LM340/LM78XX Series
3-Terminal Positive Regulators

General Description

The LM140/LM340A/LM340/LM78XXC monolithic 3-terminal positive voltage regulators employ internal current-limiting, thermal shutdown and safe-area compensation, making them essentially indestructible. If adequate heat sinking is provided, they can deliver over 1.0A output current. They are intended as fixed voltage regulators in a wide range of applications including local (on-card) regulation for elimination of noise and distribution problems associated with single-point regulation. In addition to use as fixed voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents.

Considerable effort was expended to make the entire 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.

Features

- Complete specifications at 1A load
- Output voltage tolerances of ±2% at Tj = 25˚C and ±4% over the temperature range (LM340A)
- Line regulation of 0.01% of VOUT/V of ∆VIN at 1A load (LM340A)
- Load regulation of 0.3% of VOUT/A (LM340A)
- Internal thermal overload protection
- Internal short-circuit current limit
- Output transistor safe area protection
- P+ Product Enhancement tested

Typical Applications

Fixed Output Regulator

![Fixed Output Regulator Diagram]

Adjustable Output Regulator

![Adjustable Output Regulator Diagram]

VOUT = 5V + (5V/R1 + IQ) R2 5V/R1 > 3 IQ, load regulation (Lr) ≈ [(R1 + R2)/R1] (Lr of LM340-5).

Current Regulator

![Current Regulator Diagram]

\[ I_{\text{OUT}} = \frac{V_{2-3}}{R1} + I_Q \]

\[ \Delta I_Q = 1.3 \text{ mA over line and load changes.} \]

Comparison between SOT-223 and D-Pak (TO-252) Packages

![Comparison Between Packages Diagram]

Scale 1:1

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**Ordering Information**

<table>
<thead>
<tr>
<th>Package</th>
<th>Temperature Range</th>
<th>Part Number</th>
<th>Packaging Marking</th>
<th>Transport Media</th>
<th>NSC Drawing</th>
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<tr>
<td>3-Lead TO-3</td>
<td>-55˚C to +125˚C</td>
<td>LM140K-5.0</td>
<td>LM140K 5.0P+</td>
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<td>K02A</td>
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<td>LM140K-12</td>
<td>LM140K 12P+</td>
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<td>LM140K-15</td>
<td>LM140K 15P+</td>
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<tr>
<td></td>
<td>0˚C to +125˚C</td>
<td>LM340K-5.0</td>
<td>LM340K 5.0 7805P+</td>
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<td>3-lead TO-220</td>
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<td>LM7808CT</td>
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<td>3-Lead TO-263</td>
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<td>LM340S-5.0</td>
<td>LM340S-5.0 P+</td>
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<td>LM340SX-5.0</td>
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<td>LM340S-12 P+</td>
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<td>LM140KG-15 MD8</td>
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<td>0˚C to +125˚C</td>
<td>LM340-5.0 MD8</td>
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<td></td>
<td>LM7808C MDC</td>
<td>Waffle Pack or Gel Pack</td>
<td>DI074056</td>
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</table>

**Connection Diagrams**

**TO-3 Metal Can Package (K)**

Bottom View  
See Package Number K02A

**TO-220 Power Package (T)**

Top View  
See Package Number T03B

**TO-263 Surface-Mount Package (S)**

Top View  
See Package Number TS3B

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**Absolute Maximum Ratings** (Note 1)

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

(Note 5)

- DC Input Voltage: 35V
- Internal Power Dissipation (Note 2): Internally Limited
- Maximum Junction Temperature: 150°C
- Storage Temperature Range: −65°C to +150°C
- Lead Temperature (Soldering, 10 sec.): TO-3 Package (K) 300°C, TO-220 Package (T), TO-263 Package (S) 230°C

**ESD Susceptibility** (Note 3): 2 kV

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**Operating Conditions** (Note 1)

<table>
<thead>
<tr>
<th>Temperature Range (T_A) (Note 2)</th>
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<tbody>
<tr>
<td>LM140</td>
</tr>
<tr>
<td>LM340A, LM340</td>
</tr>
<tr>
<td>LM7808C</td>
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**LM340A Electrical Characteristics**

