5 A low drop positive voltage regulator adjustable and fixed

Features

- Typical dropout 1.3 V (at 5 A)
- Three terminal adjustable or fixed output voltage 2.5 V, 5 V, 12 V.
- Guaranteed output current up to 5 A
- Output tolerance ± 1 % at 25 °C and ± 2 % in full temperature range
- Internal power and thermal limit
- Wide operating temperature range -40 °C to 125 °C
- Package available: TO-220
- Pinout compatibility with standard adjustable VREG

Description

The LD1084xx is a low drop voltage regulator able to provide up to 5 A of output current. Dropout is guaranteed at a maximum of 1.5 V at the maximum output current, decreasing at lower loads. The LD1084xx is pin to pin compatible with the older 3-terminal adjustable regulators, but has better performances in term of drop and output tolerance.

A 2.85 V output version is suitable for SCSI-2 active termination. Unlike PNP regulators, where a part of the output current is wasted as quiescent current, the LD1084xx quiescent current flows into the load, so increase efficiency. Only a 10 µF minimum capacitor is need for stability.

Table 1. Device summary

<table>
<thead>
<tr>
<th>Part numbers</th>
<th>Order codes</th>
<th>Output voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD1084XX12</td>
<td>LD1084V12</td>
<td>12 V</td>
</tr>
<tr>
<td>LD1084XX25</td>
<td>LD1084V25</td>
<td>2.5 V</td>
</tr>
<tr>
<td>LD1084XX50</td>
<td>LD1084V50</td>
<td>5.0 V</td>
</tr>
<tr>
<td>LD1084XX</td>
<td>LD1084V</td>
<td>Adjustable</td>
</tr>
</tbody>
</table>

The device is supplied in TO-220. On chip trimming allows the regulator to reach a very tight output voltage tolerance, within ± 1 % at 25 °C.
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<th></th>
</tr>
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</tbody>
</table>
1 Diagram

Figure 1. Schematic diagram
2 Pin configuration

Figure 2. Pin connections (top view)
3 Maximum ratings

Table 2. Absolute maximum ratings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_i$</td>
<td>DC input voltage</td>
<td>30</td>
<td>V</td>
</tr>
<tr>
<td>$I_o$</td>
<td>Output current</td>
<td>Internally limited</td>
<td>mA</td>
</tr>
<tr>
<td>$P_D$</td>
<td>Power dissipation</td>
<td>Internally limited</td>
<td>mW</td>
</tr>
<tr>
<td>$T_{STG}$</td>
<td>Storage temperature range</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{OP}$</td>
<td>Operating junction temperature range</td>
<td>-40 to +125</td>
<td>°C</td>
</tr>
</tbody>
</table>

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

Table 3. Thermal data

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>TO-220</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{\text{JJC}}$</td>
<td>Thermal resistance junction-case</td>
<td>3</td>
<td>°C/W</td>
</tr>
<tr>
<td>$R_{\text{JJA}}$</td>
<td>Thermal resistance junction-ambient</td>
<td>50</td>
<td>°C/W</td>
</tr>
</tbody>
</table>
4 Schematic application

Figure 3. Application circuit

\[ V_O = V_{REF} \left(1 + \frac{R_2}{R_1}\right) \]
### 5 Electrical characteristics

#### Table 4. Electrical characteristics of LD1084#25

*(V\textsubscript{I} = 5.5 V, C\textsubscript{I} = C\textsubscript{O} = 10 \mu\text{F}, T\textsubscript{A} = -40 to 125 °C, unless otherwise specified).*

