 | mA            |
| Input Bias Current Change<br>( $11\text{ Vdc} \leq V_I \leq 23\text{ Vdc}$ )<br>( $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )                                                           | $\Delta I_{IB}$            | –<br>–        | –<br>–    | 1.5<br>0.1 | mA            |
| Output Noise Voltage<br>( $T_A = +25^\circ\text{C}$ , $10\text{ Hz} \leq f \leq 100\text{ kHz}$ )                                                                                        | $V_n$                      | –             | 60        | –          | $\mu\text{V}$ |
| Ripple Rejection ( $I_O = 40\text{ mA}$ ,<br>$f = 120\text{ Hz}$ , $13\text{ V} \leq V_I \leq 24\text{ V}$ , $T_J = +25^\circ\text{C}$ )                                                 | RR                         | 37            | 57        | –          | dB            |
| Dropout Voltage<br>( $T_J = +25^\circ\text{C}$ )                                                                                                                                         | $V_I - V_O$                | –             | 1.7       | –          | Vdc           |

## MC78L00A Series, NCV78L00A

**ELECTRICAL CHARACTERISTICS** ( $V_I = 19\text{ V}$ ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  $-40^\circ\text{C} < T_J < +125^\circ\text{C}$  (for MC78LXXAB),  $0^\circ\text{C} < T_J < +125^\circ\text{C}$  (for MC78LXXAC), unless otherwise noted.)

| Characteristics                                                                                                                                                                          | Symbol                     | MC78L12AC, AB |            |              | Unit          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------|------------|--------------|---------------|
|                                                                                                                                                                                          |                            | Min           | Typ        | Max          |               |
| Output Voltage ( $T_J = +25^\circ\text{C}$ )                                                                                                                                             | $V_O$                      | 11.5          | 12         | 12.5         | Vdc           |
| Line Regulation<br>( $T_J = +25^\circ\text{C}$ , $I_O = 40\text{ mA}$ )<br>$14.5\text{ Vdc} \leq V_I \leq 27\text{ Vdc}$<br>$16\text{ Vdc} \leq V_I \leq 27\text{ Vdc}$                  | $\text{Reg}_{\text{line}}$ | –<br>–        | 120<br>100 | 250<br>200   | mV            |
| Load Regulation<br>( $T_J = +25^\circ\text{C}$ , $1.0\text{ mA} \leq I_O \leq 100\text{ mA}$ )<br>( $T_J = +25^\circ\text{C}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )             | $\text{Reg}_{\text{load}}$ | –<br>–        | 20<br>10   | 100<br>50    | mV            |
| Output Voltage<br>( $14.5\text{ Vdc} \leq V_I \leq 27\text{ Vdc}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )<br>( $V_I = 19\text{ V}$ , $1.0\text{ mA} \leq I_O \leq 70\text{ mA}$ ) | $V_O$                      | 11.4<br>11.4  | –<br>–     | 12.6<br>12.6 | Vdc           |
| Input Bias Current<br>( $T_J = +25^\circ\text{C}$ )<br>( $T_J = +125^\circ\text{C}$ )                                                                                                    | $I_{IB}$                   | –<br>–        | 4.2<br>–   | 6.5<br>6.0   | mA            |
| Input Bias Current Change<br>( $16\text{ Vdc} \leq V_I \leq 27\text{ Vdc}$ )<br>( $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )                                                           | $\Delta I_{IB}$            | –<br>–        | –<br>–     | 1.5<br>0.1   | mA            |
| Output Noise Voltage<br>( $T_A = +25^\circ\text{C}$ , $10\text{ Hz} \leq f \leq 100\text{ kHz}$ )                                                                                        | $V_n$                      | –             | 80         | –            | $\mu\text{V}$ |
| Ripple Rejection ( $I_O = 40\text{ mA}$ ,<br>$f = 120\text{ Hz}$ , $15\text{ V} \leq V_I \leq 25\text{ V}$ , $T_J = +25^\circ\text{C}$ )                                                 | RR                         | 37            | 42         | –            | dB            |
| Dropout Voltage<br>( $T_J = +25^\circ\text{C}$ )                                                                                                                                         | $V_I - V_O$                | –             | 1.7        | –            | Vdc           |

**ELECTRICAL CHARACTERISTICS** ( $V_I = 23\text{ V}$ ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  $-40^\circ\text{C} < T_J < +125^\circ\text{C}$  (for MC78LXXAB),  $0^\circ\text{C} < T_J < +125^\circ\text{C}$  (for MC78LXXAC), unless otherwise noted.)