\( I_{OUT} = 1A, 0°C \leq T_J \leq + 125°C \) (LM340A) unless otherwise specified (Note 4)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>5V</th>
<th>12V</th>
<th>15V</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_O )</td>
<td>Output Voltage</td>
<td>( T_J = 25°C )</td>
<td>4.9</td>
<td>5.0</td>
<td>5.1</td>
<td>V</td>
</tr>
<tr>
<td>( V_{MIN} \leq V_{IN} \leq V_{MAX} )</td>
<td>( P_D \leq 15W, 5 mA \leq I_O \leq 1A )</td>
<td>4.8</td>
<td>5.2</td>
<td>11.5</td>
<td>12.5</td>
<td>14.4</td>
</tr>
<tr>
<td>( \Delta V_O )</td>
<td>Line Regulation</td>
<td>( I_O = 500 mA )</td>
<td>10</td>
<td>18</td>
<td>22</td>
<td>mV</td>
</tr>
<tr>
<td>( \Delta V_{IN} )</td>
<td>( T_J = 25°C )</td>
<td>3</td>
<td>10</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \Delta V_{IN} )</td>
<td>Over Temperature</td>
<td>4</td>
<td>9</td>
<td>10</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>( \Delta V_O )</td>
<td>Load Regulation</td>
<td>( \Delta V_{IN} = 12 )</td>
<td>10</td>
<td>15</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>( \Delta V_{IN} )</td>
<td>Over Temperature, 5 mA \leq I_O \leq 1A</td>
<td>25</td>
<td>60</td>
<td>75</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>( I_O )</td>
<td>Quiescent Current</td>
<td>( T_J = 25°C )</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>mA</td>
</tr>
<tr>
<td>( I_O )</td>
<td>Over Temperature</td>
<td>6.5</td>
<td>6.5</td>
<td>6.5</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>( \Delta I_O )</td>
<td>Quiescent Current Change</td>
<td>( 5 mA \leq I_O \leq 1A )</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>mA</td>
</tr>
<tr>
<td>( \Delta I_O )</td>
<td>( T_J = 25°C, I_O = 1A )</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>( \Delta I_O )</td>
<td>( V_{MIN} \leq V_{IN} \leq V_{MAX} )</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>( \Delta I_O )</td>
<td>Over Temperature, ( V_{MIN} \leq V_{IN} \leq V_{MAX} )</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>mA</td>
<td></td>
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<tr>
<td>( V_N )</td>
<td>Output Noise Voltage</td>
<td>( T_A = 25°C, 10 Hz \leq f \leq 100 kHz )</td>
<td>40</td>
<td>75</td>
<td>90</td>
<td>µV</td>
</tr>
<tr>
<td>( \Delta V_{IN} )</td>
<td>Ripple Rejection</td>
<td>( T_J = 25°C, f = 120 Hz, I_O = 1A )</td>
<td>68</td>
<td>80</td>
<td>68</td>
<td></td>
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<tr>
<td>( \Delta V_{IN} )</td>
<td>Over Temperature, ( V_{MIN} \leq V_{IN} \leq V_{MAX} )</td>
<td>61</td>
<td>72</td>
<td>61</td>
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<td></td>
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<tr>
<td>( \Delta V_{IN} )</td>
<td>( 8 \leq V_{IN} \leq 25 )</td>
<td>60</td>
<td>70</td>
<td>60</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>( \Delta V_{OUT} )</td>
<td>( 15 \leq V_{IN} \leq 25 )</td>
<td>60</td>
<td>70</td>
<td>60</td>
<td>dB</td>
<td></td>
</tr>
<tr>
<td>( R_O )</td>
<td>Dropout Voltage</td>
<td>( T_J = 25°C, I_O = 1A )</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>V</td>
</tr>
<tr>
<td>( f = 1 kHz )</td>
<td>8</td>
<td>18</td>
<td>19</td>
<td>mΩ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( T_J = 25°C )</td>
<td>2.1</td>
<td>1.5</td>
<td>1.2</td>
<td>A</td>
<td></td>
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</table>
### LM340A Electrical Characteristics (Continued)

\( I_{\text{OUT}} = 1\,\text{A}, \quad 0˚C \leq T_J \leq +125˚C \) (LM340A) unless otherwise specified (Note 4)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Output Voltage</th>
<th>5V</th>
<th>12V</th>
<th>15V</th>
<th>Units</th>
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<tbody>
<tr>
<td>Peak Output Current</td>
<td>( T_J = 25˚C )</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
<td>A</td>
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<tr>
<td>Average TC of ( V_O )</td>
<td>Min, ( T_J = 0˚C, I_O = 5 ,\text{mA} )</td>
<td>-0.6</td>
<td>-1.5</td>
<td>-1.8</td>
<td>mV/˚C</td>
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<tr>
<td>( V_{\text{IN}} )</td>
<td>Input Voltage Required to Maintain Line Regulation</td>
<td>( T_J = 25˚C )</td>
<td>7.5</td>
<td>14.5</td>
<td>17.5</td>
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### LM140 Electrical Characteristics (Note 4)

