LM3673 Evaluation Board

National Semiconductor
Application Note 1465
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Introduction

The LM3673 evaluation board is a working demonstration of a step down DC-DC converter. This application note contains information about the evaluation board. For further information on buck converter topology, device electrical characteristics, and component selection please refer to the datasheet.

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 2.7V to 5.5V. 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 1.1V to 3.3V in a 5-bump micro SMD package.

Operating Conditions

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

Typical Application

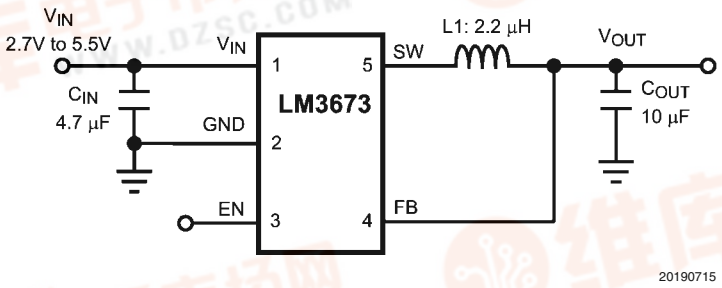

FIGURE 1. Typical Application Circuit: Fixed Voltage Option

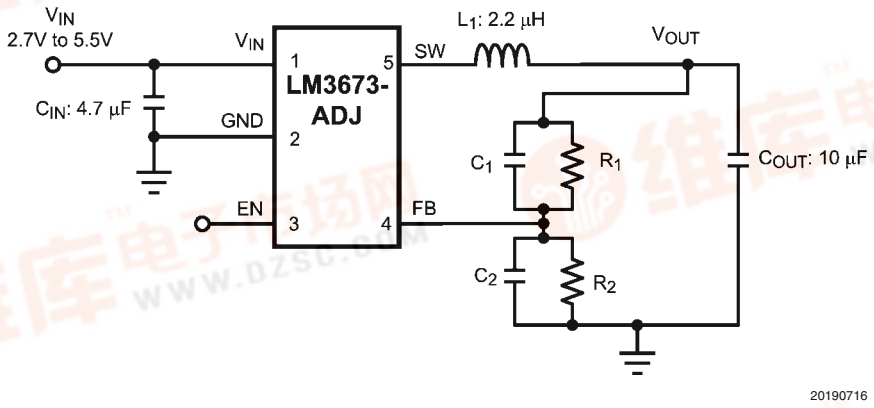

FIGURE 2. Typical Application Circuit: Adjustable Voltage Option

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 200kΩ to keep the current drawn through this network small, but large enough that it is not susceptible to noise. If R_2 is 200kΩ, and given the V_{FB} is 0.5V, then the current through the resistor feedback network will be 2.5µA. The output voltage formula is:

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

V_{OUT}: output voltage (V)

V_{FB}: feedback voltage (0.5V 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. Below are the formulas for C_1 and C_2.

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

$$C_2 = \frac{1}{2 \times \pi \times R_2 \times 45\ kHz}$$

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

Powering the LM3673 for Bench Measurements

When powering the LM3673 with a bench power supply, it is recommended to place a 100µF tantalum capacitor across the VIN 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 guaranteed operating voltage of 2.7V is reached. The enable pin should also never exceed the input voltage.

Connection Diagram and Package Mark Information

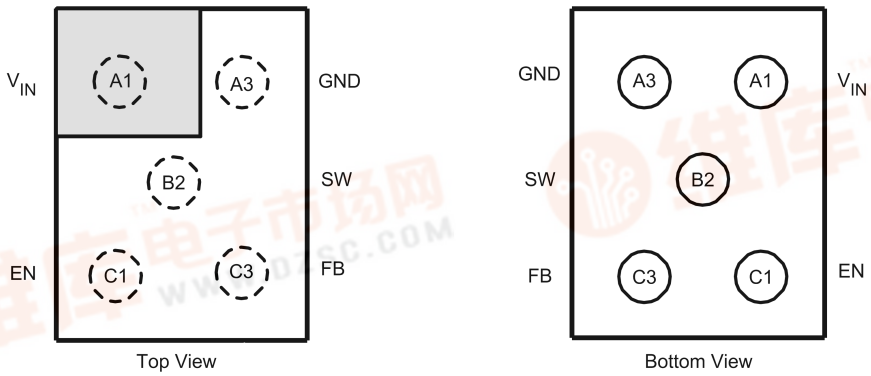

FIGURE 3. 5-bump Micro SMD Package Number TLA05CBA

Pin Descriptions (5-bump Micro SMD)

Pin#	Name	Description
1	V_{IN}	Power supply input. Connect to the input filter capacitor (Figure 1)
2	GND	Ground pin
3	EN	Enable input. The device is in shutdown mode when voltage to this pin is < 0.4V and enabled when > 1.0V. 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 (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.

