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LM350
3-Terminal 3 A Positive Adjustable Regulator

Features
- Output Adjustable Between 1.2 V and 33 V
- Guaranteed 3 A Output Current
- Internal Thermal Overload Protection
- Load Regulation (Typical: 0.1%)
- Line Regulation (Typical: 0.015%/V)
- Internal Short-Circuit Current Limit
- Output Transistor Safe-Area Compensation

Description
The LM350 is an adjustable 3-terminal positive voltage regulator capable of supplying in excess of 3.0 A over an output voltage range of 1.2 V to 33 V.

Ordering Information

<table>
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<tr>
<th>Product Number</th>
<th>Marking</th>
<th>Package</th>
<th>Packing Method</th>
<th>Operating Temperature</th>
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<tr>
<td>LM350T</td>
<td>LM350</td>
<td>TO-220 3L (Single Gauge)</td>
<td>Rail</td>
<td>0 to +125°C</td>
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</tbody>
</table>
Block Diagram

Figure 1. Block Diagram

Absolute Maximum Ratings
Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at $T_A = 25^\circ C$ unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_I - V_O$</td>
<td>Input-Output Voltage Differential</td>
<td>35</td>
<td>V</td>
</tr>
<tr>
<td>$T_{LEAD}$</td>
<td>Lead Temperature (Soldering, 10 sec)</td>
<td>300</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{OPR}$</td>
<td>Operating Temperature Range</td>
<td>0 to +125</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{STG}$</td>
<td>Storage Temperature Range</td>
<td>-65 to +150</td>
<td>°C</td>
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</table>

Thermal Characteristics
Values are at $T_A = 25^\circ C$ unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_D$</td>
<td>Power Dissipation</td>
<td>Internally Limited</td>
<td>W</td>
</tr>
</tbody>
</table>
### Electrical Characteristics

*V₁ - V₀ = 5 V, I₀ = 1.5 A, 0°C ≤ TＪ ≤ +125°C, P₀ ≤ P₀MAX*, unless otherwise specified.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rₗᵢₙₑ</td>
<td>Line Regulation</td>
<td>TＡ = +25°C, 3 V ≤ V₁ - V₀ ≤ 35 V</td>
<td>0.015</td>
<td>0.030</td>
<td></td>
<td>%/V</td>
</tr>
<tr>
<td>Rₗ₀ᵣₜₑ</td>
<td>Load Regulation</td>
<td>TＡ = +25°C, 3 V ≤ V₁ - V₀ ≤ 35 V, V₀ ≤ 5V</td>
<td>5</td>
<td>25</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TＡ = +25°C, 3 V ≤ V₁ - V₀ ≤ 35 V, V₀ ≥ 5V</td>
<td>0.1</td>
<td>0.5</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Iₐₜ𝐽</td>
<td>Adjustment Pin Current</td>
<td>-</td>
<td>50</td>
<td>100</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td>ΔIₐₜ𝐽</td>
<td>Adjustment Pin Current Change</td>
<td>3 V ≤ V₁ - V₀ ≤ 35 V, 10 mA ≤ I₀ ≤ 3 A, P₀ ≤ P₀MAX</td>
<td>0.2</td>
<td>5.0</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td>REGₜ</td>
<td>Thermal Regulation</td>
<td>Pulse = 20 ms, TＡ = +25°C</td>
<td>0.002</td>
<td></td>
<td>%/W</td>
<td></td>
</tr>
<tr>
<td>Vₐᵣₑ</td>
<td>Reference Voltage</td>
<td>3 V ≤ V₁ - V₀ ≤ 35 V, 10 mA ≤ I₀ ≤ 3 A, P₀ ≤ 30 W</td>
<td>1.20</td>
<td>1.25</td>
<td>1.30</td>
<td>V</td>
</tr>
<tr>
<td>Rₗᵢₙₑ</td>
<td>Line Regulation</td>
<td>3.0 V ≤ V₁ - V₀ ≤ 35 V</td>
<td>0.02</td>
<td>0.07</td>
<td>%/W</td>
<td></td>
</tr>
<tr>
<td>Rₗ₀ᵣₜₑ</td>
<td>Load Regulation</td>
<td>10 mA ≤ I₀ ≤ 3.0 A, V₀ ≤ 5.0 V</td>
<td>20</td>
<td>70</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 mA ≤ I₀ ≤ 3.0 A, V₀ ≥ 5.0 V</td>
<td>0.3</td>
<td>1.5</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>STₜ</td>
<td>Temperature Stability</td>
<td>TＪ = 0°C to +125°C</td>
<td>1.0</td>
<td></td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>I₀(MAX)</td>
<td>Maximum Output Current</td>
<td>V₁ - V₀ ≤ 10 V, P₀ ≤ P₀MAX</td>
<td>3.0</td>
<td>4.5</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V₁ - V₀ = 30 V, P₀ ≤ P₀MAX, TＡ = +25°C</td>
<td>0.25</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iₗ(MIN)</td>
<td>Minimum Load Current</td>
<td>V₁ - V₀ = 35 V</td>
<td>3.5</td>
<td>10</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Vₐᵣₑ</td>
<td>RMS Noise, % of V₀put</td>
<td>10 Hz ≤ f ≤ 10 kHz, TＡ = +25°C</td>
<td>0.003</td>
<td></td>
<td>%/V₀</td>
<td></td>
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<tr>
<td>RR</td>
<td>Ripple Rejection</td>
<td>V₀ = 10 V, f = 120 Hz, C₀ᵣᵣₑ = 0</td>
<td>65</td>
<td></td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>V₀ = 10 V, f = 120 Hz, C₀ᵣᵣₑ = 10 μF</td>
<td>66</td>
<td>80</td>
<td></td>
<td></td>
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<tr>
<td>ST</td>
<td>Long-Term Stability</td>
<td>TＪ = +125°C</td>
<td>0.3</td>
<td>1</td>
<td>%/1000HR</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

