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Trademarks
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1 Introduction

The LMR12010 is a step down DC-DC regulator that operates at the following switching frequencies: the LMR12010X at 1.6 MHz and the LMR12010Y at 3 MHz. The demo board is configured to convert 5-V input to 1.8-V output at 1-A load current using the Y version. The tiny low profile thin SOT23 package allows the design to use less than 1 square inch of board area.

The circuit is configured with the boost diode connected to V\textsubscript{IN}. V\textsubscript{IN} must not exceed the maximum operating limit of 5.5 V + V\textsubscript{ID2} using this configuration. This makes sure that the voltage between the boost and SW pins, V\textsubscript{BOOST} – V\textsubscript{SW}, does not exceed 5.5 V for proper operation. For more information regarding this requirement, see the *LMR12010 SIMPLE SWITCHER\textsuperscript{®} 20Vin, 1A Step-Down Voltage Regulator in SOT-23 Data Sheet*.

The schematics at the end of this document show how to reconfigure this demo board for various input and output conditions as discussed in the *LMR12010 SIMPLE SWITCHER\textsuperscript{®} 20Vin, 1A Step-Down Voltage Regulator in SOT-23 Data Sheet*. Short or leave open the connections as indicated in the schematics. The previously mentioned restrictions for the input voltage are valid only for the demo board as shipped with the demo board schematic shown in Figure 4-3.

2 Features

- 3.0-V to 5-V input voltage range (as shipped)
- 1.8-V output voltage
- Up to 1-A output current
- Switching frequency of 3 MHz
- Small solution size (17 mm × 17 mm)

3 Enable Operation

The demo board includes a spot for a pullup resistor R5 (not stuffed) to enable the device once V\textsubscript{IN} has exceeded 1.8 V (typical). A typical value for this resistor is 100 KΩ. Otherwise, use the EN post to apply a logic signal to test start-up and shutdown of the device. Never allow the EN voltage to exceed V\textsubscript{IN}.

4 Adjusting the Output Voltage

The output voltage can be changed from 1.8V to another voltage by adjusting the feedback resistors using

\[ V_{OUT} = V_{FB}(1 + (RFBT / RFBB)) \]  

(1)

where

- \( V_{FB} \) is 0.8 V.

For more information on component selection and features, see the device-specific data sheet.
Table 4-1. Bill of Materials (BOM) for LMR12010Y

<table>
<thead>
<tr>
<th>Part ID</th>
<th>Part Value</th>
<th>Manufacturer</th>
<th>Part Number</th>
<th>Package Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>1-A Buck Regulator</td>
<td>Texas Instruments</td>
<td>LMR12010</td>
<td>Thin SOT23-6</td>
</tr>
<tr>
<td>C1, Input Cap</td>
<td>10 µF, 10 V, X5R</td>
<td>Murata</td>
<td>GRM316R81A475KE19D</td>
<td>1206</td>
</tr>
<tr>
<td>C2, Output Cap</td>
<td>10 µF, 6.3 V, X5R</td>
<td>Murata</td>
<td>GRM319R60J106KE01D</td>
<td>1206</td>
</tr>
<tr>
<td>C3, Boost Cap</td>
<td>0.01 µF</td>
<td>Vishay</td>
<td>VJ0805Y103KXAC</td>
<td>0805</td>
</tr>
<tr>
<td>D1, Catch Diode</td>
<td>0.45 Vf Schottky  1 A, 20VR</td>
<td>Vishay</td>
<td>MBRA120TRPBF</td>
<td>SMA</td>
</tr>
</tbody>
</table>
Table 4-1. Bill of Materials (BOM) for LMR12010Y (continued)

<table>
<thead>
<tr>
<th>Part ID</th>
<th>Part Value</th>
<th>Manufacturer</th>
<th>Part Number</th>
<th>Package Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>D2, Boost Diode</td>
<td>1 Vf at 50-mA Diode</td>
<td>Diodes, Inc.</td>
<td>1N4148W-7-F</td>
<td>SOD-123</td>
</tr>
<tr>
<td>L1</td>
<td>2.7 µH, 1.8 A, 33 mΩ</td>
<td>TDK</td>
<td>VLCF5028T-2R7N1R8-2</td>
<td>6028</td>
</tr>
<tr>
<td>R1</td>
<td>12.4 kΩ, 1%</td>
<td>Vishay</td>
<td>CRCW080512K4FKEA</td>
<td>0805</td>
</tr>
<tr>
<td>R2</td>
<td>10 kΩ, 1%</td>
<td>Vishay</td>
<td>CRCW080510K0FKEA</td>
<td>0805</td>
</tr>
<tr>
<td>R3</td>
<td>0 Ω</td>
<td>Vishay</td>
<td>CRCW08050000Z0EA</td>
<td>0805</td>
</tr>
<tr>
<td>D3, C4, R4, R5</td>
<td>Open</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5 Test Setup

Table 5-1. Demonstration Board Quick Setup Procedures

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Connect a power supply to VIN terminals.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Connect a load to VO terminals.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>EN should be connected to VIN for normal operation. Short this to ground to shut down the part.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Set $V_{IN} = 5$ V, with 0-A load applied. Check $V_O$ with a voltmeter.</td>
<td>Nominal 1.8 V</td>
</tr>
<tr>
<td>5</td>
<td>Apply a 1-A load and check $V_O$.</td>
<td>Nominal 1.8 V</td>
</tr>
</tbody>
</table>

![Figure 5-1. Efficiency Measurements](image)

![Figure 5-2. Voltage Ripple Measurements](image)
Figure 5-3. Edge Connector Schematic
6 Typical Performance Characteristics

Figure 6-1. Efficiency vs. Load Current
LMR12010Y, $V_O = 1.8$ V

Figure 6-2. Load Transient Waveforms LMR12010Y,
$I_{OUT} = 100$ mA to $1000$ mA

Figure 6-3. Switching Node and Output Voltage Waveforms

Figure 6-4. Start-Up Waveform
7 Layout

Figure 7-1. Top Layer

Figure 7-2. Top Overlay
Figure 7-5. Bottom Layer

Figure 7-6. Bottom Overlay
8 Additional Circuit Configuration Schematics

Figure 8-1. $V_{\text{BOOST}}$ Derived from $V_{\text{OUT}}$

Figure 8-2. $V_{\text{BOOST}}$ Derived from $V_{\text{SHUNT}}$
Figure 8-3. \( V_{\text{BOOST}} \) Derived from Series Zener Diode (\( V_{\text{IN}} \))

Figure 8-4. \( V_{\text{BOOST}} \) Derived from Series Zener Diode (\( V_{\text{OUT}} \))

9 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision A (April 2013) to Revision B (December 2021)  
- Updated the numbering format for tables, figures, and cross-references throughout the document. .................2  
- Updated the user's guide title........................................................................................................................................2  
- Edited user's guide for clarity.........................................................................................................................................2
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