Evaluation Board Layout

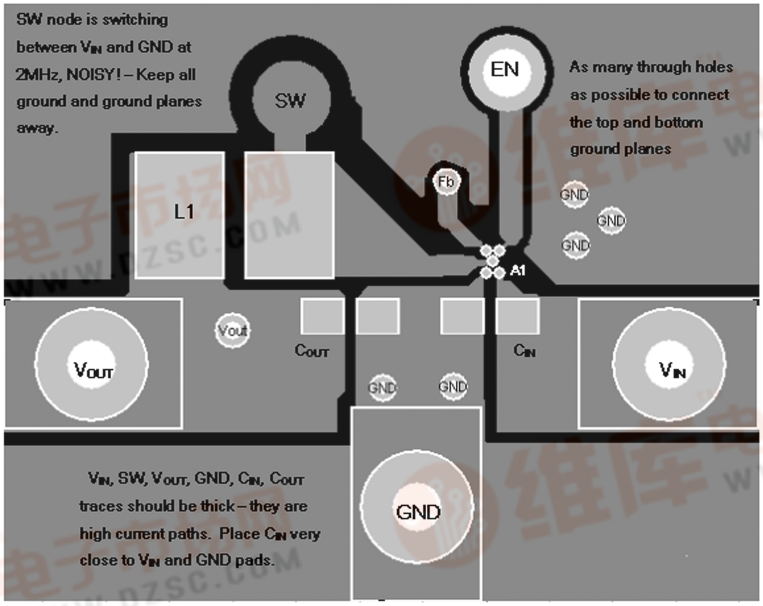

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FIGURE 4. Top Layer (5-bump Micro SMD)

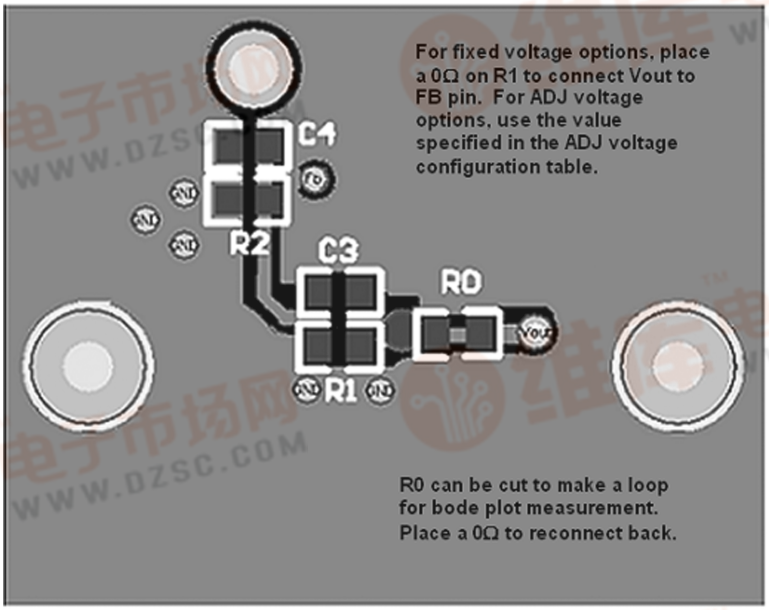

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FIGURE 5. Bottom Layer (5-bump Micro SMD)

BOM For Common Configurations

	Manufacture	Manufacture #	Description
LM3673TL - 1.5V FIXED			
C1 (input C)	TDK	C2012XR0J475K	4.7 µF, 6.3V, 0805, 10%
C2 (output C)	TDK	C2012X5R0J106K	10 µF, 6.3V, 0805, 10%
L1 (inductor)	Coilcraft	DO3314-222MX	2.2 µH inductor, 1.6A sat
R1 (V_{OUT} to V_{FB})	Vishay	CRCW06030R00F	0Ω, 0603, 1%
R2 (V_{FB} to GND)	None		
C3 (V_{OUT} to V_{FB})	None		
C4 (V_{FB} to GND)	None		
LM3673TL - 3.3V ADJUSTABLE			
C1 (input C)	TDK	C2012XR0J475K	4.7 µF, 6.3V, 0805, 10%
C2 (output C)	TDK	C2012X5R0J106K	10 µF, 6.3V, 0805, 10%
L1 (inductor)	Coilcraft	DO3314-222MX	2.2 µH inductor, 1.6A sat
R1 (V_{OUT} to V_{FB})	Vishay	CRCW06034643F	562kΩ, 0603, 1%
R2 (V_{FB} to GND)	Vishay	CRCW06031783F	100kΩ, 0603, 1%
C3 (V_{OUT} to V_{FB})	Vishay	VJ0603A8R2KXAA	8.2pF, 0603, 10%
C4 (V_{FB} to GND)	Vishay	VJ0603A8R2KXAA	33pF , 0603, 10%
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 eval board
Post for V_{IN}	Turrent	1502-2	Upright post from eval board
Post for V_{OUT}	Turrent	1502-2	Upright post from eval boardt
Post for GND	Turrent	1502-2	Upright post from eval board

Notes

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