| Characteristics                                                                                                                                                                          | Symbol                     | MC78L15AC, AB  |            |                | Unit          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------------|------------|----------------|---------------|
|                                                                                                                                                                                          |                            | Min            | Typ        | Max            |               |
| Output Voltage ( $T_J = +25^\circ\text{C}$ )                                                                                                                                             | $V_O$                      | 14.4           | 15         | 15.6           | Vdc           |
| Line Regulation<br>( $T_J = +25^\circ\text{C}$ , $I_O = 40\text{ mA}$ )<br>$17.5\text{ Vdc} \leq V_I \leq 30\text{ Vdc}$<br>$20\text{ Vdc} \leq V_I \leq 30\text{ Vdc}$                  | $\text{Reg}_{\text{line}}$ | –<br>–         | 130<br>110 | 300<br>250     | mV            |
| Load Regulation<br>( $T_J = +25^\circ\text{C}$ , $1.0\text{ mA} \leq I_O \leq 100\text{ mA}$ )<br>( $T_J = +25^\circ\text{C}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )             | $\text{Reg}_{\text{load}}$ | –<br>–         | 25<br>12   | 150<br>75      | mV            |
| Output Voltage<br>( $17.5\text{ Vdc} \leq V_I \leq 30\text{ Vdc}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )<br>( $V_I = 23\text{ V}$ , $1.0\text{ mA} \leq I_O \leq 70\text{ mA}$ ) | $V_O$                      | 14.25<br>14.25 | –<br>–     | 15.75<br>15.75 | Vdc           |
| Input Bias Current<br>( $T_J = +25^\circ\text{C}$ )<br>( $T_J = +125^\circ\text{C}$ )                                                                                                    | $I_{IB}$                   | –<br>–         | 4.4<br>–   | 6.5<br>6.0     | mA            |
| Input Bias Current Change<br>( $20\text{ Vdc} \leq V_I \leq 30\text{ Vdc}$ )<br>( $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )                                                           | $\Delta I_{IB}$            | –<br>–         | –<br>–     | 1.5<br>0.1     | mA            |
| Output Noise Voltage<br>( $T_A = +25^\circ\text{C}$ , $10\text{ Hz} \leq f \leq 100\text{ kHz}$ )                                                                                        | $V_n$                      | –              | 90         | –              | $\mu\text{V}$ |
| Ripple Rejection ( $I_O = 40\text{ mA}$ ,<br>$f = 120\text{ Hz}$ , $18.5\text{ V} \leq V_I \leq 28.5\text{ V}$ , $T_J = +25^\circ\text{C}$ )                                             | RR                         | 34             | 39         | –              | dB            |
| Dropout Voltage<br>( $T_J = +25^\circ\text{C}$ )                                                                                                                                         | $V_I - V_O$                | –              | 1.7        | –              | Vdc           |

## MC78L00A Series, NCV78L00A

**ELECTRICAL CHARACTERISTICS** ( $V_I = 27\text{ V}$ ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  $0^\circ\text{C} < T_J < +125^\circ\text{C}$ , unless otherwise noted.)

| Characteristics                                                                                                                                                                                                                                                                                                                                                    | Symbol                     | MC78L18AC    |          |              | Unit          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------|----------|--------------|---------------|
|                                                                                                                                                                                                                                                                                                                                                                    |                            | Min          | Typ      | Max          |               |
| Output Voltage ( $T_J = +25^\circ\text{C}$ )                                                                                                                                                                                                                                                                                                                       | $V_O$                      | 17.3         | 18       | 18.7         | Vdc           |
| Line Regulation<br>( $T_J = +25^\circ\text{C}$ , $I_O = 40\text{ mA}$ )<br>$21.4\text{ Vdc} \leq V_I \leq 33\text{ Vdc}$<br>$20.7\text{ Vdc} \leq V_I \leq 33\text{ Vdc}$<br>$22\text{ Vdc} \leq V_I \leq 33\text{ Vdc}$<br>$21\text{ Vdc} \leq V_I \leq 33\text{ Vdc}$                                                                                            | $\text{Reg}_{\text{line}}$ | –<br>–       | 45<br>35 | 325<br>275   | mV            |
| Load Regulation<br>( $T_J = +25^\circ\text{C}$ , $1.0\text{ mA} \leq I_O \leq 100\text{ mA}$ )<br>( $T_J = +25^\circ\text{C}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )                                                                                                                                                                                       | $\text{Reg}_{\text{load}}$ | –<br>–       | 30<br>15 | 170<br>85    | mV            |
| Output Voltage<br>( $21.4\text{ Vdc} \leq V_I \leq 33\text{ Vdc}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )<br>( $20.7\text{ Vdc} \leq V_I \leq 33\text{ Vdc}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )<br>( $V_I = 27\text{ V}$ , $1.0\text{ mA} \leq I_O \leq 70\text{ mA}$ )<br>( $V_I = 27\text{ V}$ , $1.0\text{ mA} \leq I_O \leq 70\text{ mA}$ ) | $V_O$                      | 17.1<br>17.1 | –<br>–   | 18.9<br>18.9 | Vdc           |
| Input Bias Current<br>( $T_J = +25^\circ\text{C}$ )<br>( $T_J = +125^\circ\text{C}$ )                                                                                                                                                                                                                                                                              | $I_{IB}$                   | –<br>–       | 3.1<br>– | 6.5<br>6.0   | mA            |
| Input Bias Current Change<br>( $22\text{ Vdc} \leq V_I \leq 33\text{ Vdc}$ )<br>( $21\text{ Vdc} \leq V_I \leq 33\text{ Vdc}$ )<br>( $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )                                                                                                                                                                                  | $\Delta I_{IB}$            | –<br>–       | –<br>–   | 1.5<br>0.1   | mA            |
| Output Noise Voltage<br>( $T_A = +25^\circ\text{C}$ , $10\text{ Hz} \leq f \leq 100\text{ kHz}$ )                                                                                                                                                                                                                                                                  | $V_n$                      | –            | 150      | –            | $\mu\text{V}$ |
| Ripple Rejection ( $I_O = 40\text{ mA}$ ,<br>$f = 120\text{ Hz}$ , $23\text{ V} \leq V_I \leq 33\text{ V}$ , $T_J = +25^\circ\text{C}$ )                                                                                                                                                                                                                           | RR                         | 33           | 48       | –            | dB            |
| Dropout Voltage<br>( $T_J = +25^\circ\text{C}$ )                                                                                                                                                                                                                                                                                                                   | $V_I - V_O$                | –            | 1.7      | –            | Vdc           |