\( -55˚C \leq T_J \leq +150˚C \) unless otherwise specified

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<th>Symbol</th>
<th>Output Voltage</th>
<th>5V</th>
<th>12V</th>
<th>15V</th>
<th>Units</th>
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<tbody>
<tr>
<td>( V_O )</td>
<td>Output Voltage</td>
<td>( T_J = 25˚C, 5 ,\text{mA} \leq I_O \leq 1,\text{A} )</td>
<td>4.8</td>
<td>5</td>
<td>5.2</td>
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<td></td>
<td>( P_D \leq 15W, 5 ,\text{mA} \leq I_O \leq 1,\text{A} )</td>
<td>4.75</td>
<td>5.25</td>
<td>(8 \leq V_{\text{IN}} \leq 20)</td>
<td>V</td>
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<tr>
<td></td>
<td>( V_{\text{MIN}} \leq V_{\text{IN}} \leq V_{\text{MAX}} )</td>
<td>11.4</td>
<td>12.6</td>
<td>14.4</td>
<td>15</td>
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<tr>
<td>( \Delta V_O )</td>
<td>Line Regulation</td>
<td>( I_O = 500 ,\text{mA} )</td>
<td>3</td>
<td>50</td>
<td>(7 \leq V_{\text{IN}} \leq 25)</td>
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<tr>
<td></td>
<td>( T_J = 25˚C )</td>
<td>4</td>
<td>120</td>
<td>(14.5 \leq V_{\text{IN}} \leq 30)</td>
<td>V</td>
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<td></td>
<td>( \Delta V_{\text{IN}} )</td>
<td>-55˚C \leq T_J \leq +150˚C</td>
<td>50</td>
<td>120</td>
<td>(18.5 \leq V_{\text{IN}} \leq 30)</td>
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<td></td>
<td>( \Delta V_{\text{IN}} )</td>
<td>( I_O \leq 1,\text{A} )</td>
<td>50</td>
<td>120</td>
<td>(17.7 \leq V_{\text{IN}} \leq 30)</td>
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<td>( T_J = 25˚C )</td>
<td>60</td>
<td>120</td>
<td>(20 \leq V_{\text{IN}} \leq 26)</td>
<td>V</td>
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<tr>
<td>( I_O )</td>
<td>Quiescent Current</td>
<td>( I_O \leq 1,\text{A} )</td>
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<td>6</td>
<td>(16 \leq V_{\text{IN}} \leq 22)</td>
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<td>( T_J = 25˚C )</td>
<td>7</td>
<td>7</td>
<td>(20 \leq V_{\text{IN}} \leq 26)</td>
<td>mA</td>
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<td>( \Delta I_O )</td>
<td>Quiescent Current Change</td>
<td>( I_O = 500 ,\text{mA} )</td>
<td>0.8</td>
<td>0.8</td>
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<tr>
<td></td>
<td>( T_J = 25˚C, I_O \leq 1,\text{A} )</td>
<td>(8 \leq V_{\text{IN}} \leq 20)</td>
<td>(18.5 \leq V_{\text{IN}} \leq 30)</td>
<td>V</td>
<td></td>
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<td>( V_{\text{MIN}} \leq V_{\text{IN}} \leq V_{\text{MAX}} )</td>
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<td>0.8</td>
<td>(15 \leq V_{\text{IN}} \leq 30)</td>
<td>mA</td>
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<tr>
<td>( V_N )</td>
<td>Output Noise Voltage</td>
<td>( T_A = 25˚C, \quad 10 ,\text{Hz} \leq f \leq 100 ,\text{kHz} )</td>
<td>40</td>
<td>75</td>
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### LM140 Electrical Characteristics (Note 4) (Continued)

