

AN-1722 LM3678 Evaluation Board

1 Introduction

The LM3678 evaluation board is a working demonstration of a synchronous buck DC-DC converter. This document contains information about the evaluation board. For more details and electrical characteristics about the converter operation, see the *High-Performance Miniature 1.5-A Step-Down DC-DC Converter for Handheld Applications Data Sheet* ([SNVS464](#)).

2 Operating Range

- V_{IN} range: 2.5 V to 5.5 V
- Recommended load current: up to 1.5A
- $V_{OUT} = 0.8/1.2$ V

3 Package

WSOON-10 no-pullback (3mm x 3mm x 0.8mm)

4 Typical Application

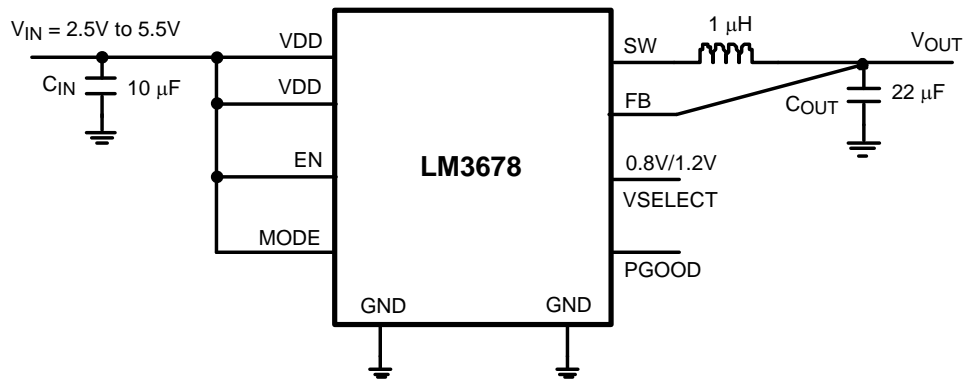


Figure 1. Typical Application Circuit

5 Connection Diagrams

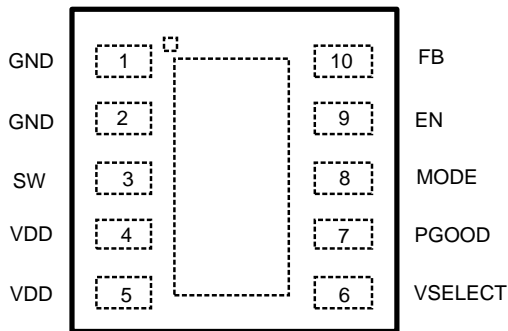


Figure 2. Top View

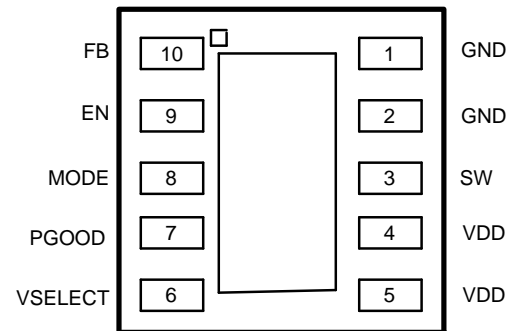


Figure 3. Bottom View

Note: Figure 1 through Figure 3 are not to any actual scale

6 Pin Descriptions

Pin No	Name	Description
1	GND	Ground
2	GND	
3	SW	Switching node connection to the internal PFET switch and NFET synchronous rectifier.
4	V_{DD}	Power supply input. Connect to the input filter capacitor (Figure 1).
5	V_{DD}	
6	VSELECT	Output Voltage Select. For Example : VSELECT = LOW $V_{OUT} = 0.8$ V VSELECT = HIGH, $V_{OUT} = 1.2$ V
7	PGOOD	Power Good Flag. This common drain logic output is pulled to ground when the output voltage is not within $\pm 7.5\%$ of regulation.
8	MODE	Mode Control Pin: Mode = 1 selects forced PWM mode Mode = 0 selects auto PFM-PWM mode
9	EN	Enable Pin. The device is in shutdown mode when voltage to this pin < 0.4 V and enabled when > 1.0 V. Do not leave this pin floating.
10	FB	Feedback Analog Input. Connect directly to the output filter capacitor for fixed voltage versions.
DAP	DAP	Die Attach Pad; connect the DAP to GND on PCB layout to enhance thermal performance. It should not be used as a primary ground connection.