## MC78L00A Series, NCV78L00A

**ELECTRICAL CHARACTERISTICS** ( $V_I = 33\text{ V}$ ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$ ,  $0^\circ\text{C} < T_J < +125^\circ\text{C}$ , unless otherwise noted.)

| Characteristics                                                                                                                                                                                                                                                                                                                                                                                                | Symbol                     | MC78L24AC    |               |                 | Unit          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------|---------------|-----------------|---------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                |                            | Min          | Typ           | Max             |               |
| Output Voltage ( $T_J = +25^\circ\text{C}$ )                                                                                                                                                                                                                                                                                                                                                                   | $V_O$                      | 23           | 24            | 25              | Vdc           |
| Line Regulation<br>( $T_J = +25^\circ\text{C}$ , $I_O = 40\text{ mA}$ )<br>$27.5\text{ Vdc} \leq V_I \leq 38\text{ Vdc}$<br>$28\text{ Vdc} \leq V_I \leq 80\text{ Vdc}$<br>$27\text{ Vdc} \leq V_I \leq 38\text{ Vdc}$                                                                                                                                                                                         | $\text{Reg}_{\text{line}}$ | –<br>–<br>–  | –<br>50<br>60 | –<br>300<br>350 | mV            |
| Load Regulation<br>( $T_J = +25^\circ\text{C}$ , $1.0\text{ mA} \leq I_O \leq 100\text{ mA}$ )<br>( $T_J = +25^\circ\text{C}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )                                                                                                                                                                                                                                   | $\text{Reg}_{\text{load}}$ | –<br>–       | 40<br>20      | 200<br>100      | mV            |
| Output Voltage<br>( $28\text{ Vdc} \leq V_I \leq 38\text{ Vdc}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )<br>( $27\text{ Vdc} \leq V_I \leq 38\text{ Vdc}$ , $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )<br>( $28\text{ Vdc} \leq V_I \leq 33\text{ Vdc}$ , $1.0\text{ mA} \leq I_O \leq 70\text{ mA}$ )<br>( $27\text{ Vdc} \leq V_I \leq 33\text{ Vdc}$ , $1.0\text{ mA} \leq I_O \leq 70\text{ mA}$ ) | $V_O$                      | 22.8<br>22.8 | –<br>–        | 25.2<br>25.2    | Vdc           |
| Input Bias Current<br>( $T_J = +25^\circ\text{C}$ )<br>( $T_J = +125^\circ\text{C}$ )                                                                                                                                                                                                                                                                                                                          | $I_{IB}$                   | –<br>–       | 3.1<br>–      | 6.5<br>6.0      | mA            |
| Input Bias Current Change<br>( $28\text{ Vdc} \leq V_I \leq 38\text{ Vdc}$ )<br>( $1.0\text{ mA} \leq I_O \leq 40\text{ mA}$ )                                                                                                                                                                                                                                                                                 | $\Delta I_{IB}$            | –<br>–       | –<br>–        | 1.5<br>0.1      | mA            |
| Output Noise Voltage<br>( $T_A = +25^\circ\text{C}$ , $10\text{ Hz} \leq f \leq 100\text{ kHz}$ )                                                                                                                                                                                                                                                                                                              | $V_n$                      | –            | 200           | –               | $\mu\text{V}$ |
| Ripple Rejection ( $I_O = 40\text{ mA}$ ,<br>$f = 120\text{ Hz}$ , $29\text{ V} \leq V_I \leq 35\text{ V}$ , $T_J = +25^\circ\text{C}$ )                                                                                                                                                                                                                                                                       | RR                         | 31           | 45            | –               | dB            |
| Dropout Voltage<br>( $T_J = +25^\circ\text{C}$ )                                                                                                                                                                                                                                                                                                                                                               | $V_I - V_O$                | –            | 1.7           | –               | Vdc           |

