

# LM3200 Evaluation Board

National Semiconductor  
Application Note 1373  
Naomi Sugiura  
March 2005



## Introduction

The LM3200 evaluation board is a working demonstration of a buck converter. This application note contains information about the board. For further information on buck converter topology and component selection please see the datasheet.

## General Description

The LM3200 converts high input voltages to lower output voltages with high efficiency. It does this through a inductor based switching topology, applying the input voltage to the inductor for a certain portion of the cycle. The duty cycle in PWM mode will be  $V_{OUT}/V_{IN}$ , which can be seen on the SW pin.

There are three modes of operation. These are Fixed Frequency PWM (Pulse Width Modulation) , Forced Bypass,

and Shutdown mode. Setting the BYP pin low ( $\leq 0.4V$ ) or leaving floating places the device in PWM mode. Setting the BYP pin high ( $\geq 1.2V$ ) places the device in Forced Bypass mode. Setting the EN pin low ( $\leq 0.4V$ ) places the device in Shutdown mode. Setting the EN pin high ( $\geq 1.2V$ ) enables normal operation.

At the PWM mode, the output voltage is setting by the voltage of the  $V_{CON}$  pin, as in the following formula:

$$V_{OUT} = 3 \times V_{CON}$$

## Operating Conditions

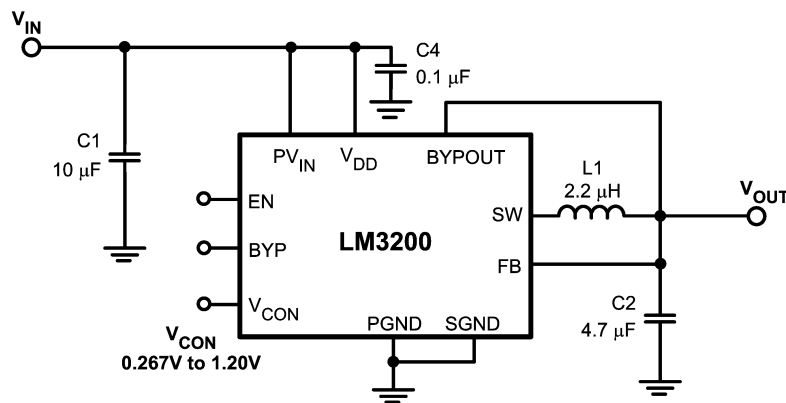
The board will operate under the following conditions:

$$2.7V \leq V_{IN} \leq 5.5V$$

$$0.267V \leq V_{CON} \leq 1.2V$$

$$0 \text{ mA} \leq I_{OUT} \leq 300 \text{ mA}$$

## Schematic



20143304

FIGURE 1. Typical Operating Circuit

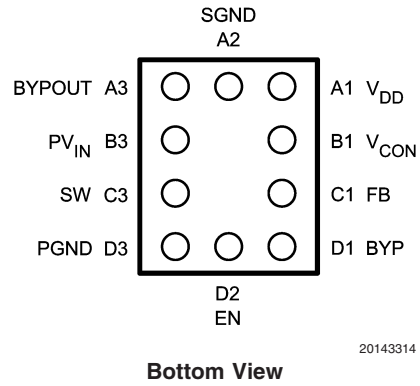
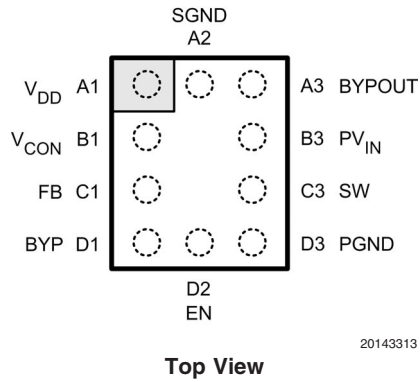


