AN-1465 LM3673 Evaluation Board

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_{IN} range: 2.7 V ≤ V_{IN} ≤ 5.5 V
- Recommended load current: 0 mA ≤ I_{OUT} ≤ 350 mA
- Ambient temperature (T_A) range: -30°C to +85°C
- Junction temperature (T_J) range: -30°C to +125°C

4 Typical Application

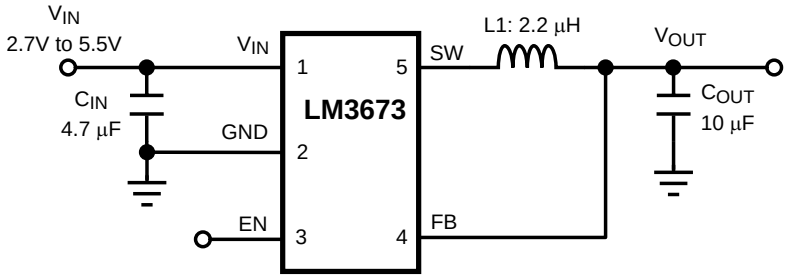

Figure 1. Typical Application Circuit: Fixed Voltage Option

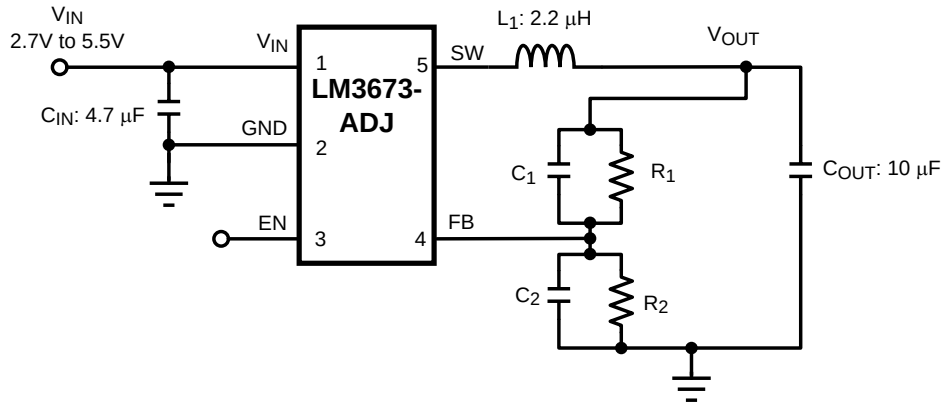

Figure 2. Typical Application Circuit: Adjustable Voltage Option

5 Output Voltage Selection for LM3673MF-ADJ

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

$$V_{OUT} = V_{FB}\left(\frac{R_1}{R_2} + 1\right) \quad (1)$$

V_{OUT}: output voltage (V)

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

R_1: feedback resistor from V_{OUT} to FB(Ω)

R_2: feedback resistor from FB to GND (Ω)

For the fixed output voltage parts the feedback resistors are internal. Place a 0Ω 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.

$$C_1 = \frac{1}{2 \times \pi \times R_1 \times 45\ kHz} \quad (2)$$

$$C_2 = \frac{1}{2 \times \pi \times R_2 \times 45\ kHz} \quad (3)$$

Table 1. LM3673-ADJ Configurations for Various V_{out} (Circuit of Figure 2)

V_{OUT} (V)	R_1(kΩ)	R_2(kΩ)	C_1(pF)	C_2(pF)	L (µH)	C_{IN} (µF)	C_{OUT} (µF)
1.0	200	200	18	None	2.2	4.7	10
1.1	191	158	18	None	2.2	4.7	10
1.2	280	200	12	None	2.2	4.7	10
1.5	357	178	10	None	2.2	4.7	10
1.6	442	200	8.2	None	2.2	4.7	10
1.7	432	178	8.2	None	2.2	4.7	10
1.8	464	178	8.2	None	2.2	4.7	10
1.875	523	191	6.8	None	2.2	4.7	10
2.5	402	100	8.2	None	2.2	4.7	10
2.8	464	100	8.2	33	2.2	4.7	10
3.3	562	100	6.8	33	2.2	4.7	10