# MC78L00A Series, NCV78L00A

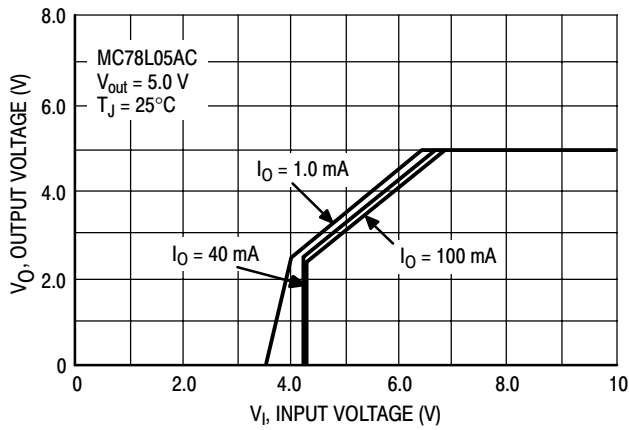


Figure 3. Dropout Characteristics

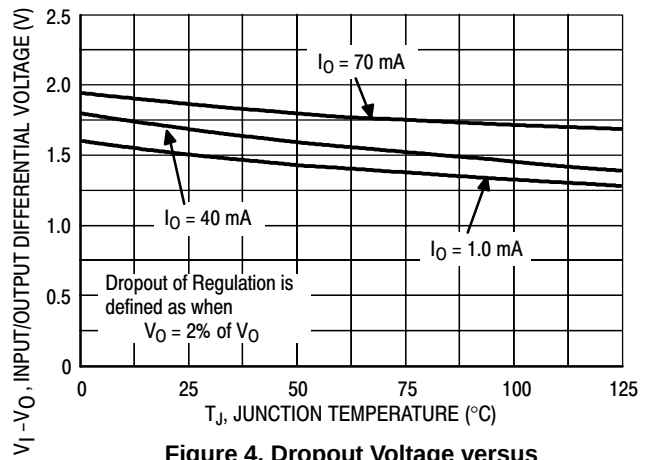


Figure 4. Dropout Voltage versus Junction Temperature

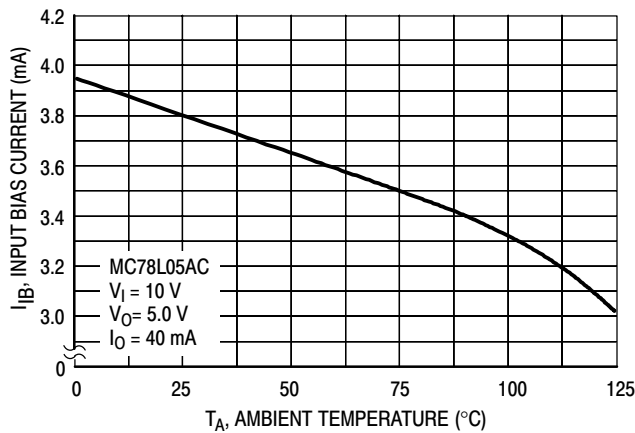


Figure 5. Input Bias Current versus Ambient Temperature

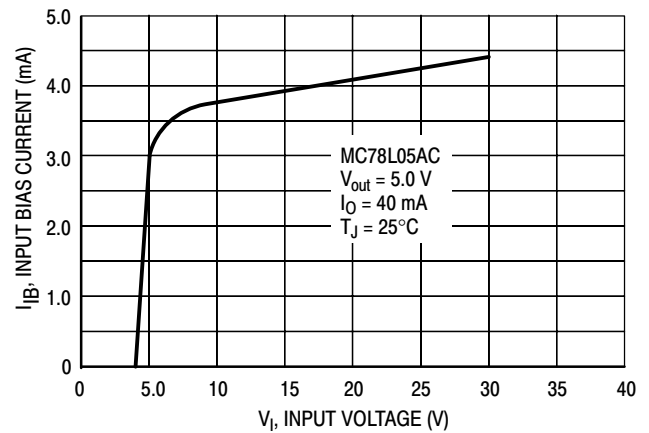


Figure 6. Input Bias Current versus Input Voltage

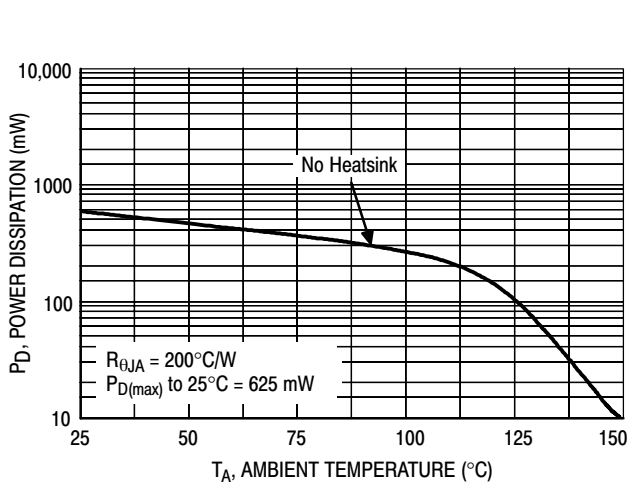


Figure 7. Maximum Average Power Dissipation versus Ambient Temperature – TO-92 Type Package

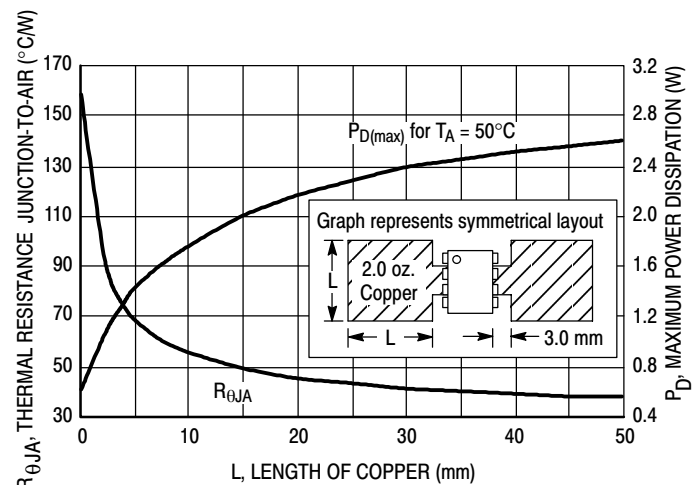


Figure 8. SOIC-8 Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length

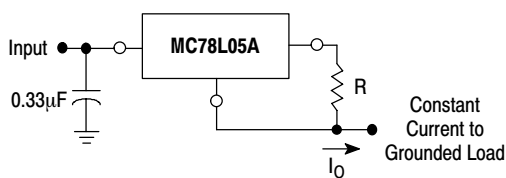
## APPLICATIONS INFORMATION

### Design Considerations

The MC78L00A Series of fixed voltage regulators are designed with Thermal Overload Protection that shuts down the circuit when subjected to an excessive power overload condition. Internal Short Circuit Protection limits the maximum current the circuit will pass.