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<td></td>
<td>Input Voltage (unless otherwise noted)</td>
<td>10V</td>
<td>19V</td>
<td>23V</td>
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<tr>
<td>Parameter</td>
<td>Conditions</td>
<td>Min</td>
<td>Typ</td>
<td>Max</td>
</tr>
<tr>
<td>ΔVIN/ΔVOUT</td>
<td>Ripple Rejection</td>
<td>≤1A, TJ = 25°C</td>
<td>68 80</td>
<td>61 72</td>
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<tr>
<td></td>
<td>f = 120 Hz</td>
<td>68 61</td>
<td>60</td>
<td>dB</td>
</tr>
<tr>
<td></td>
<td>VMIN ≤ VIN ≤ VMAX</td>
<td>(8 ≤ VIN ≤ 18)</td>
<td>(15 ≤ VIN ≤ 25)</td>
<td>(18.5 ≤ VIN ≤ 28.5)</td>
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<tr>
<td>RO</td>
<td>Dropout Voltage</td>
<td>TJ = 25°C, IO = 1A</td>
<td>2.0</td>
<td>2.0</td>
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<td>R</td>
<td>Output Resistance</td>
<td>TJ = 25°C</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>f = 1 kHz</td>
<td>2.1</td>
<td>1.5</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>Tj = 25°C</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
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<tr>
<td></td>
<td>Average TC of</td>
<td>VOUT</td>
<td>0°C ≤ TJ ≤ +150°C, IO = 5 mA</td>
<td>−0.6</td>
</tr>
<tr>
<td>VIN</td>
<td>Input Voltage</td>
<td>TJ = 25°C, IO ≤ 1A</td>
<td>7.5</td>
<td>14.6</td>
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### LM340 Electrical Characteristics (Note 4)

<table>
<thead>
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<th>12V</th>
<th>15V</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Input Voltage (unless otherwise noted)</td>
<td>10V</td>
<td>19V</td>
<td>23V</td>
</tr>
<tr>
<td>Parameter</td>
<td>Conditions</td>
<td>Min</td>
<td>Typ</td>
<td>Max</td>
</tr>
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<td>VO</td>
<td>Output Voltage</td>
<td>TJ = 25°C, 5 mA ≤ IO ≤ 1A</td>
<td>4.8</td>
<td>5</td>
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<td>PD ≤ 15W, 5 mA ≤ IO ≤ 1A</td>
<td>4.75</td>
<td>5.25</td>
<td>11.4</td>
</tr>
<tr>
<td></td>
<td>VMIN ≤ VIN ≤ VMAX</td>
<td>(7.5 ≤ VIN ≤ 20)</td>
<td>(14.5 ≤ VIN ≤ 27)</td>
<td>V</td>
</tr>
<tr>
<td>ΔVO</td>
<td>Line Regulation</td>
<td>IO = 500 mA</td>
<td>TJ = 25°C</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ΔVIN</td>
<td>(7 ≤ VIN ≤ 25)</td>
<td>(14.5 ≤ VIN ≤ 30)</td>
<td>(17.5 ≤ VIN ≤ 30)</td>
</tr>
<tr>
<td></td>
<td>0°C ≤ TJ ≤ +125°C</td>
<td>50</td>
<td>120</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td>ΔVIN</td>
<td>(8 ≤ VIN ≤ 20)</td>
<td>(15 ≤ VIN ≤ 27)</td>
<td>(17.5 ≤ VIN ≤ 30)</td>
</tr>
<tr>
<td></td>
<td>IO = 1A</td>
<td>TJ = 25°C</td>
<td>50</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>ΔVIN</td>
<td>(7.5 ≤ VIN ≤ 20)</td>
<td>(14.6 ≤ VIN ≤ 27)</td>
<td>(17.7 ≤ VIN ≤ 30)</td>
</tr>
<tr>
<td></td>
<td>0°C ≤ TJ ≤ +125°C</td>
<td>25</td>
<td>60</td>
<td>(16 ≤ VIN ≤ 22)</td>
</tr>
<tr>
<td></td>
<td>ΔVIN</td>
<td>(8 ≤ VIN ≤ 12)</td>
<td>(20 ≤ VIN ≤ 26)</td>
<td>V</td>
</tr>
<tr>
<td>ΔVO</td>
<td>Load Regulation</td>
<td>TJ = 25°C</td>
<td>5 mA ≤ IO ≤ 1.5A</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>250 mA ≤ IO ≤ 750 mA</td>
<td>50</td>
<td>122</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 mA ≤ IO ≤ 1A, 0°C ≤ TJ ≤ +125°C</td>
<td>50</td>
<td>120</td>
<td>150</td>
</tr>
<tr>
<td>IO</td>
<td>Quiescent Current</td>
<td>IO = 1A</td>
<td>TJ = 25°C</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>0°C ≤ TJ ≤ +125°C</td>
<td>8.5</td>
<td>8.5</td>
<td>8.5</td>
</tr>
<tr>
<td>ΔIO</td>
<td>Quiescent Current Change</td>
<td>5 mA ≤ IO ≤ 1A</td>
<td>TJ = 25°C</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>0°C ≤ TJ ≤ +125°C</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>
LM340 Electrical Characteristics (Note 4) (Continued)

