1 Introduction
The LM3673 evaluation board is a working demonstration of a step down DC-DC converter. This document contains information about the evaluation board. For further information on buck converter topology, device electrical characteristics, and component selection, see the device-specific data sheet.

2 General Description
The LM3673, a high efficient step down DC-DC switching buck converter, steps down a constant voltage for cell phones, PDA's, and many other applications from a single Li-ion battery ranging from 2.7 V to 5.5 V. The automatic intelligent switching between PFM and PWM provides high efficiency throughout the Iout range. The LM3673 is available in both fixed and adjustable output voltages options ranging from 1.1 V to 3.3 V in a 5-bump DSBGA package.

3 Operating Conditions
- $V_{\text{IN}}$ range: $2.7 \text{ V} \leq V_{\text{IN}} \leq 5.5 \text{ V}$
- Recommended load current: $0 \text{ mA} \leq I_{\text{OUT}} \leq 350 \text{ mA}$
- Ambient temperature ($T_A$) range: $-30^\circ \text{ C}$ to $+85^\circ \text{ C}$
- Junction temperature ($T_J$) range: $-30^\circ \text{ C}$ to $+125^\circ \text{ C}$

4 Typical Application

![Typical Application Circuit: Fixed Voltage Option](image)

Figure 1. Typical Application Circuit: Fixed Voltage Option

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Output Voltage Selection for LM3673MF-ADJ

The output voltage of the adjustable parts can be programmed through the resistor network connected from \( V_{\text{OUT}} \) to FB to GND. The resistor from FB to GND (\( R_2 \)) should be 200 k\( \Omega \) to keep the current drawn through this network small, but large enough that it is not susceptible to noise. If \( R_2 \) is 200 k\( \Omega \), and given the \( V_{\text{FB}} \) is 0.5V, then the current through the resistor feedback network will be 2.5 \( \mu A \). The output voltage formula is:

\[
V_{\text{OUT}} = V_{\text{FB}} \left( \frac{R_1}{R_2} + 1 \right)
\]

(1)

\( V_{\text{OUT}} \): output voltage (V)

\( V_{\text{FB}} \): feedback voltage (0.5 V typical)

\( R_1 \): feedback resistor from \( V_{\text{OUT}} \) to FB (\( \Omega \))

\( R_2 \): feedback resistor from FB to GND (\( \Omega \))

For the fixed output voltage parts the feedback resistors are internal. Place a 0\( \Omega \) resistor for \( R_1 \).

The bypass capacitors \( C_1 \) and \( C_2 \) (labeled \( C_3 \) and \( C_4 \) on evaluation board) in parallel with the feedback resistors are chosen for stable operation. **Equation 2** and **Equation 3** show the formulas for \( C_1 \) and \( C_2 \):

\[
C_1 = \frac{1}{2 \times \pi \times R_1 \times 45 \text{ kHz}}
\]

(2)

\[
C_2 = \frac{1}{2 \times \pi \times R_2 \times 45 \text{ kHz}}
\]

(3)

### Table 1. LM3673-ADJ Configurations for Various \( V_{\text{OUT}} \) (Circuit of Figure 2)

<table>
<thead>
<tr>
<th>( V_{\text{OUT}} ) (V)</th>
<th>( R_1 ) (k( \Omega ))</th>
<th>( R_2 ) (k( \Omega ))</th>
<th>( C_1 ) (pF)</th>
<th>( C_2 ) (pF)</th>
<th>( L ) (( \mu H ))</th>
<th>( C_{\text{IN}} ) (( \mu F ))</th>
<th>( C_{\text{OUT}} ) (( \mu F ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>200</td>
<td>200</td>
<td>18</td>
<td>None</td>
<td>2.2</td>
<td>4.7</td>
<td>10</td>
</tr>
<tr>
<td>1.1</td>
<td>191</td>
<td>158</td>
<td>18</td>
<td>None</td>
<td>2.2</td>
<td>4.7</td>
<td>10</td>
</tr>
<tr>
<td>1.2</td>
<td>280</td>
<td>200</td>
<td>12</td>
<td>None</td>
<td>2.2</td>
<td>4.7</td>
<td>10</td>
</tr>
<tr>
<td>1.5</td>
<td>357</td>
<td>178</td>
<td>10</td>
<td>None</td>
<td>2.2</td>
<td>4.7</td>
<td>10</td>
</tr>
<tr>
<td>1.6</td>
<td>442</td>
<td>200</td>
<td>8.2</td>
<td>None</td>
<td>2.2</td>
<td>4.7</td>
<td>10</td>
</tr>
<tr>
<td>1.7</td>
<td>432</td>
<td>178</td>
<td>8.2</td>
<td>None</td>
<td>2.2</td>
<td>4.7</td>
<td>10</td>
</tr>
<tr>
<td>1.8</td>
<td>464</td>
<td>178</td>
<td>8.2</td>
<td>None</td>
<td>2.2</td>
<td>4.7</td>
<td>10</td>
</tr>
<tr>
<td>1.875</td>
<td>523</td>
<td>191</td>
<td>6.8</td>
<td>None</td>
<td>2.2</td>
<td>4.7</td>
<td>10</td>
</tr>
<tr>
<td>2.5</td>
<td>402</td>
<td>100</td>
<td>8.2</td>
<td>None</td>
<td>2.2</td>
<td>4.7</td>
<td>10</td>
</tr>
<tr>
<td>2.8</td>
<td>464</td>
<td>100</td>
<td>8.2</td>
<td>33</td>
<td>2.2</td>
<td>4.7</td>
<td>10</td>
</tr>
<tr>
<td>3.3</td>
<td>562</td>
<td>100</td>
<td>6.8</td>
<td>33</td>
<td>2.2</td>
<td>4.7</td>
<td>10</td>
</tr>
</tbody>
</table>
6 Powering the LM3673 for Bench Measurements