1. Regulation is measured at constant junction temperature. Changes in output voltage due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.
Typical Performance Characteristics

Figure 2. Load Regulation

Figure 3. Current Limit

Figure 4. Adjustment Pin Current

Figure 5. Dropout Voltage

Figure 6. Temperature Stability

Figure 7. Minimum Load Current
Typical Performance Characteristics (Continued)

Figure 8. Ripple Rejection vs. $V_O$

Figure 9. Ripple Rejection vs. $I_O$

Figure 10. Ripple Rejection vs Frequency

Figure 11. Output Impedance

Figure 12. Line Transient Response

Figure 13. Load Transient Response
Typical Application\(^{(2)}\)

![Typical Application Diagram](image)

**Figure 14.**

**Note:**

2. CI: C\(_I\) is required if the regulator is located an appreciable distance from power supply filter.
   C\(_O\): Output capacitors in the range of 1 \(\mu\)F to 100 \(\mu\)F of aluminum or tantalum electronic are commonly used to provide improved output impedance and rejection of transients.

In operation, the LM350 develops a nominal 1.25 V reference voltage, \(V_{\text{REF}}\), between the output and adjustment terminal. The reference voltage is impressed across program resistor R\(_1\) and, since the voltage is constant, a constant current I\(_1\) then flows through the output set resistor R\(_2\), giving an output voltage of

\[
V_O = 1.25V(1+R_1/R_2) + I_{\text{ADJ}} R_2
\]

Since I\(_{\text{ADJ}}\) current (less than 100 mA) from the adjustment terminal represents an error term, the LM350 was designed to minimize I\(_{\text{ADJ}}\) and make it very constant with line and load changes. To do this, all quiescent operating current is returned to the output establishing a minimum load current requirement. If there is insufficient load on the output, the output voltage will rise. Since the LM350 is a floating regulator, it is only the voltage differential across the circuit which is important to performance, and operation at high voltage with respect to ground is possible.

Since I\(_{\text{ADJ}}\) is controlled to less than 100 mA, the error associated with this term is negligible in most applications.
Physical Dimensions

Figure 15. TO-220, MOLDED, 3LEAD, JEDEC VARIATION AB
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<th>Product Status</th>
<th>Definition</th>
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<td>Product Status</td>
<td>Definition</td>
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