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V\text{O})</td>
<td>Output voltage (^{(1)})</td>
<td>(I\text{O} = 0\ mA, T\text{J} = 25°C)</td>
<td>2.475</td>
<td>2.5</td>
<td>2.525</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(I\text{O} = 0\ to 5A, \ V\text{I} = 4.1\ to 30V)</td>
<td>2.45</td>
<td>2.5</td>
<td>2.55</td>
<td>V</td>
</tr>
<tr>
<td>(\Delta V\text{O})</td>
<td>Line regulation</td>
<td>(I\text{O} = 0\ mA, \ V\text{I} = 4.1\ to 18V, T\text{J} = 25°C)</td>
<td>0.5</td>
<td>6</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(I\text{O} = 0\ mA, \ V\text{I} = 4.1\ to 18V)</td>
<td>0.1</td>
<td>6</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>(\Delta V\text{O})</td>
<td>Load regulation</td>
<td>(I\text{O} = 0\ to 5A, T\text{J} = 25°C)</td>
<td>3</td>
<td>15</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(I\text{O} = 0\ to 5A)</td>
<td>7</td>
<td>20</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>(V\text{d})</td>
<td>Dropout voltage</td>
<td>(I\text{O} = 5A)</td>
<td>1.3</td>
<td>1.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>(I\text{q})</td>
<td>Quiescent current</td>
<td>(V\text{I} \leq 30V)</td>
<td>5</td>
<td>10</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>(I\text{sc})</td>
<td>Short circuit current</td>
<td>(V\text{I} - V\text{O} = 5V)</td>
<td>5.5</td>
<td>6.5</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(V\text{I} - V\text{O} = 25V)</td>
<td>0.5</td>
<td>0.7</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thermal regulation</td>
<td>(T\text{A} = 25°C, \ 30\text{ms pulse})</td>
<td>0.003</td>
<td>0.015</td>
<td>%/W</td>
<td></td>
</tr>
<tr>
<td>(SVR)</td>
<td>Supply voltage rejection</td>
<td>(f = 120\ Hz, C\text{O} = 25\mu\text{F}, I\text{O} = 5A, V\text{I} = 7.5\pm 3V)</td>
<td>60</td>
<td>72</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>(e\text{N})</td>
<td>RMS output noise voltage (% of (V\text{O}))</td>
<td>(T\text{A} = 25°C, f = 10\text{Hz to 10kHz})</td>
<td>0.003</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(S)</td>
<td>Temperature stability</td>
<td></td>
<td>0.5</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(S)</td>
<td>Long term stability</td>
<td>(T\text{A} = 125°C, 1000\text{Hrs})</td>
<td>0.5</td>
<td>%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. See short-circuit current curve for available output current at fixed dropout.
Table 5. **Electrical characteristics of LD1084#50**  
(VI = 8 V, CI = CO = 10 µF, TA = -40 to 125 °C, unless otherwise specified).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO</td>
<td>Output voltage (1)</td>
<td>IO = 0 mA, TJ = 25°C</td>
<td>4.95</td>
<td>5</td>
<td>5.05</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IO = 0 to 5A, VI = 6.6 to 30V</td>
<td>4.9</td>
<td>5</td>
<td>5.1</td>
<td>V</td>
</tr>
<tr>
<td>ΔVO</td>
<td>Line regulation</td>
<td>IO = 0 mA, VI = 6.6 to 20V, TJ = 25°C</td>
<td>0.5</td>
<td>10</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IO = 0 mA, VI = 6.6 to 20V</td>
<td>1</td>
<td>10</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>ΔVO</td>
<td>Load regulation</td>
<td>IO = 0 to 5A, TJ = 25°C</td>
<td>5</td>
<td>20</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IO = 0 to 5A</td>
<td>10</td>
<td>35</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>Vd</td>
<td>Dropout voltage</td>
<td>IO = 0 mA, VI = 6.6 to 20V</td>
<td>0.5</td>
<td>10</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>Iq</td>
<td>Quiescent current</td>
<td>VI ≤ 30V</td>
<td>5</td>
<td>10</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Isc</td>
<td>Short circuit current</td>
<td>VI - VO = 5V</td>
<td>5.5</td>
<td>6.5</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>VI - VO = 25V</td>
<td>0.5</td>
<td>0.7</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thermal regulation</td>
<td>TA = 25°C, 30ms pulse</td>
<td>0.003</td>
<td>0.015</td>
<td>%/W</td>
<td></td>
</tr>
<tr>
<td>SVR</td>
<td>Supply voltage rejection</td>
<td>f = 120 Hz, CO = 25µF, IO = 5A</td>
<td>60</td>
<td>72</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>eN</td>
<td>RMS output noise voltage (% of VO)</td>
<td>TA = 25°C, f = 10Hz to 10kHz</td>
<td>0.003</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Temperature stability</td>
<td>TA = 25°C, 1000Hrs</td>
<td>0.5</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Long term stability</td>
<td>TA = 125°C, 1000Hrs</td>
<td>0.5</td>
<td>%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. See short-circuit current curve for available output current at fixed dropout.
Table 6. Electrical characteristics of LD1084#12