**FIGURE 2. Top Layer**



### FIGURE 3. Bottom Layer

## Connection Diagrams



**10-Bump Thin Micro SMD Package, Large Bump**  
See NS Package Number TLP10NHA

## Pin Description

Pin #	Name	Description
A1	V <sub>DD</sub>	Analog Supply Input. A 0.1 $\mu$ F ceramic capacitor is recommended to be placed as close to this pin as possible.
B1	V <sub>CON</sub>	Voltage Control Analog input. V <sub>CON</sub> controls V <sub>OUT</sub> in PWM mode. Set: V <sub>OUT</sub> = 3 x V <sub>CON</sub> . Do not leave floating.
C1	FB	Feedback Analog Input. Connect to the output at the output filter capacitor.
D1	BYP	Bypass. Use this digital input to command operation in Bypass mode. Set the BYP pin high (> 1.2V ) for Bypass mode. Set BYP low (< 0.4V ) for normal operation.
D2	EN	Enable Input. Set this digital input high (> 1.2V) after Vin > 2.7V for normal operation. For shutdown, set low (< 0.4V).
D3	PGND	Power Ground
C3	SW	Switching Node connection to the internal PFET switch and NFET synchronous rectifier. Connect to an inductor with a saturation current rating that exceeds the maximum Switch Peak Current Limit specification of the LM3200.
B3	PV <sub>IN</sub>	Power Supply Voltage Input to the internal PFET switch and Bypass FET.
A3	BYPOUT	Bypass FET Drain. Connect to the output capacitor. Do not leave floating.
A2	SGND	Analog and Control Ground

**BOM**

	Manufacture	Manufacture #	Description
C1 (input C)	TDK	C3216JB1A106K	10 $\mu$ F, 10V, 20%, 1206(3216)
C2 (output C)	TDK	C2012JB0J475K	4.7 $\mu$ F, 6.3V, 20%, 0805(2012)
C4 (input C)			0.1 $\mu$ F, 10V, 20%, 0402(1005)
L1 (inductor)	Coilcraft	DO3314-222	2.2 $\mu$ H inductor, 1.6A Isat, 0.2 $\Omega$ max.
<b>COMMON TO ALL</b>			
V <sub>IN</sub> banana jack - red	Johnson Components	108-0902-001	conn banana jack insul nylon red
V <sub>OUT</sub> banana jack - yellow	Johnson Components	108-0907-001	conn banana jack insul nylon yellow
GND banana jack - black	Johnson Components	108-0903-001	conn banana jack insul nylon black

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.

For the most current product information visit us at [www.national.com](http://www.national.com).

**LIFE SUPPORT POLICY**

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

**BANNED SUBSTANCE COMPLIANCE**

National Semiconductor manufactures products and uses packing materials that meet the provisions of the Customer Products Stewardship Specification (CSP-9-111C2) and the Banned Substances and Materials of Interest Specification (CSP-9-111S2) and contain no "Banned Substances" as defined in CSP-9-111S2.

Leadfree products are RoHS compliant.



**National Semiconductor**  
Americas Customer  
Support Center  
Email: [new.feedback@nsc.com](mailto:new.feedback@nsc.com)  
Tel: 1-800-272-9959

**National Semiconductor**  
Europe Customer Support Center  
Fax: +49 (0) 180-530 85 86  
Email: [europe.support@nsc.com](mailto:europe.support@nsc.com)  
Deutsch Tel: +49 (0) 69 9508 6208  
English Tel: +44 (0) 870 24 0 2171  
Français Tel: +33 (0) 1 41 91 8790

**National Semiconductor**  
Asia Pacific Customer  
Support Center  
Email: [ap.support@nsc.com](mailto:ap.support@nsc.com)

**National Semiconductor**  
Japan Customer Support Center  
Fax: 81-3-5639-7507  
Email: [jpn.feedback@nsc.com](mailto:jpn.feedback@nsc.com)  
Tel: 81-3-5639-7560

[www.national.com](http://www.national.com)