0˚C ≤ TJ ≤ +125˚C unless otherwise specified

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Output Voltage</th>
<th>5V</th>
<th>12V</th>
<th>15V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Input Voltage (unless otherwise noted)</td>
<td>10V</td>
<td>19V</td>
<td>23V</td>
</tr>
<tr>
<td>Parameter</td>
<td>Conditions</td>
<td>Min</td>
<td>Typ</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>VMIN ≤ VIN ≤ VMAX</td>
<td>(7.5 ≤ VIN ≤ 20)</td>
<td>(14.8 ≤ VIN ≤ 27)</td>
<td>(17.9 ≤ VIN ≤ 30)</td>
</tr>
<tr>
<td></td>
<td>IO ≤ 500 mA, 0˚C ≤ TJ ≤ +125˚C</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>VMIN ≤ VIN ≤ VMAX</td>
<td>(7 ≤ VIN ≤ 25)</td>
<td>(14.5 ≤ VIN ≤ 30)</td>
<td>(17.5 ≤ VIN ≤ 30)</td>
</tr>
<tr>
<td>VN</td>
<td>Output Noise Voltage</td>
<td>TA = 25˚C, 10 Hz ≤ f ≤ 100 kHz</td>
<td>40</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Ripple Rejection</td>
<td>f = 120 Hz</td>
<td>62</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>IIO ≤ 1A, TJ = 25˚C</td>
<td>62</td>
<td>80</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>or IO ≤ 500 mA, 0˚C ≤ TJ ≤ +125˚C</td>
<td>62</td>
<td>80</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>VMIN ≤ VIN ≤ VMAX</td>
<td>(8 ≤ VIN ≤ 18)</td>
<td>(15 ≤ VIN ≤ 25)</td>
<td>(18.5 ≤ VIN ≤ 28.5)</td>
</tr>
<tr>
<td>RO</td>
<td>Dropout Voltage</td>
<td>TJ = 25˚C, IIO = 1A</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>Output Resistance</td>
<td>f = 1 kHz</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Short-Circuit Current</td>
<td>TJ = 25˚C</td>
<td>2.1</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Peak Output Current</td>
<td>TJ = 25˚C</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>Average TC of VOUT</td>
<td>0˚C ≤ TJ ≤ +125˚C, IIO = 5 mA</td>
<td>−0.6</td>
<td>−1.5</td>
</tr>
<tr>
<td></td>
<td>VIN</td>
<td>Input Voltage Required to Maintain Line Regulation</td>
<td>TJ = 25˚C, IIO ≤ 1A</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Note 1: Absolute Maximum Ratings are limits beyond which damage to the device may occur. Operating Conditions are conditions under which the device functions but the specifications might not be guaranteed. For guaranteed specifications and test conditions see the Electrical Characteristics.

Note 2: The maximum allowable power dissipation at any ambient temperature is a function of the maximum junction temperature for operation (TJMAX = 125˚C or 150˚C), the junction-to-ambient thermal resistance (θJA), and the ambient temperature (TA). PDMAX = (TJMAX − TA)/θJA. If this dissipation is exceeded, the die temperature will rise above the maximum junction temperature for operation, and electrical specifications do not apply. If the die temperature rises above 150˚C, the device will go into thermal shutdown.

For the TO-3 package (K, KC), the junction-to-ambient thermal resistance (θJA) is 39˚C/W. When using a heatsink, θJA is the sum of the 4˚C/W junction-to-case thermal resistance (θJC) of the TO-3 package and the case-to-ambient thermal resistance of the heatsink. For the TO-220 package (T), θJA is 54˚C/W and θJC is 4˚C/W. If SOT-223 is used, the junction-to-ambient thermal resistance is 174˚C/W and can be reduced by a heatsink (see Applications Hints on heatsinking).