(V_I = 15 V, C_I = C_O = 10 µF, T_A = -40 to 125 °C, unless otherwise specified).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_O</td>
<td>Output voltage (1)</td>
<td>IO = 0 mA, T_J = 25°C</td>
<td>11.88</td>
<td>12</td>
<td>12.12</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IO = 0 to 5A, V_I = 13.6 to 30V</td>
<td>11.76</td>
<td>12</td>
<td>12.24</td>
<td>V</td>
</tr>
<tr>
<td>ΔV_O</td>
<td>Line regulation</td>
<td>IO = 0 mA, V_I = 13.6 to 25V, T_J = 25°C</td>
<td>2</td>
<td>25</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_I = 13.6 to 25V</td>
<td>4</td>
<td>25</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>ΔV_O</td>
<td>Load regulation</td>
<td>IO = 0 to 5A, T_J = 25°C</td>
<td>12</td>
<td>36</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IO = 0 to 5A</td>
<td>24</td>
<td>72</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>V_d</td>
<td>Dropout voltage</td>
<td>IO = 5A</td>
<td>1.3</td>
<td>1.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>I_q</td>
<td>Quiescent current</td>
<td>V_I ≤ 30V</td>
<td>5</td>
<td>10</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>I_sc</td>
<td>Short circuit current</td>
<td>V_I - V_O = 5V</td>
<td>5.5</td>
<td>6.5</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_I - V_O = 25V</td>
<td>0.5</td>
<td>0.7</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Thermal regulation</td>
<td>T_A = 25°C, 30ms pulse</td>
<td>0.003</td>
<td>0.015</td>
<td></td>
<td>%/W</td>
</tr>
<tr>
<td>SVR</td>
<td>Supply voltage rejection</td>
<td>f = 120 Hz, C_O = 25µF, IO = 5A</td>
<td>54</td>
<td>66</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>eN</td>
<td>RMS output noise voltage</td>
<td>T_A = 25°C, f = 10Hz to 10kHz</td>
<td>0.003</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>(% of V_O)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Temperature stability</td>
<td></td>
<td>0.5</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>S</td>
<td>Long term stability</td>
<td>T_A = 125°C, 1000Hrs</td>
<td>0.5</td>
<td></td>
<td></td>
<td>%</td>
</tr>
</tbody>
</table>

1. See short-circuit current curve for available output current at fixed dropout.
Table 7. **Electrical characteristics of LD1084**

(V<sub>I</sub> = 4.25 V, C<sub>I</sub> = C<sub>O</sub> = 10 µF, T<sub>A</sub> = -40 to 125 °C, unless otherwise specified).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V&lt;sub&gt;O&lt;/sub&gt;</td>
<td>Output voltage (1)</td>
<td>I&lt;sub&gt;O&lt;/sub&gt; = 10mA, T&lt;sub&gt;J&lt;/sub&gt; = 25°C</td>
<td>1.237</td>
<td>1.25</td>
<td>1.263</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I&lt;sub&gt;O&lt;/sub&gt; = 10mA to 3A, V&lt;sub&gt;I&lt;/sub&gt; = 2.85 to 30V</td>
<td>1.225</td>
<td>1.25</td>
<td>1.275</td>
<td>V</td>
</tr>
<tr>
<td>ΔV&lt;sub&gt;O&lt;/sub&gt;</td>
<td>Line regulation</td>
<td>I&lt;sub&gt;O&lt;/sub&gt; = 10mA, V&lt;sub&gt;I&lt;/sub&gt; = 2.85 to 16.5V, T&lt;sub&gt;J&lt;/sub&gt; = 25°C</td>
<td>0.015</td>
<td>0.2</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I&lt;sub&gt;O&lt;/sub&gt; = 10mA, V&lt;sub&gt;I&lt;/sub&gt; = 2.85 to 16.5V</td>
<td>0.035</td>
<td>0.2</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>ΔV&lt;sub&gt;O&lt;/sub&gt;</td>
<td>Load regulation</td>
<td>I&lt;sub&gt;O&lt;/sub&gt; = 10mA to 5A, T&lt;sub&gt;J&lt;/sub&gt; = 25°C</td>
<td>0.1</td>
<td>0.3</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I&lt;sub&gt;O&lt;/sub&gt; = 0 to 5A</td>
<td>0.2</td>
<td>0.4</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>V&lt;sub&gt;d&lt;/sub&gt;</td>
<td>Dropout voltage</td>
<td>I&lt;sub&gt;O&lt;/sub&gt; = 5A</td>
<td>1.3</td>
<td>1.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>I&lt;sub&gt;0(min)&lt;/sub&gt;</td>
<td>Minimum load current</td>
<td>V&lt;sub&gt;I&lt;/sub&gt; = 30V</td>
<td>3</td>
<td>10</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>I&lt;sub&gt;sc&lt;/sub&gt;</td>
<td>Short circuit current</td>
<td>V&lt;sub&gt;I&lt;/sub&gt; - V&lt;sub&gt;O&lt;/sub&gt; = 5V</td>
<td>5.5</td>
<td>6.5</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V&lt;sub&gt;I&lt;/sub&gt; - V&lt;sub&gt;O&lt;/sub&gt; = 25V</td>
<td>0.5</td>
<td>0.7</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Thermal regulation</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 25°C, 30ms pulse</td>
<td></td>
<td>0.003</td>
<td>0.015</td>
<td></td>
<td>%/W</td>
</tr>
<tr>
<td>SVR</td>
<td>Supply voltage rejection</td>
<td>f = 120 Hz, C&lt;sub&gt;O&lt;/sub&gt; = 25µF, C&lt;sub&gt;ADJ&lt;/sub&gt; = 25 µF, I&lt;sub&gt;O&lt;/sub&gt; = 5A, V&lt;sub&gt;I&lt;/sub&gt; = 6.25 ± 3V</td>
<td>60</td>
<td>72</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>I&lt;sub&gt;ADJ&lt;/sub&gt;</td>
<td>Adjust pin current</td>
<td>V&lt;sub&gt;I&lt;/sub&gt; = 4.25V, I&lt;sub&gt;O&lt;/sub&gt; = 10 mA</td>
<td>55</td>
<td>120</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>ΔI&lt;sub&gt;ADJ&lt;/sub&gt;</td>
<td>Adjust pin current change (1)</td>
<td>I&lt;sub&gt;O&lt;/sub&gt; = 10mA to 5A, V&lt;sub&gt;I&lt;/sub&gt; = 2.85 to 16.5V</td>
<td>0.2</td>
<td>5</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>eN</td>
<td>RMS output noise voltage (% of V&lt;sub&gt;O&lt;/sub&gt;)</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 25°C, f =10Hz to 10kHz</td>
<td>0.003</td>
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<td>Temperature stability</td>
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<td>S</td>
<td>Long term stability</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 125°C, 1000Hrs</td>
<td>0.5</td>
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1. See short-circuit current curve for available output current at fixed dropout.
6 Typical application