7 Powering the LM3678 for Bench Measurements

When powering the LM3678 with a bench power supply, it is recommended to place a 100 μ F tantalum capacitor across the V_{IN} and GND supply terminals of the bench power supply. This capacitor reduces 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 be given to the enable pin of the device. The enable should never be taken high, until the minimum ensured operating voltage of 2.7 V is reached. The enable pin should also never exceed the input voltage.

8 Operating Information

The LM3678 evaluation board is set for the following default positions:

- $V_{OUT} = 1.2$ V, for 0.8 V, set VSELECT pin to low via jumper
- Mode = H (PWM mode), for Auto mode, set mode = Low (move jumper to inner position).
- EN pin is tied to V_{IN} via a jumper

9 Evaluation Board Layout

LM3678 is a four-layer board designed to maximize the performance. The top layer consists of high-current path and the bottom layer for low-current and logic signals path. The inner layer 1 and layer 2 are dedicated for PGND (power GND) and SGND (analog and logic GND). For optimum performance, it is recommended to separate the PGND and SGND pins and join them together at the start GND on the PCB.

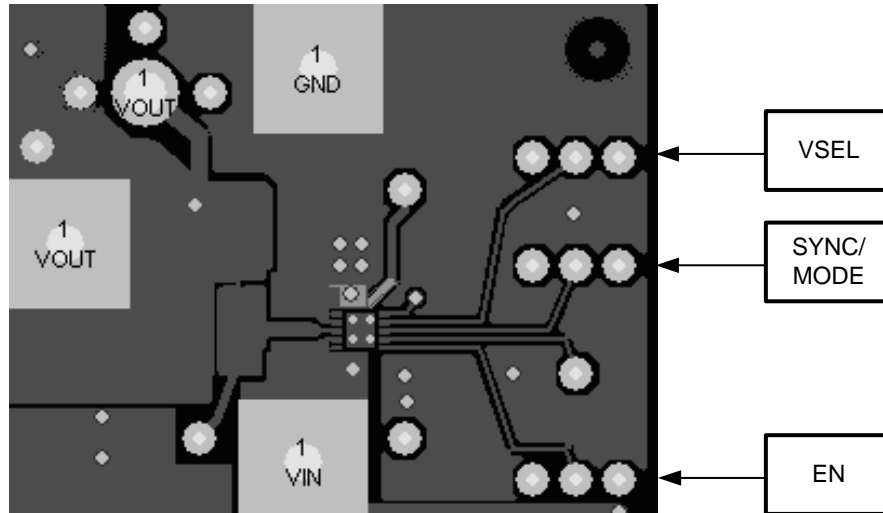


Figure 4. Top Layer

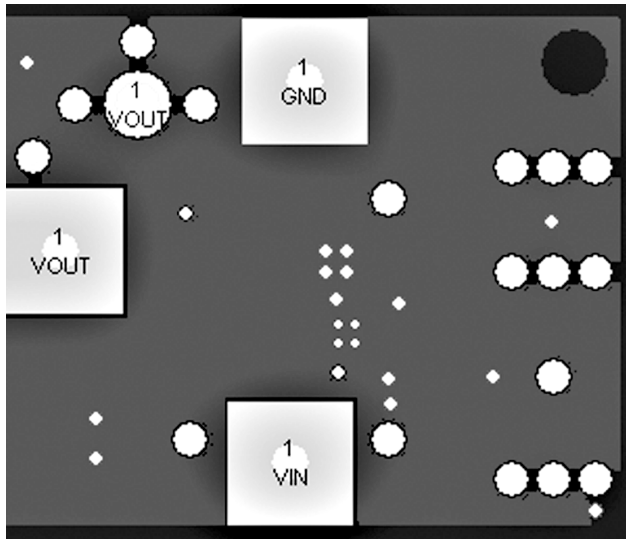


Figure 5. Mid Layer 1

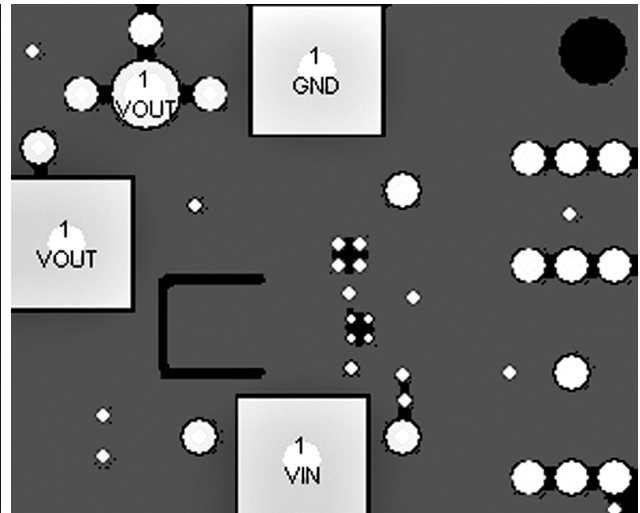


Figure 6. Mid Layer 2

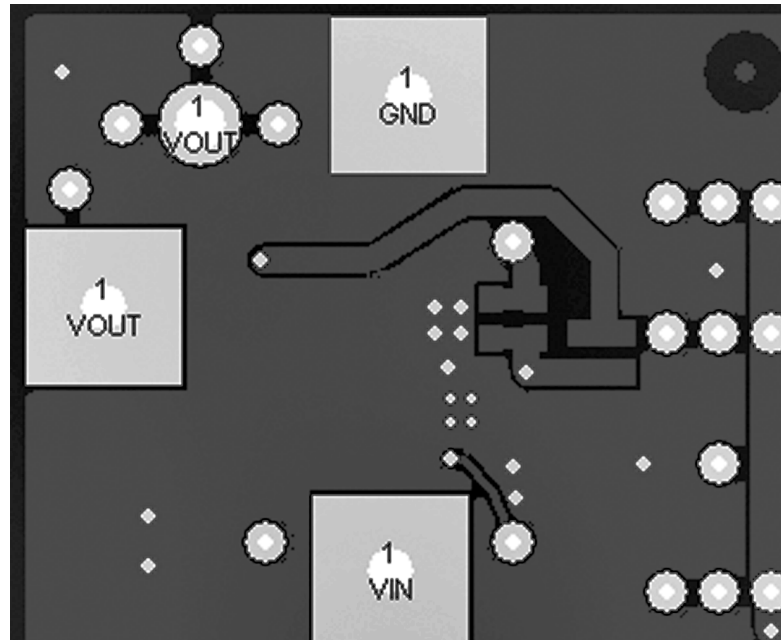


Figure 7. Bottom Layer

10 Bill of Materials (BOM) for LM3678

Table 1. Bill of Materials (BOM)

Component Name	Manufacturer	Specification	Case Size
LM3678	NSC	WSON-10	3 mm x 3 mm x 0.8 mm
C1 = 10 μ F	Taiyo-Yuden	JMK212BJ106K	0805 (2012)
C2 = 22 μ F		JMK212BJ226MG	0805 (2012)
Inductor	Taiyo-Yuden	NR4012T-1RON	4 mm x 4 mm x 1.2 mm
R1	Vishay/any manufacturer	0603	0 Ω

Table 2. Test Point

V_{SEL} , Mode and EN	Header	3 in Series 3 (3 x 1)
V_{SEL} , Mode and EN	Jumper Female (Handle centerline)	A26242-ND
V_{IN} banana jack - red	Johnson Components	108-0902-001
V_{OUT} banana jack - yellow	Johnson Components	108-0907-001
GND banana jack - black	Johnson Components	108-0903-001

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com