In many low current applications, compensation capacitors are not required. However, it is recommended that the regulator input be bypassed with a capacitor if the regulator is connected to the power supply filter with long wire lengths, or if the output load capacitance is large. The

input bypass capacitor should be selected to provide good high-frequency characteristics to insure stable operation under all load conditions. A 0.33  $\mu$ F or larger tantalum, mylar, or other capacitor having low internal impedance at high frequencies should be chosen. The bypass capacitor should be mounted with the shortest possible leads directly across the regulators input terminals. Good construction techniques should be used to minimize ground loops and lead resistance drops since the regulator has no external sense lead. Bypassing the output is also recommended.



The MC78L00 regulators can also be used as a current source when connected as above. In order to minimize dissipation the MC78L05C is chosen in this application. Resistor R determines the current as follows:

$$I_O = \frac{5.0 \text{ V}}{R} + I_B$$

$$I_B = 3.8 \text{ mA over line and load changes}$$

For example, a 100 mA current source would require R to be a 50  $\Omega$ , 1/2 W resistor and the output voltage compliance would be the input voltage less 7 V.

Figure 9. Current Regulator

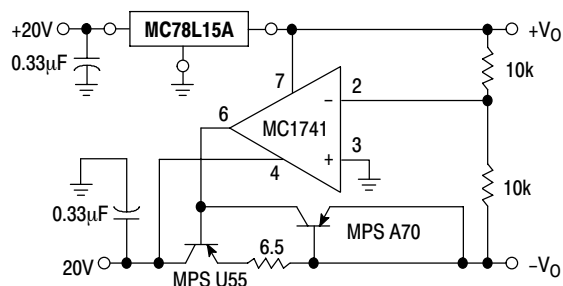


Figure 10.  $\pm 15$  V Tracking Voltage Regulator

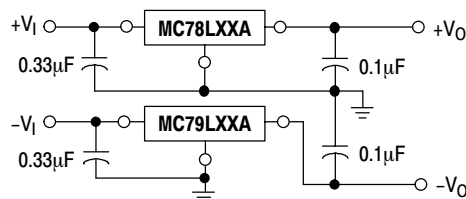


Figure 11. Positive and Negative Regulator

# MC78L00A Series, NCV78L00A

## ORDERING INFORMATION

| Device         | Output Voltage | Operating Temperature Range                       | Package          | Shipping <sup>†</sup> |
|----------------|----------------|---------------------------------------------------|------------------|-----------------------|
| MC78L05ABD     | 5.0 V          | $T_J = -40^\circ \text{ to } +125^\circ \text{C}$ | SOIC-8           | 98 Units/Rail         |
| MC78L05ABDG    |                |                                                   | SOIC-8           | 98 Units/Rail         |
| MC78L05ABDR2   |                |                                                   | SOIC-8           | 2500 Tape & Reel      |
| MC78L05ABDR2G  |                |                                                   | SOIC-8 (Pb-Free) | 2500 Tape & Reel      |
| NCV78L05ABDR2* |                |                                                   | SOIC-8           | 2500 Tape & Reel      |
| MC78L05ABP     |                |                                                   | TO-92            | 2000 Units/Bag        |
| MC78L05ABPG    |                |                                                   | TO-92 (Pb-Free)  | 2000 Units/Bag        |
| MC78L05ABPRA   |                |                                                   | TO-92            | 2000 Tape & Reel      |
| MC78L05ABPRAG  |                |                                                   | TO-92 (Pb-Free)  | 2000 Tape & Reel      |
| MC78L05ABPRE   |                |                                                   | TO-92            | 2000 Tape & Reel      |
| MC78L05ABPREG  |                |                                                   | TO-92 (Pb-Free)  | 2000 Tape & Reel      |
| MC78L05ABPRM   |                |                                                   | TO-92            | 2000 Ammo Pack        |
| MC78L05ABPRMG  |                |                                                   | TO-92 (Pb-Free)  | 2000 Ammo Pack        |
| MC78L05ACD     |                | $T_J = 0^\circ \text{ to } +125^\circ \text{C}$   | SOIC-8           | 98 Units/Rail         |
| MC78L05ACDG    |                |                                                   | SOIC-8 (Pb-Free) | 98 Units/Rail         |
| MC78L05ACDR2   |                |                                                   | SOIC-8           | 2500 Tape & Reel      |
| MC78L05ACDR2G  |                |                                                   | SOIC-8 (Pb-Free) | 2500 Tape & Reel      |
| MC78L05ACP     |                |                                                   | TO-92            | 2000 Units/Bag        |
| MC78L05ACPG    |                |                                                   | TO-92 (Pb-Free)  | 2000 Units/Bag        |
| MC78L05ACPRA   |                |                                                   | TO-92            | 2000 Tape & Reel      |
| MC78L05ACPRAG  |                |                                                   | TO-92 (Pb-Free)  | 2000 Tape & Reel      |
| MC78L05ACPRE   |                |                                                   | TO-92            | 2000 Tape & Reel      |
| MC78L05ACPREG  |                |                                                   | TO-92 (Pb-Free)  | 2000 Tape & Reel      |
| MC78L05ACPRM   |                |                                                   | TO-92            | 2000 Ammo Pack        |
| MC78L05ACPRMG  |                |                                                   | TO-92 (Pb-Free)  | 2000 Ammo Pack        |
| MC78L05ACPRP   |                |                                                   | TO-92            | 2000 Ammo Pack        |
| MC78L05ACPRPG  |                |                                                   | TO-92 (Pb-Free)  | 2000 Ammo Pack        |