If the TO-263 package is used, the thermal resistance can be reduced by increasing the PC board copper area thermally connected to the package. Using 0.5 square inches of copper area, θJA is 50˚C/W; with 1 square inch of copper area, θJA is 37˚C/W; and with 1.6 or more inches of copper area, θJA is 32˚C/W.

Note 3: ESD rating is based on the human body model, 100 pF discharged through 1.5 kΩ.

Note 4: All characteristics are measured with a 0.22 µF capacitor from input to ground and a 0.1 µF capacitor from output to ground. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (τp ≤ 10 ms, duty cycle ≤ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

Note 5: Military datasheets are available upon request. At the time of printing, the military datasheet specifications for the LM140K-5.0/883, LM140K-12/883, and LM140K-15/883 complied with the min and max limits for the respective versions of the LM140. The LM140H and LM140K may also be procured as JAN devices on slash sheet JM38510/107.
# LM7808C Electrical Characteristics

0˚C \( \leq T_J \leq +150˚C, V_I = 14V, I_O = 500 mA, C_I = 0.33 \mu F, C_O = 0.1 \mu F \), unless otherwise specified

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions (Note 6)</th>
<th>LM7808C</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min</td>
<td>Typ</td>
</tr>
<tr>
<td>( V_O )</td>
<td>Output Voltage</td>
<td>( T_J = 25˚C )</td>
<td>7.7</td>
<td>8.0</td>
</tr>
<tr>
<td>( \Delta V_O )</td>
<td>Line Regulation</td>
<td>( T_J = 25˚C )</td>
<td>6.0</td>
<td>160 mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.5V ( \leq V_I \leq 25V )</td>
<td>2.0</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.0V ( \leq V_I \leq 17V )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \Delta V_O )</td>
<td>Load Regulation</td>
<td>( T_J = 25˚C )</td>
<td>12</td>
<td>160 mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.0 mA ( \leq I_O \leq 1.5A )</td>
<td>4.0</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>250 mA ( \leq I_O \leq 750 mA )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_O )</td>
<td>Output Voltage</td>
<td>11.5V ( \leq V_I \leq 23V ), 5.0 mA ( \leq I_O \leq 1.0A, P \leq 15W )</td>
<td>7.6</td>
<td>8.4</td>
</tr>
<tr>
<td>( I_Q )</td>
<td>Quiescent Current</td>
<td>( T_J = 25˚C )</td>
<td>4.3</td>
<td>8.0 mA</td>
</tr>
<tr>
<td>( \Delta I_Q )</td>
<td>Quiescent Current Change</td>
<td>With Line</td>
<td>1.0 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.5V ( \leq V_I \leq 25V )</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>With Load</td>
<td>5.0 mA ( \leq I_O \leq 1.0A )</td>
<td>0.5</td>
</tr>
<tr>
<td>( V_N )</td>
<td>Noise</td>
<td>( T_A = 25˚C, 10 \text{ Hz} \leq f \leq 100 \text{ kHz} )</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>( \Delta V/I/\Delta V_O )</td>
<td>Ripple Rejection</td>
<td>( f = 120 \text{ Hz}, I_O = 350 mA, T_J = 25˚C )</td>
<td>56</td>
<td>72</td>
</tr>
<tr>
<td>( V_{DO} )</td>
<td>Dropout Voltage</td>
<td>( I_O = 1.0A, T_J = 25˚C )</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>( R_O )</td>
<td>Output Resistance</td>
<td>( f = 1.0 \text{ kHz} )</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>( I_{OS} )</td>
<td>Output Short Circuit Current</td>
<td>( T_J = 25˚C, V_I = 35V )</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td>( I_{PK} )</td>
<td>Peak Output Current</td>
<td>( T_J = 25˚C )</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>( \Delta V_O/T )</td>
<td>Average Temperature Coefficient of Output Voltage</td>
<td>( I_O = 5.0 mA )</td>
<td>0.8 mV/˚C</td>
<td></td>
</tr>
</tbody>
</table>

**Note 6:** All characteristics are measured with a 0.22 \( \mu F \) capacitor from input to ground and a 0.1 \( \mu F \) capacitor from output to ground. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques (\( t_w \leq 10 \text{ ms}, \text{ duty cycle} \leq 5\% \)). Output voltage changes due to changes in internal temperature must be taken into account separately.