

# NCV890430

## NCV890430 Evaluation Board User's Manual



ON Semiconductor®

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

### EVAl BOARD USER'S MANUAL

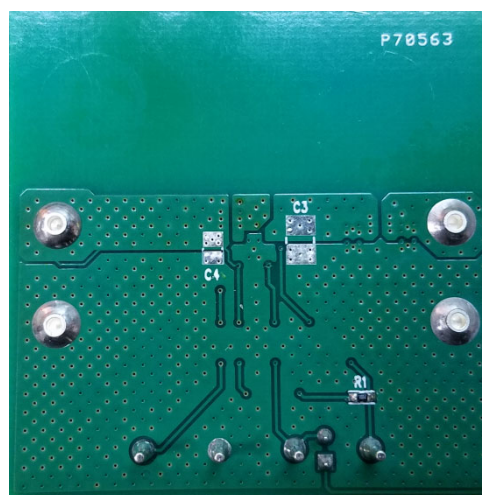
#### Description

The NCV890430 is a fixed-frequency Synchronous Buck regulator intended for Automotive, battery-connected applications that operate with up to a 45 V input supply. It is suitable for automotive systems requiring low noise and low shutdown currents that also need to operate at low input voltage close to the output voltage. A reset pin (with adjustable delay) simplifies interfacing with a microcontroller. This part also features an enable input that can either be connected to a low voltage (such as a micro-controller output) or high voltage (such as the battery input), and a synchronization input. The NCV890430 also provides several protection features expected in automotive

power supply systems such as current limit, short circuit protection, and thermal shutdown. In addition, the high switching frequency produces low output voltage ripple even when using small inductor values and all-ceramic input and output filter capacitors – forming a space-efficient switching regulator solution.



Top Side



Bottom Side

Figure 1. Evaluation Board Photo

#### Features and Benefits

- Internal 550 mΩ P Channel and 300 mΩ N-Channel Power Switches
- Capable of 100% Duty Cycle Operation
- $V_{IN}$  Operating Range 3.5 V to 37 V, Withstands Load Dump to 45 V
- 2 MHz Free-running Switching Frequency
- Shutdown Current Less than 10  $\mu$ A
- High Voltage Enable Pin
- Synchronization Input Pin

- Maximum DC Output Current of at Least 0.6 A
- Fixed Output Voltages of 2.5 V, 3.3 V or 5.0 V with  $\pm 2\%$  Accuracy

#### Typical Applications

- Automotive Infotainment and Instrumentation
- Automotive Body Applications
- Linear Regulator Replacement
- Rear View Camera