\*NCV78L05A:  $T_{\text{low}} = -40^\circ \text{C}$ ,  $T_{\text{high}} = +125^\circ \text{C}$ . Guaranteed by design. NCV prefix is for automotive and other applications requiring site and change control.

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MC78L00A Series, NCV78L00A

## ORDERING INFORMATION

| Device         | Output Voltage | Operating Temperature Range                          | Package          | Shipping <sup>†</sup> |
|----------------|----------------|------------------------------------------------------|------------------|-----------------------|
| MC78L08ABD     | 8.0 V          | $T_J = -40^{\circ} \text{ to } +125^{\circ}\text{C}$ | SOIC-8           | 98 Units/Rail         |
| MC78L08ABDG    |                |                                                      | SOIC-8 (Pb-Free) | 98 Units/Rail         |
| MC78L08ABDR2   |                |                                                      | SOIC-8           | 2500 Tape & Reel      |
| MC78L08ABDR2G  |                |                                                      | SOIC-8 (Pb-Free) | 2500 Tape & Reel      |
| MC78L08ABP     |                |                                                      | TO-92            | 2000 Units/Bag        |
| MC78L08ABPRA   |                |                                                      | TO-92            | 2000 Tape & Reel      |
| MC78L08ABPRP   |                |                                                      | TO-92            | 2000 Ammo Pack        |
| MC78L08ACD     |                | $T_J = 0^{\circ} \text{ to } +125^{\circ}\text{C}$   | SOIC-8           | 98 Units/Rail         |
| MC78L08ACDG    |                |                                                      | SOIC-8           | 98 Units/Rail         |
| MC78L08ACDR2   |                |                                                      | SOIC-8           | 2500 Tape & Reel      |
| MC78L08ACP     |                |                                                      | TO-92            | 2000 Units/Bag        |
| MC78L08ACPG    |                |                                                      | TO-92 (Pb-Free)  | 2000 Units/Bag        |
| MC78L08ACPRA   |                |                                                      | TO-92            | 2000 Tape & Reel      |
| MC78L08ACPRA G |                |                                                      | TO-92 (Pb-Free)  | 2000 Tape & Reel      |
| MC78L08ACPRE   |                |                                                      | TO-92            | 2000 Tape & Reel      |
| MC78L08ACPRP   |                |                                                      | TO-92            | 2000 Ammo Pack        |
| MC78L08ACPRPG  |                |                                                      | TO-92 (Pb-Free)  | 2000 Ammo Pack        |
| MC78L09ABD     | 9.0 V          | $T_J = -40^{\circ} \text{ to } +125^{\circ}\text{C}$ | SOIC-8           | 98 Units/Rail         |
| MC78L09ABDG    |                |                                                      | SOIC-8 (Pb-Free) | 98 Units/Rail         |
| MC78L09ABDR2   |                |                                                      | SOIC-8           | 2500 Tape & Reel      |
| MC78L09ABPRA   |                |                                                      | TO-92            | 2000 Tape & Reel      |
| MC78L09ABPRP   |                |                                                      | TO-92            | 2000 Ammo Pack        |
| MC78L09ABDG    |                |                                                      | SOIC-8 (Pb-Free) | 98 Units/Rail         |
| MC78L09ACD     |                | $T_J = 0^{\circ} \text{ to } +125^{\circ}\text{C}$   | SOIC-8           | 98 Units/Rail         |
| MC78L09ACDG    |                |                                                      | SOIC-8 (Pb-Free) | 98 Units/Rail         |
| MC78L09ACDR2   |                |                                                      | SOIC-8           | 2500 Tape & Reel      |
| MC78L09ACDR2G  |                |                                                      | SOIC-8 (Pb-Free) | 2500 Tape & Reel      |
| MC78L09ACP     |                |                                                      | TO-92            | 2000 Units/Bag        |
| MC78L09ACPG    |                |                                                      | TO-92 (Pb-Free)  | 2000 Units/Bag        |
| MC78L09ACDR2G  |                |                                                      | SOIC-8 (Pb-Free) | 2500 Tape & Reel      |
| MC78L09ACPG    |                |                                                      | TO-92 (Pb-Free)  | 2000 Units/Bag        |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MC78L00A Series, NCV78L00A