When powering the LM3673 with a bench power supply, it is recommended to place a 100 µF tantalum capacitor across the \( V_{\text{IN}} \) and GND supply terminals of the bench power supply. This capacitor will reduce the input spike caused by the power supply and long power cables. The combination of the power supply and inductance within the power cables produce a large voltage spike that may damage the device. In addition, consideration must also be looked at the enable pin of the device. The enable should never be taken high, until minimum ensured operating voltage of 2.7 V is reached. The enable pin should also never exceed the input voltage.

7 Connection Diagram and Package Mark Information

![Connection Diagram](image)

**Figure 3. 5-bump DSBGA Package Number YZR0005CBA**

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( V_{\text{IN}} )</td>
<td>Power supply input. Connect to the input filter capacitor (see Figure 1)</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground pin</td>
</tr>
<tr>
<td>3</td>
<td>EN</td>
<td>Enable input. The device is in shutdown mode when voltage to this pin is (&lt; 0.4 \text{ V} ) and enabled when ( &gt; 1.0 \text{ V} ). Do not leave this pin floating.</td>
</tr>
<tr>
<td>4</td>
<td>FB</td>
<td>Feedback analog input. Connect directly to the output filter capacitor for fixed voltage versions. For adjustable version external resistor dividers are required (see Figure 2). The internal resistor dividers are disabled for the adjustable version.</td>
</tr>
<tr>
<td>5</td>
<td>SW</td>
<td>Switching node connection to the internal PFET switch and NFET synchronous rectifier.</td>
</tr>
</tbody>
</table>
Figure 4. Top Layer (5-bump DSBGA)

Figure 5. Bottom Layer (5-bump DSBGA)
Table 3. Bill of Materials (BOM) For Common Configurations

<table>
<thead>
<tr>
<th>Manufacture</th>
<th>Manufacture No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LM3673 - 1.5V FIXED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1 (input C)</td>
<td>TDK</td>
<td>C2012XR0J475K</td>
</tr>
<tr>
<td>C2 (output C)</td>
<td>TDK</td>
<td>C2012X5R0J106K</td>
</tr>
<tr>
<td>L1 (inductor)</td>
<td>Coilcraft</td>
<td>DO3314-222MX</td>
</tr>
<tr>
<td>R1 (V_OUT to V_FB)</td>
<td>Vishay</td>
<td>CRCW06030R00F</td>
</tr>
<tr>
<td>R2 (V_FB to GND)</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>C3 (V_OUT to V_FB)</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>C4 (V_FB to GND)</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td><strong>LM3673 - 3.3V ADJUSTABLE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1 (input C)</td>
<td>TDK</td>
<td>C2012XR0J475K</td>
</tr>
<tr>
<td>C2 (output C)</td>
<td>TDK</td>
<td>C2012X5R0J106K</td>
</tr>
<tr>
<td>L1 (inductor)</td>
<td>Coilcraft</td>
<td>DO3314-222MX</td>
</tr>
<tr>
<td>R1 (V_OUT to V_FB)</td>
<td>Vishay</td>
<td>CRCW06035623F</td>
</tr>
<tr>
<td>R2 (V_FB to GND)</td>
<td>Vishay</td>
<td>CRCW06031003F</td>
</tr>
<tr>
<td>C3 (V_OUT to V_FB)</td>
<td>Vishay</td>
<td>VJ0603A6R8KXAA</td>
</tr>
<tr>
<td>C4 (V_FB to GND)</td>
<td>Vishay</td>
<td>VJ0603A330JXACW1BC</td>
</tr>
<tr>
<td><strong>COMMON TO ALL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V_IN banana jack - red</td>
<td>Johnson Components</td>
<td>108-0902-001</td>
</tr>
<tr>
<td>V_OUT banana jack - yellow</td>
<td>Johnson Components</td>
<td>108-0907-001</td>
</tr>
<tr>
<td>GND banana jack - black</td>
<td>Johnson Components</td>
<td>108-0903-001</td>
</tr>
<tr>
<td>Post for EN</td>
<td>Turrent</td>
<td>1573-2</td>
</tr>
<tr>
<td>Post for V_IN</td>
<td>Turrent</td>
<td>1502-2</td>
</tr>
<tr>
<td>Post for V_OUT</td>
<td>Turrent</td>
<td>1502-2</td>
</tr>
<tr>
<td>Post for GND</td>
<td>Turrent</td>
<td>1502-2</td>
</tr>
</tbody>
</table>
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- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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This Class A or B digital apparatus complies with Canadian ICES-003. Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

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Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

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2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
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Texas Instruments Japan Limited
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