# NCV890430

## BLOCK DIAGRAM

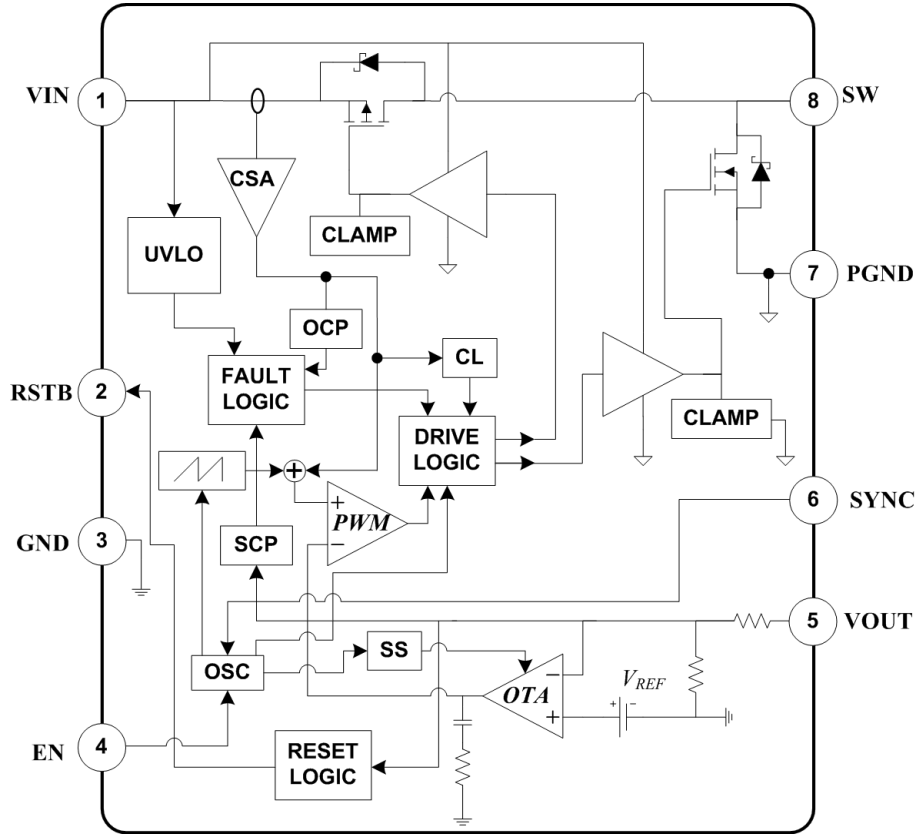


Figure 2. NCV890430 Simplified Block Diagram

## TYPICAL APPLICATION

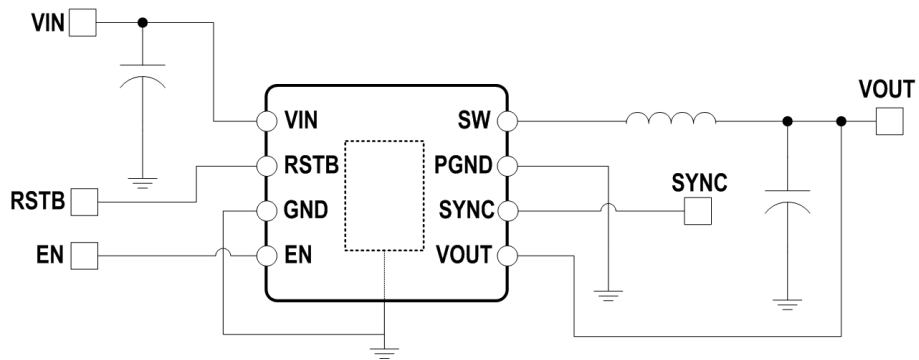


Figure 3. NCV890430 Typical Application Diagram

**Table 1. EVALUATION BOARD TERMINALS**

Pin Number	Pin Name	Function
1	VIN	Input voltage from battery. Place an input filter capacitor in close proximity to this pin.
2	RSTB	Reset reporting flag. Open drain output, pulling down to ground when the output voltage is out of regulation. The value of the external pull-up resistor determines the delay time that the Reset is held low.
3	GND	Analog ground reference – should be connected directly to the output capacitor ground and the exposed pad.
4	EN	Enable input. Connecting a “high” voltage (TTL compatible, battery voltage tolerant) to this pin turns on the regulator. A low voltage forces the part into a very low Iq shutdown mode.
5	VOUT	Output voltage sensing for regulation.
6	SYNC	Synchronization input. Connecting an external clock to this pin synchronizes switching to the rising edge of the SYNC signal.

**Table 2. ABSOLUTE MAXIMUM RATINGS**

(Voltages are with respect to GND)

Rating	Value	Units
DC supply voltage (VIN)	-0.3 to 45	V
DC supply voltage (EN)	-0.3 to 40	V
DC supply voltage (VOUT)	-0.3 to 18	V
DC supply voltage (SYNC and RSTB)	-0.3 to 6	V
Storage Temperature Range	-55 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**Table 3. ELECTRICAL CHARACTERISTICS**