## ORDERING INFORMATION

| Device         | Output Voltage | Operating Temperature Range                          | Package          | Shipping <sup>†</sup> |
|----------------|----------------|------------------------------------------------------|------------------|-----------------------|
| MC78L12ABD     | 12 V           | $T_J = -40^{\circ} \text{ to } +125^{\circ}\text{C}$ | SOIC-8           | 98 Units/Rail         |
| MC78L12ABDR2   |                |                                                      | SOIC-8           | 2500 Tape & Reel      |
| MC78L12ABP     |                |                                                      | TO-92            | 2000 Units/Bag        |
| MC78L12ABPRP   |                |                                                      | TO-92            | 2000 Ammo Pack        |
| NCV78L12ABDR2* |                |                                                      | SOIC_8           | 2500 Tape & Reel      |
| MC78L12ACD     |                | $T_J = 0^{\circ} \text{ to } +125^{\circ}\text{C}$   | SOIC-8           | 98 Units/Rail         |
| MC78L12ACDR2   |                |                                                      | SOIC-8           | 2500 Tape & Reel      |
| MC78L12ACP     |                |                                                      | TO-92            | 2000 Units/Bag        |
| MC78L12ACPRA   |                |                                                      | TO-92            | 2000 Tape & Reel      |
| MC78L12ACPRAG  |                |                                                      | TO-92 (Pb-Free)  | 2000 Tape & Reel      |
| MC78L12ACPRE   |                |                                                      | TO-92            | 2000 Tape & Reel      |
| MC78L12ACPRM   |                |                                                      | TO-92            | 2000 Ammo Pack        |
| MC78L12ACPRMG  |                |                                                      | TO-92 (Pb-Free)  | 2000 Ammo Pack        |
| MC78L12ACPRP   |                |                                                      | TO-92            | 2000 Ammo Pack        |
| MC78L12ACPRPG  |                |                                                      | TO-92 (Pb-Free)  | 2000 Ammo Pack        |
| MC78L12ACDR2G  |                |                                                      | SOIC-8 (Pb-Free) | 2500 Tape & Reel      |
| MC78L12ACPG    |                |                                                      | TO-92 (Pb-Free)  | 2000 Units/Bag        |
| MC78L15ABD     | 15 V           | $T_J = -40^{\circ} \text{ to } +125^{\circ}\text{C}$ | SOIC-8           | 98 Units/Rail         |
| MC78L15ABDR2   |                |                                                      | SOIC-8           | 2500 Tape & Reel      |
| MC78L15ABDR2G  |                |                                                      | SOIC-8 (Pb-Free) | 2500 Tape & Reel      |
| MC78L15ABP     |                |                                                      | TO-92            | 2000 Units/Bag        |
| MC78L15ABPRA   |                |                                                      | TO-92            | 2000 Tape & Reel      |
| MC78L15ABPRP   |                |                                                      | TO-92            | 2000 Ammo Pack        |
| MC78L15ABPRPG  |                |                                                      | TO-92 (Pb-Free)  | 2000 Ammo Pack        |
| MC78L15ACD     |                | $T_J = 0^{\circ} \text{ to } +125^{\circ}\text{C}$   | SOIC-8           | 98 Units/Rail         |
| MC78L15ACDR2   |                |                                                      | SOIC-8           | 2500 Tape & Reel      |
| MC78L15ACP     |                |                                                      | TO-92            | 2000 Units/Bag        |
| MC78L15ACPRA   |                |                                                      | TO-92            | 2000 Tape & Reel      |
| MC78L15ACPRAG  |                |                                                      | TO-92 (Pb-Free)  | 2000 Tape & Reel      |
| MC78L15ACPRP   |                |                                                      | TO-92            | 2000 Ammo Pack        |

\*NCV78L12A:  $T_{\text{low}} = -40^{\circ}\text{C}$ ,  $T_{\text{high}} = +125^{\circ}\text{C}$ . Guaranteed by design. NCV prefix is for automotive and other applications requiring site and change control.

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

## MC78L00A Series, NCV78L00A

### ORDERING INFORMATION

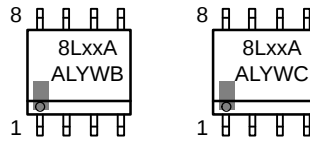
| Device        | Output Voltage | Operating Temperature Range     | Package         | Shipping†        |
|---------------|----------------|---------------------------------|-----------------|------------------|
| MC78L18ABP    | 18 V           | T <sub>J</sub> = −40° to +125°C | TO−92           | 2000 Units/Bag   |
| MC78L18ACP    |                | T <sub>J</sub> = 0° to +125°C   | TO−92           | 2000 Units/Bag   |
| MC78L18ACPG   | 18 V           |                                 | TO−92 (Pb−Free) | 2000 Units/Bag   |
| MC78L18ACPRA  |                |                                 | TO−92           | 2000 Tape & Reel |
| MC78L18ACPRM  |                |                                 | TO−92           | 2000 Ammo Pack   |
| MC78L18ACPRP  |                |                                 | TO−92           | 2000 Ammo Pack   |
| MC78L24ABP    | 24 V           | T <sub>J</sub> = −40° to +125°C | TO−92           | 2000 Units/Bag   |
| MC78L24ACP    |                | T <sub>J</sub> = 0° to +125°C   | TO−92           | 2000 Units/Bag   |
| MC78L24ACPG   |                |                                 | TO−92 (Pb−Free) | 2000 Units/Bag   |
| MC78L24ACPRA  |                |                                 | TO−92           | 2000 Tape & Reel |
| MC78L24ACPRP  |                |                                 | TO−92           | 2000 Ammo Pack   |
| MC78L24ACPRPG |                |                                 | TO−92 (Pb−Free) | 2000 Ammo Pack   |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MC78L00A Series, NCV78L00A

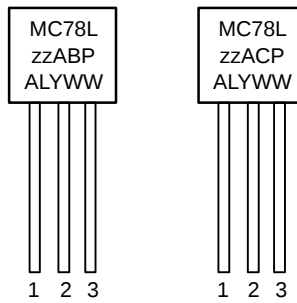
## MARKING DIAGRAMS

### SOIC-8 D SUFFIX CASE 751



xx = 05, 08, 09, 12, or 15  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
B, C = Temperature Range

### TO-92 P SUFFIX CASE 029

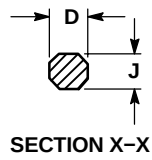
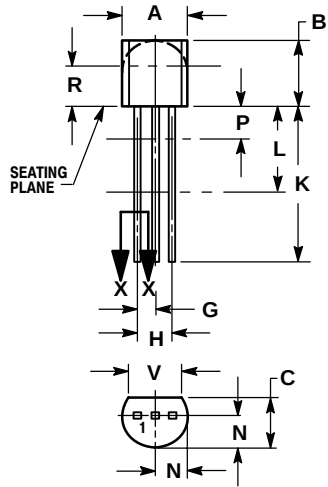


zz = 05, 08, 09, 12, 15, 18 or 24  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
WW = Work Week

# MC78L00A Series, NCV78L00A

## PACKAGE DIMENSIONS

TO-92 (TO-226)  
P SUFFIX  
CASE 29-11  
ISSUE AL



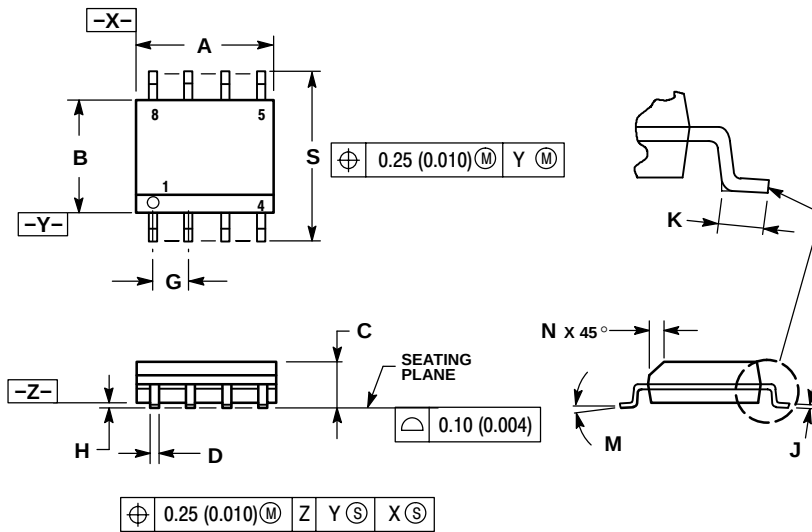
### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.175  | 0.205 | 4.45        | 5.20  |
| B   | 0.170  | 0.210 | 4.32        | 5.33  |
| C   | 0.125  | 0.165 | 3.18        | 4.19  |
| D   | 0.016  | 0.021 | 0.407       | 0.533 |
| G   | 0.045  | 0.055 | 1.15        | 1.39  |
| H   | 0.095  | 0.105 | 2.42        | 2.66  |
| J   | 0.015  | 0.020 | 0.39        | 0.50  |
| K   | 0.500  | ----  | 12.70       | ----  |
| L   | 0.250  | ----  | 6.35        | ----  |
| N   | 0.080  | 0.105 | 2.04        | 2.66  |
| P   | ----   | 0.100 | ----        | 2.54  |
| R   | 0.115  | ----  | 2.93        | ----  |
| V   | 0.135  | ----  | 3.43        | ----  |

# MC78L00A Series, NCV78L00A

SOIC-8 NB  
D SUFFIX  
CASE 751-07  
ISSUE AB

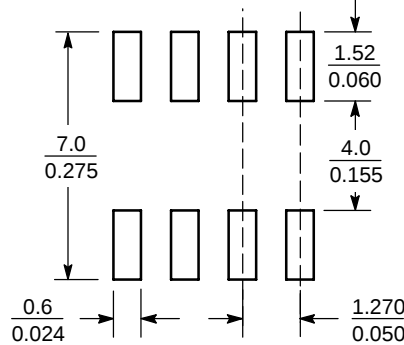


## NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.80        | 5.00 | 0.189     | 0.197 |
| B   | 3.80        | 4.00 | 0.150     | 0.157 |
| C   | 1.35        | 1.75 | 0.053     | 0.069 |
| D   | 0.33        | 0.51 | 0.013     | 0.020 |
| G   | 1.27 BSC    |      | 0.050 BSC |       |
| H   | 0.10        | 0.25 | 0.004     | 0.010 |
| J   | 0.19        | 0.25 | 0.007     | 0.010 |
| K   | 0.40        | 1.27 | 0.016     | 0.050 |
| M   | 0°          | 8°   | 0°        | 8°    |
| N   | 0.25        | 0.50 | 0.010     | 0.020 |
| S   | 5.80        | 6.20 | 0.228     | 0.244 |

## SOLDERING FOOTPRINT\*



SCALE 6:1  $\left( \frac{\text{mm}}{\text{inches}} \right)$

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MC78L00A Series, NCV78L00A

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