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_{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

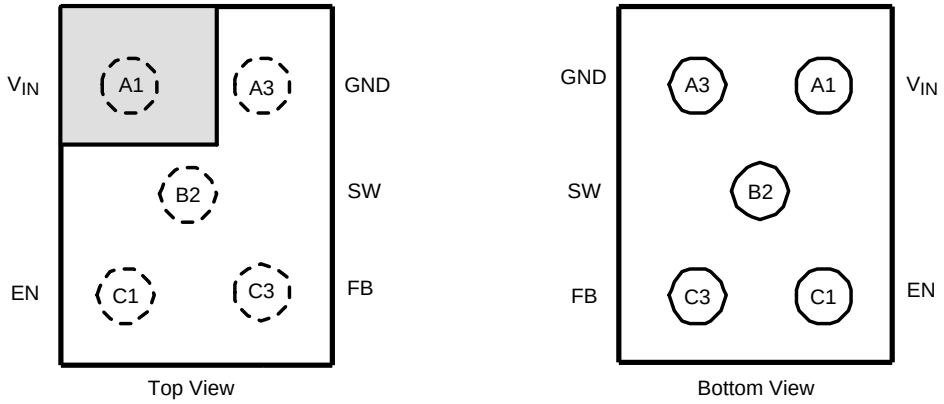

Figure 3. 5-bump DSBGA Package Number YZR0005CBA

Table 2. Pin Descriptions (5-bump DSBGA)

Pin No	Name	Description
1	V_{IN}	Power supply input. Connect to the input filter capacitor (see Figure 1)
2	GND	Ground pin
3	EN	Enable input. The device is in shutdown mode when voltage to this pin is < 0.4 V and enabled when > 1.0 V. Do not leave this pin floating.
4	FB	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.
5	SW	Switching node connection to the internal PFET switch and NFET synchronous rectifier.

8 Evaluation Board Layout

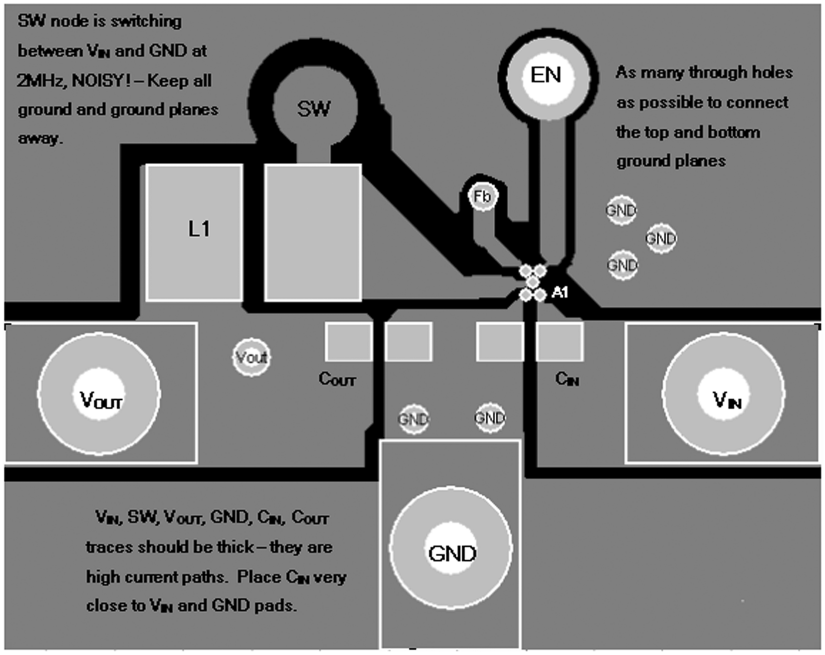

Figure 4. Top Layer (5-bump DSBGA)