Characteristics	Conditions	Typical Value	Units
<b>Regulation</b>			
Output Voltage (NCV890430MW25GEVB)		2.5	V
Output Voltage (NCV890430MW33GEVB)		3.3	V
Output Voltage (NCV890430MW50GEVB)		5.0	V
<b>Switching</b>			
Switching Frequency		2.0	MHz
Soft-start Time		1.4	ms
Synchronization Frequency Range	2.5 V version 3.3 V and 5.0 V version	1.8 to 2.2 1.8 to 2.5	MHz
<b>Current Limit</b>			
Peak Current Limit		1.9	A
<b>Protections</b>			
Input Undervoltage Lockout (UVLO)	V <sub>IN</sub> decreasing	3.2	V
Input Overvoltage Protection	V <sub>IN</sub> increasing	37	V
Thermal Shutdown	T <sub>J</sub> rising	170	°C

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

**Quick-Start Guide**

The following steps will get you familiar with the setup of inputs and outputs of the NCV890430.

*Required Equipment*

- |   |             |
|---|-------------|
| 1 DC Source – $\geq 40$ V, $\geq 2$ A capable | VIN         |
| 1 Oscilloscope – 2 Channel minimum            | VOUT and SW |
| 1 Multi-meter                                 | VOUT        |
| 1 DC Electronic Load – 1 A capable            | ILOAD       |

1. Disconnect the EN jumper.
2. Connect DC source set to 13.2 V DC between the VIN and GND terminals in the center left of the evaluation board.
3. Connect a multi-meter or oscilloscope probe between the VOUT and GND terminals located in the center right of the evaluation board.
4. Connect the EN jumper between VIN to the EN input.

Verify that VOUT is:

- a.) 2.5 V  $\pm 2\%$  for NCV890430MW25GEVB
  - b.) 3.3 V  $\pm 2\%$  for NCV890430MW33GEVB
  - c.) 5.0 V  $\pm 2\%$  for NCV890430MW50GEVB
5. Apply a 600 mA load to VOUT.
    - a.) Verify that VOUT is at the necessary regulated voltage.
    - b.) Place a scope probe tip on the SW side of L1. It should show a stable 2 MHz pulsed

waveform with amplitude approximately between VIN and GND.

6. While at load, increase VIN to 21 V. Verify that the SW signal now shows a stable 1 MHz pulsed waveform with amplitude approximately between VIN and GND.
7. Increase VIN to 39 V. Verify the switching regulator turns off and there is 0 V at VOUT.
8. Reduce VIN to 13.2 V. Verify that VOUT is restored to the necessary regulated voltage and that the SW signal returns to a 2 MHz pulsed waveform with amplitude approximately between VIN and GND.
9. Remove the jumper between VIN the EN input. Verify the switching regulator turns off and there is 0 V at VOUT.
10. Disconnect all external connections from the board and restore the EN jumper.

**Soft Start**

The NCV890430 contains a battery-connectable EN pin for the regulator. A common setup includes the following connections:

EN  $\rightarrow$  VIN

When the EN connection on the board is as shown above, the following startup profile can be seen on an oscilloscope:

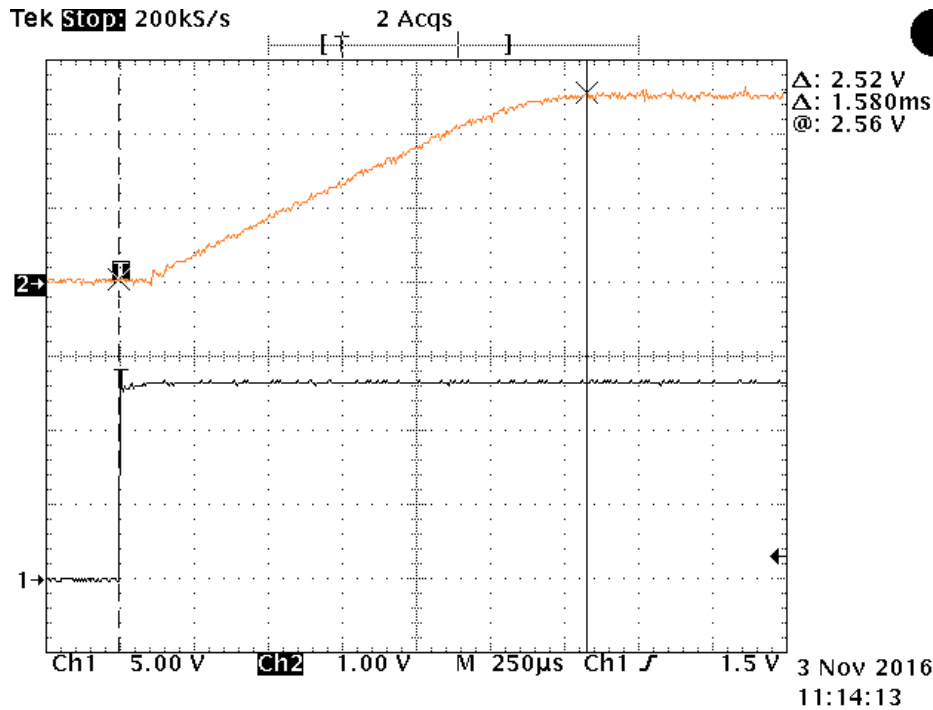


Figure 4. Typical NCV890430 Startup Profile

**EMI Filter**

In a typical application, an LC filter is used on the input line of a buck regulator to filter EMI from the device. On this demo board, an LC filter is pre-populated to allow you to perform EMI testing directly with this demo board.

LF1: 1.0  $\mu$ H  
CF1: 0.1  $\mu$ F

An input filter can drastically reduce the emissions from a switching regulator.



**Figure 5. LC Filter on VIN Line**

# NCV890430

## Efficiency

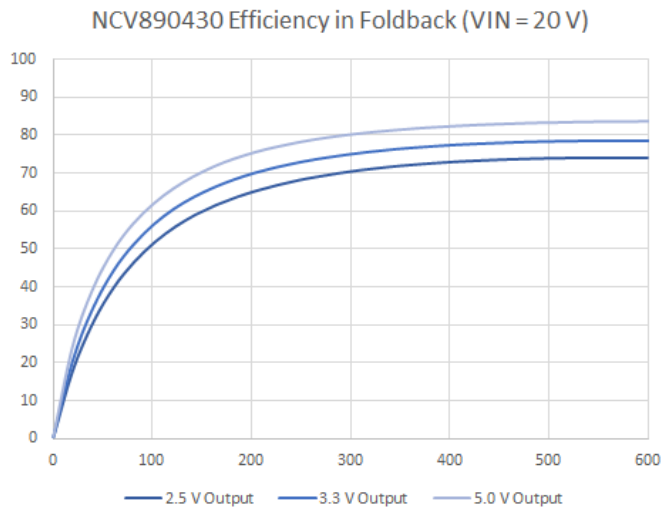
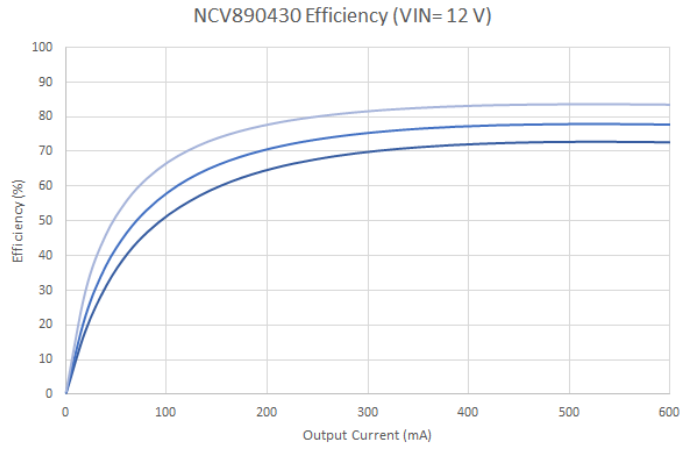