Unless otherwise specified $T_J = 25^\circ C$, $C_I = 10\mu F$ (tant.), $C_O = 22\mu F$ (tant.)

**Figure 4.** Short circuit current vs dropout voltage

**Figure 5.** Line regulation vs temperature

**Figure 6.** Quiescent current vs temperature

**Figure 7.** Output voltage vs temperature

**Figure 8.** Load regulation vs temperature

**Figure 9.** Quiescent current vs output voltage
Typical application

LD1084xx

Figure 10. Quiescent current vs input voltage

Figure 11. Dropout voltage vs output current

Figure 12. Supply voltage rejection vs output current

Figure 13. Dropout voltage vs temperature

Figure 14. Supply voltage rejection vs temperature

Figure 15. Supply voltage rejection vs frequency
Figure 16. Adjust pin current vs output current

Figure 17. Reference voltage vs temperature

Figure 18. Load regulation vs temperature

Figure 19. Adjust pin current vs temperature

Figure 20. Line regulation vs temperature

Figure 21. Minimum load current vs temperature
Figure 22. Supply voltage rejection vs temperature

Figure 23. Supply voltage rejection vs frequency

Figure 24. Stability

Figure 25. Supply voltage rejection vs output current

Figure 26. Stability

Figure 27. Line transient

VI=14 to 15V, IO=200mA, CI = 1µF(tant), CO=10µF(tant), 

Ts=tf=5ms
**Figure 28. Line transient**

- **Input Voltage (Vin):** 12 to 13V
- **Load Current (ILOAD):** 200mA
- **Capacitors:** C1 = 1µF, C0 = 10µF
- **No C_ADJ**
- **Time (ts):** 5μs

**Figure 29. Load transient**

- **Input Voltage (Vin):** 15V
- **Load Current (ILOAD):** 0.1 to 5A
- **Capacitors:** C1 = 1µF, C0 = 10µF
- **No C_ADJ**

**Figure 30. Load transient**

- **Input Voltage (Vin):** 15V
- **Load Current (ILOAD):** 0.1 to 5A
- **Capacitors:** C1 = 1µF, C0 = 10µF
- **No C_ADJ**

**Figure 31. Line transient**

- **Input Voltage (Vin):** 12 to 13V
- **Load Current (ILOAD):** 200mA
- **Capacitors:** C1 = 1µF, C0 = 10µF
- **C_ADJ = 1µF**
- **Time (ts):** 5µs

**Figure 32. Load Transient**

- **Input Voltage (Vin):** 13V
- **Load Current (ILOAD):** 0.1 to 5A
- **Capacitors:** C1 = 1µF, C0 = 10µF
In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.
## TO-220 mechanical data

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### Diagram

![Diagram of TO-220 package mechanical data](image-url)
8 Revision history

Table 8. Document revision history

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<td>Mistake order codes - Table 1.</td>
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<td>Mistake U.M. Load Regulation - V ==&gt; mV.</td>
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<td>04-Apr-2007</td>
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<td>08-Apr-2008</td>
<td>8</td>
<td>Modified: Table 1 on page 1. Removed: packages D²PAK, D²PAK/A and mechanical data.</td>
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