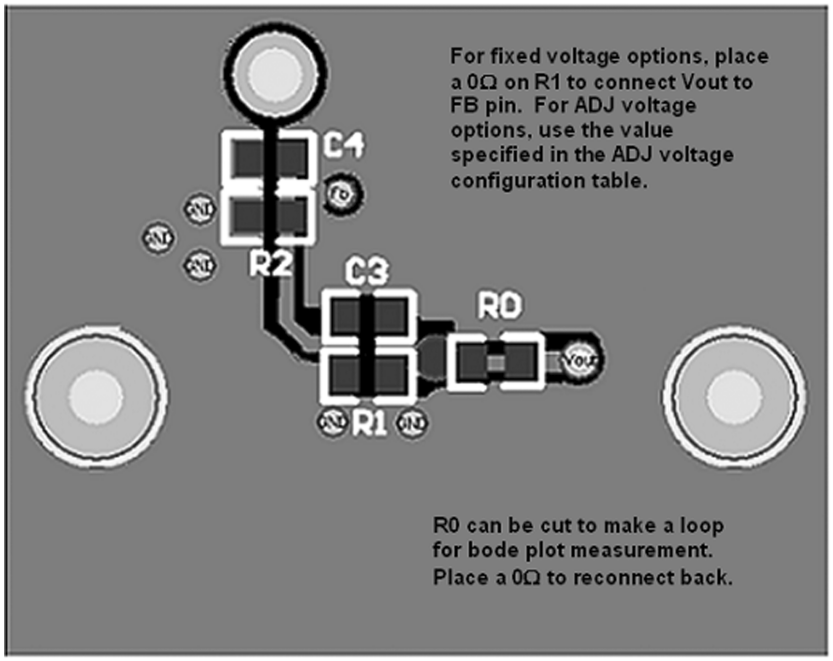

Figure 5. Bottom Layer (5-bump DSBGA)

Table 3. Bill of Materials (BOM) For Common Configurations

	Manufacture	Manufacture No	Description
LM3673 - 1.5V FIXED			
C1 (input C)	TDK	C2012XR0J475K	4.7 µF, 6.3 V, 0805, 10%
C2 (output C)	TDK	C2012X5R0J106K	10 µF, 6.3 V, 0805, 10%
L1 (inductor)	Coilcraft	DO3314-222MX	2.2 µH inductor, 1.6A sat
R1 (V_{OUT} to V_{FB})	Vishay	CRCW06030R00F	0 Ω, 0603, 1%
R2 (V_{FB} to GND)	None		
C3 (V_{OUT} to V_{FB})	None		
C4 (V_{FB} to GND)	None		
LM3673 - 3.3V ADJUSTABLE			
C1 (input C)	TDK	C2012XR0J475K	4.7 µF, 6.3 V, 0805, 10%
C2 (output C)	TDK	C2012X5R0J106K	10 µF, 6.3 V, 0805, 10%
L1 (inductor)	Coilcraft	DO3314-222MX	2.2 µH inductor, 1.6A sat
R1 (V_{OUT} to V_{FB})	Vishay	CRCW06035623F	562 kΩ, 0603, 1%
R2 (V_{FB} to GND)	Vishay	CRCW06031003F	100 kΩ, 0603, 1%
C3 (V_{OUT} to V_{FB})	Vishay	VJ0603A6R8KXAA	6.8 pF, 0603, 10%
C4 (V_{FB} to GND)	Vishay	VJ0603A330JXACW1BC	33 pF , 0603, 5%
COMMON TO ALL			
V_{IN} banana jack - red	Johnson Components	108-0902-001	Connector, insulated banana jack (red)
V_{OUT} banana jack - yellow	Johnson Components	108-0907-001	Connector, insulated banana jack (yellow)
GND banana jack - black	Johnson Components	108-0903-001	Connector, insulated banana jack (black)
Post for EN	Turrent	1573-2	Upright post from evaluation board
Post for V_{IN}	Turrent	1502-2	Upright post from evaluation board
Post for V_{OUT}	Turrent	1502-2	Upright post from evaluation board
Post for GND	Turrent	1502-2	Upright post from evaluation board

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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.

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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.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

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Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

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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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