Figure 6. NCV890430 Efficiency Curves

SCHEMATIC

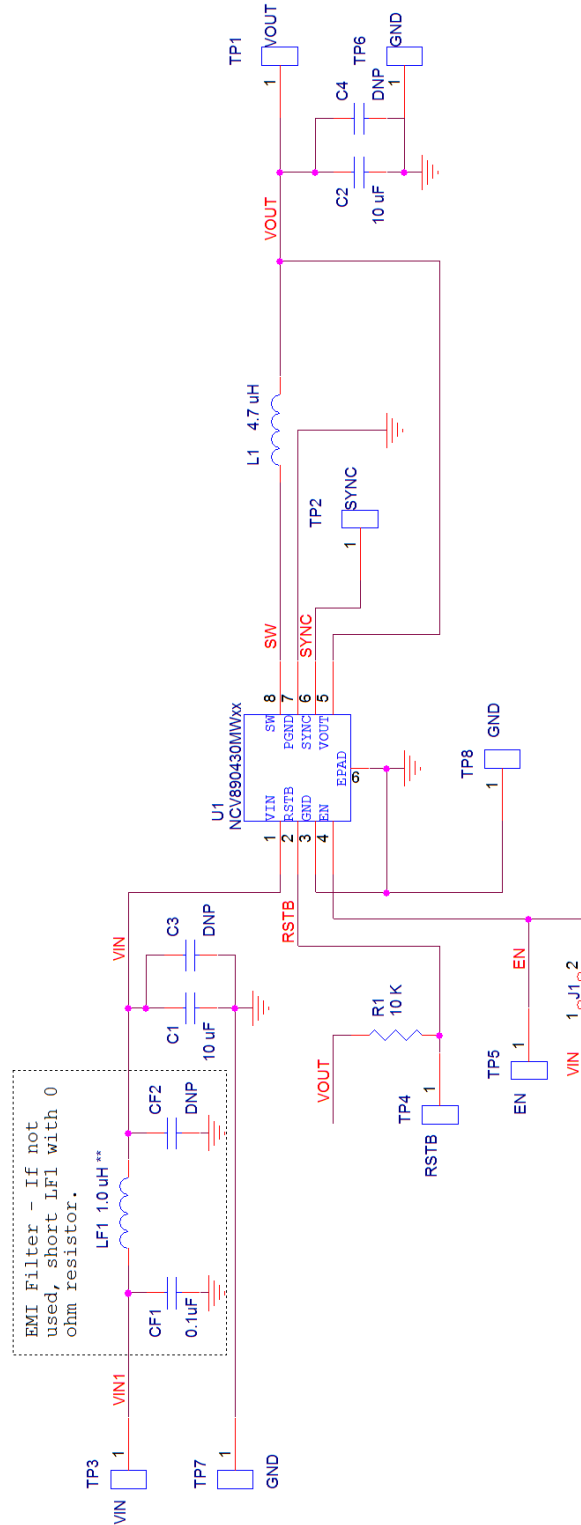


Figure 7. NCV890430MWxxGEVB Evaluation Board Schematic – Rev.1

# NCV890430

## PCB LAYOUT

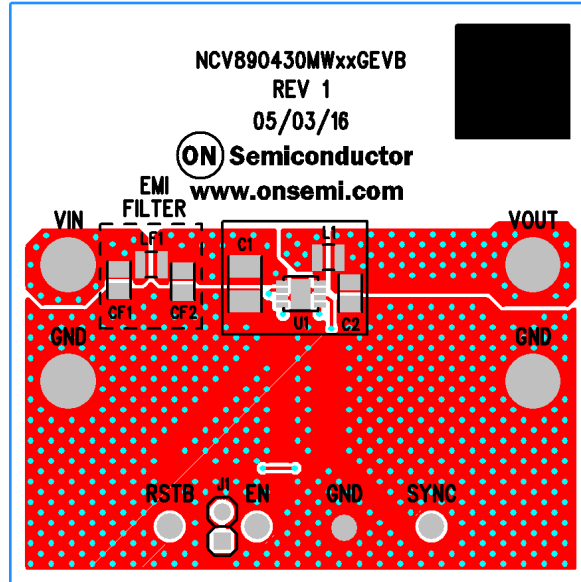


Figure 8. NCV890430MWxxGEVB PCB Layout – Top

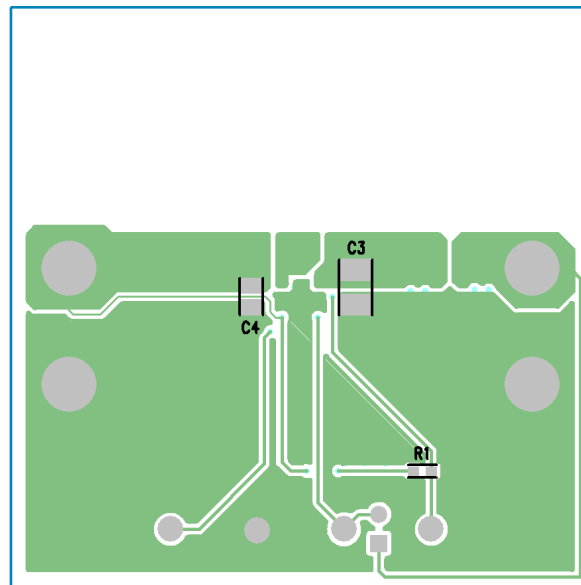


Figure 9. NCV890430MWxxGEVB PCB Layout – Bottom (mirrored)

All evaluation board PCB layouts are identical with the exception of TOP Silkscreen and device mounted upon them.



# NCV890430

## BILL OF MATERIALS

**Table 4. BILL OF MATERIALS**

Reference Designator(s)	Qty	Description	Value	Tolerance	Footprint	Manufacturer	Manufacturer's Part Number
C1	1	CAP CER 10UF 50V 10% X7R 1210	10 $\mu$ F	10%	1210	Taiyo Yuden	UMK325AB7106KM-T
C3	1	CAP CER 10UF 50V 10% X7R 1210	10 $\mu$ F	10%	DNP	Taiyo Yuden	UMK325AB7106KM-T
C2	1	CAP CER 10UF 10V 10% X7R 0805	10 $\mu$ F	10%	805	Murata Electronics North America	GRM21BR71A106KE51L
C4	1	CAP CER 10UF 10V 10% X7R 0805	10 $\mu$ F	10%	DNP	Murata Electronics North America	GRM21BR71A106KE51L
