LM78XX Series Voltage Regulators

General Description

The LM78XX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow these regulators to be used in logic systems, instrumentation, HiFi, and other solid state electronic equipment. Although designed primarily as fixed voltage regulators these devices can be used with external components to obtain adjustable voltages and currents.

The LM78XX series is available in an aluminum TO-3 package which will allow over 1.0A load current if adequate heat sinking is provided. Current limiting is included to limit the peak output current to a safe value. Safe area protection for the output transistor is provided to limit internal power dissipation. If internal power dissipation becomes too high for the heat sinking provided, the thermal shutdown circuit takes over preventing the IC from overheating.

Considerable effort was expanded to make the LM78XX series of regulators easy to use and minimize the number of external components. It is not necessary to bypass the output, although this does improve transient response. Input bypassing is needed only if the regulator is located far from the filter capacitor of the power supply.

For output voltage other than 5V, 12V and 15V the LM78XX series provides an output voltage range from 1.2V to 57V.

Features

- Output current in excess of 1A
- Internal thermal overload protection
- No external components required
- Output transistor safe area protection
- Internal short circuit current limit
- Available in the aluminum TO-3 package

Voltage Range

- LM7805C 5V
- LM7812C 12V
- LM7815C 15V

Schematic and Connection Diagrams

[Diagram showing the internal connections of the LM78XX series voltage regulators]
### Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

- **Input Voltage (V<sub>in</sub>):** 5V, 12V and 15V
- **35V**
- **Storage Temperature Range:** –65°C to +150°C
- **Lead Temperature (Soldering, 10 sec.):** 230°C
- **Operating Temperature Range (T<sub>A</sub>):** 0°C to +70°C

#### Electrical Characteristics

**LM78XXC**

(Not 2) 0°C ≤ T<sub>j</sub> ≤ 125°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Output Voltage</th>
<th>Input Voltage (unless otherwise noted)</th>
<th>5V</th>
<th>12V</th>
<th>15V</th>
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<tbody>
<tr>
<td>Symbol</td>
<td>Parameter</td>
<td>Units</td>
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<tr>
<td>V&lt;sub&gt;O&lt;/sub&gt;</td>
<td>Output Voltage</td>
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<td>P&lt;sub&gt;O&lt;/sub&gt;</td>
<td>Quiescent Current</td>
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<tr>
<td>ΔV&lt;sub&gt;O&lt;/sub&gt;</td>
<td>Line Regulation</td>
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<tr>
<td>ΔI&lt;sub&gt;O&lt;/sub&gt;</td>
<td>Load Regulation</td>
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<tr>
<td>I&lt;sub&gt;Q&lt;/sub&gt;</td>
<td>Quiescent Current</td>
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<tr>
<td>ΔI&lt;sub&gt;Q&lt;/sub&gt;</td>
<td>Quiescent Current Change</td>
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<tr>
<td>VN</td>
<td>Output Noise Voltage</td>
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<td></td>
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<tr>
<td>ΔVIN</td>
<td>Ripple Rejection</td>
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<tr>
<td>ΔVOUT</td>
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<tr>
<td>R&lt;sub&gt;O&lt;/sub&gt;</td>
<td>Dropout Voltage</td>
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<tr>
<td>VN</td>
<td>Input Voltage Required to Maintain Line Regulation</td>
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</table>

#### Notes:

1. Thermal resistance of the TO-3 package (K, KC) is typically 4°C/W junction to case and 35°C/W case to ambient. Thermal resistance of the TO-220 package (T) is typically 4°C/W junction to case and 59°C/W case to ambient.
2. All characteristics are measured with capacitor across the input of 0.22 µF, and a capacitor across the output of 0.1µF. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (T<sub>PP</sub> ≤ 10 ms, duty cycle ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.
### Typical Performance Characteristics

**Maximum Average Power Dissipation**

- INFINITE HEAT SINK
- WITH 10 CW HEAT SINK
- NO HEAT SINK

**Output Voltage (Normalized to 1V at Tj = 25°C)**

- \( V_{IN} - V_{OUT} = 5V \)
- \( V_{OUT} = 5mA \)
- \( T_j = 25°C \)

**Ripple Rejection**

- \( V_{IN} - V_{OUT} = 5V \)
- \( V_{OUT} = 10V \)
- \( T_j = 25°C \)

**Output Impedance**

- \( V_{IN} = 1V \)
- \( V_{OUT} = 5V \)
- \( q_{OUT} = 5mA \)
- \( T_j = 20°C \)

**Dropout Voltage**

- \( \Delta V_{OUT} = 100mV \)
- \( q_{OUT} = 1A \)
- \( T_j = 20°C \)

**Quiescent Current**

- \( V_{IN} = 1V \)
- \( q_{OUT} = 5mA \)
- \( T_j = 20°C \)
Physical Dimensions inches (millimeters)

Aluminum Metal Can Package (KC)
Order Number LM7805CK, LM7812CK or LM7815CK
NS Package Number KC02A

KC02A (REV C)
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2. A critical component is 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.