CF1	1	CAP CER 0.1UF 50V 10% X7R 0805	0.1 $\mu$ F	10%	805	Murata Electronics North America	GCM21BR71H104KA37K
CF2	1	CAP CER 0.1UF 50V 10% X7R 0805	0.1 $\mu$ F	10%	DNP	Murata Electronics North America	GCM21BR71H104KA37K
L0	1	FIXED IND 1UH 2.5A 75 MOHM SMD	1.0 $\mu$ H	30%	WURTHSMA LLSMDL	Würth Electronics Inc	78438323010
L1	1	FIXED IND 4.7UH 940MA 388 MOHM	4.7 $\mu$ H	30%	WURTHSMA LLSMDL	Würth Electronics Inc	78438323047
R1	1	RES 10.0K OHM 1/10W 1% 0603 SMD	10.0 K	1%	603	Vishay/Dale	CRCW060310K0FKEA
GND1, GND2, VIN1, VOUT	4	TERM SOLDER TURRET .219" .109"L	N/A	N/A	TURRET	Mill-Max Manufacturing Corp.	2501-2-00-44-00-00-07-0
J1	1	DIODE SCHOTTKY 4.0A 40V SMB	N/A	N/A	JMP	Molex Connector Corporation	22-28-4023
	1	DIODE SWITCH 200MA 100V SOD323	N/A	N/A		Sullins Connector Solutions	SSC02SYAN
EN, GND3, RSTB, SYNC	4	High Current Shielded Inductor 1.0uH, 8.7A SAT	N/A	N/A	TP	Vector Electronics	K24C/M
U1	1	High Current Shielded Inductor 2.2uH, 5.6A SAT	N/A	N/A	8PINDFNP 65	ON Semiconductor	NCV890430MWxxTXG

\*The Bills of Materials for all three evaluation boards covered in this user's manual are identical with the exception of the mounted device. This can be either NCV890430MW25TXG, NCV890430MW33TXG, or NCV890430MW50TXG.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi's** product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

The evaluation board/kit (research and development board/kit) (hereinafter the "board") is not a finished product and is not available for sale to consumers. The board is only intended for research, development, demonstration and evaluation purposes and will only be used in laboratory/development areas by persons with an engineering/technical training and familiar with the risks associated with handling electrical/mechanical components, systems and subsystems. This person assumes full responsibility/liability for proper and safe handling. Any other use, resale or redistribution for any other purpose is strictly prohibited.

**THE BOARD IS PROVIDED BY ONSEMI TO YOU "AS IS" AND WITHOUT ANY REPRESENTATIONS OR WARRANTIES WHATSOEVER. WITHOUT LIMITING THE FOREGOING, ONSEMI (AND ITS LICENSORS/SUPPLIERS) HEREBY DISCLAIMS ANY AND ALL REPRESENTATIONS AND WARRANTIES IN RELATION TO THE BOARD, ANY MODIFICATIONS, OR THIS AGREEMENT, WHETHER EXPRESS, IMPLIED, STATUTORY OR OTHERWISE, INCLUDING WITHOUT LIMITATION ANY AND ALL REPRESENTATIONS AND WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE, NON-INFRINGEMENT, AND THOSE ARISING FROM A COURSE OF DEALING, TRADE USAGE, TRADE CUSTOM OR TRADE PRACTICE.**

**onsemi** reserves the right to make changes without further notice to any board.

You are responsible for determining whether the board will be suitable for your intended use or application or will achieve your intended results. Prior to using or distributing any systems that have been evaluated, designed or tested using the board, you agree to test and validate your design to confirm the functionality for your application. Any technical, applications or design information or advice, quality characterization, reliability data or other services provided by **onsemi** shall not constitute any representation or warranty by **onsemi**, and no additional obligations or liabilities shall arise from **onsemi** having provided such information or services.

**onsemi** products including the boards are not designed, intended, or authorized for use in life support systems, or any FDA Class 3 medical devices or medical devices with a similar or equivalent classification in a foreign jurisdiction, or any devices intended for implantation in the human body. You agree to indemnify, defend and hold harmless **onsemi**, its directors, officers, employees, representatives, agents, subsidiaries, affiliates, distributors, and assigns, against any and all liabilities, losses, costs, damages, judgments, and expenses, arising out of any claim, demand, investigation, lawsuit, regulatory action or cause of action arising out of or associated with any unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of any products and/or the board.

This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and may not meet the technical requirements of these or other related directives.

FCC WARNING – This evaluation board/kit is intended for use for engineering development, demonstration, or evaluation purposes only and is not considered by **onsemi** to be a finished end product fit for general consumer use. It may generate, use, or radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment may cause interference with radio communications, in which case the user shall be responsible, at its expense, to take whatever measures may be required to correct this interference.

**onsemi** does not convey any license under its patent rights nor the rights of others.

LIMITATIONS OF LIABILITY: **onsemi** shall not be liable for any special, consequential, incidental, indirect or punitive damages, including, but not limited to the costs of requalification, delay, loss of profits or goodwill, arising out of or in connection with the board, even if **onsemi** is advised of the possibility of such damages. In no event shall **onsemi's** aggregate liability from any obligation arising out of or in connection with the board, under any theory of liability, exceed the purchase price paid for the board, if any.

The board is provided to you subject to the license and other terms per **onsemi's** standard terms and conditions of sale. For more information and documentation, please visit [www.onsemi.com](http://www.onsemi.com).

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**onsemi Website:** [www.onsemi.com](http://www.onsemi.com)

### TECHNICAL SUPPORT

**North American Technical Support:**

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative