

## NCP4306 Synchronous Rectification Evaluation Board User's Manual



ON Semiconductor®

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

### EVAL BOARD USER'S MANUAL

#### Description

This evaluation board user's manual describes a high efficiency synchronous rectification evaluation board that can easily replace a secondary side rectification diode in an SMPS.

The NCP4306 is used as synchronous rectification controller. The evaluation board has very few external components and illustrates how small and effective such a design can be.

The NCP4306 features a very precise 0 mV turn-off comparator that supports even very low current flowing through the MOSFET even when very low RDS(on) synchronous MOSFETs is used.

#### Key Features

- Precise Turn-off Comparator
- Wide Input Voltage Range
- High Operation Frequency
- Strong MOSFET Driver
- High Efficiency
- Adjustable Minimum On and Off Times
- Adjustable Light Load Detection Feature
- Capable to Operate in Positive and Negative Branch
- Small Size

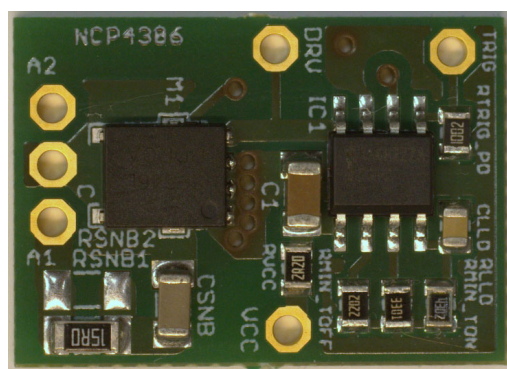


Figure 1. Evaluation Board Photo

Table 1.

SMPS Type	Supply Voltage	Reverse Voltage	Effective Resistance
LLC	4 – 35 V	60 V	3.8 mΩ

CONNECTION DIAGRAM

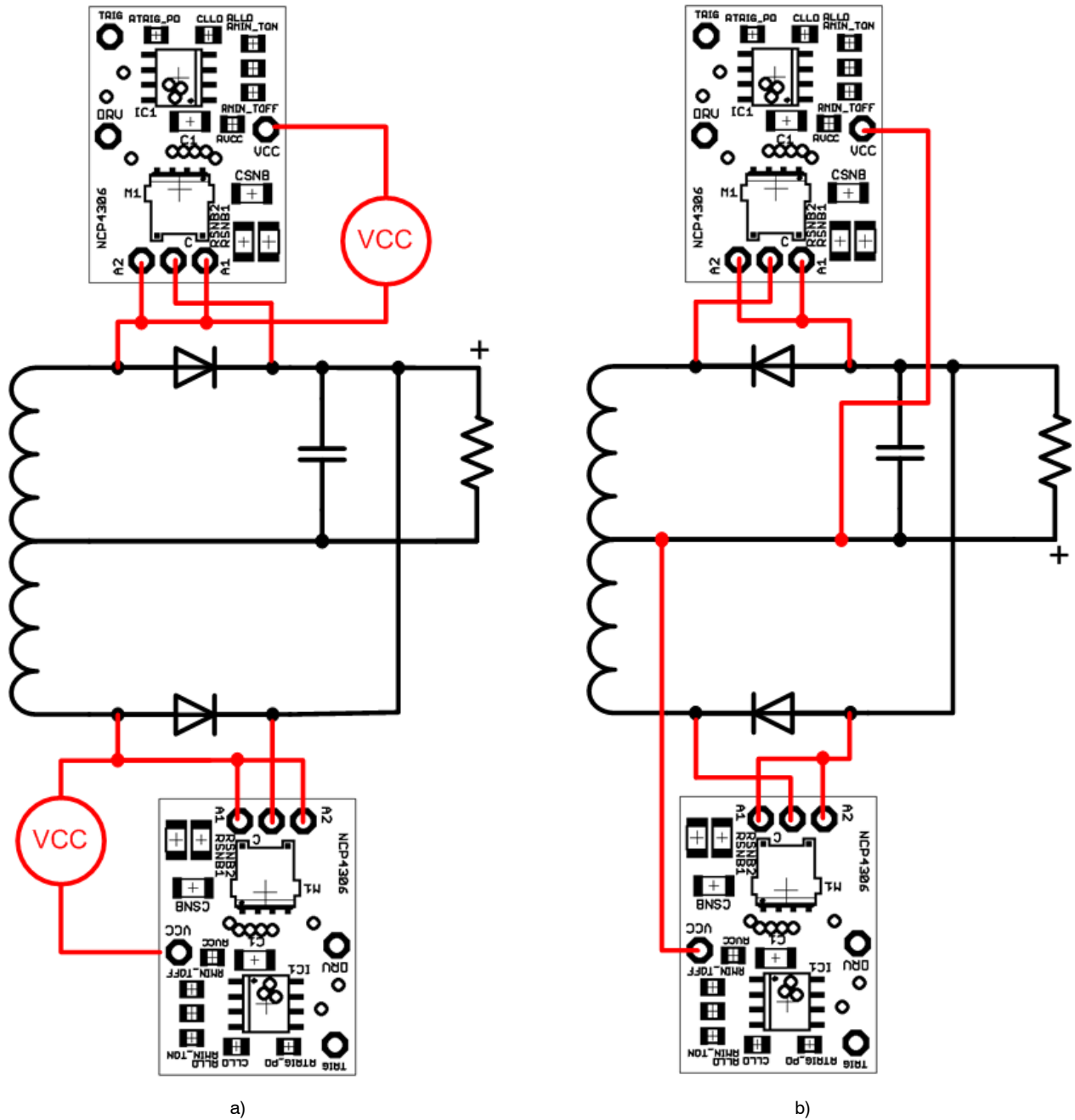


Figure 2. Possible Connections into Circuit

The evaluation board can be connected in circuit where the rectification diode is in the positive or negative branch. If connection to a positive branch is used, it is necessary to

use an external power supply (or auxiliary winding with rectification) to provide power to the evaluation board. VCC should be referenced to A1 or A2 points.

EVALUATION BOARD SCHEMATIC

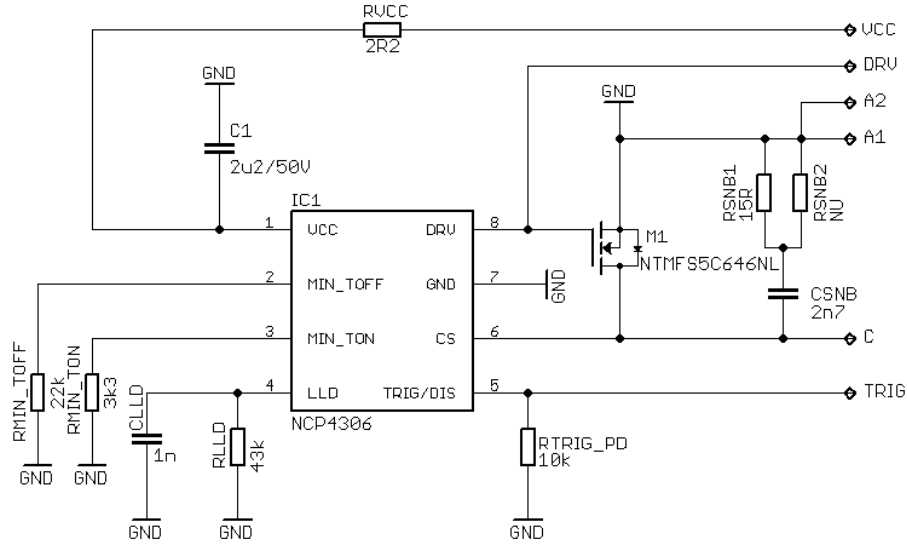


Figure 3. Schematic of the NCP4306

The evaluation board was designed to support a minimal external component count implementation. C1 is decoupling capacitor that should be placed as close as possible to the VCC and GND pins. Resistors RMIN\_TON and RMIN\_TOFF are used to set the protection interval when the synchronous MOSFET is turned on and off. It may be needed to adjust them according to used SMPS. Actual

setup is 2.2  $\mu$ s  $t_{MIN\_TOFF}$  and 330 ns  $t_{MIN\_TON}$ . RLLD sets light load detection time and CLLD is optional for LLD voltage decoupling. Components CSNB, RSNB1 and RSNB2 form a snubber circuit.

Transistor M1 is 60 V  $V_{DS}$  capable,  $R_{DS(on)}$  of 3.8 m $\Omega$  typ@10 V that should be enough for LLC with  $V_{OUT}$  up to 24 V.

## CIRCUIT LAYOUT

The PCB consists of a 2 layer FR4 board with 35  $\mu\text{m}$  copper cladding. All components are surface mount and use 0805 and 1206 size for easy rework. Critical component such as blocking capacitor C1 has to be placed carefully near the IC. The synchronous driver path to the MOSFETs was done with very low resistance and parasitic inductance to

minimize emissions and minimize turn-on and turn-off times. The same is true for the CS pin. For the CS pin, a kelvin contact was done to be able to sense the voltage directly at the drain. Improper connection of the GND and CS connects can impact the turn-off process especially when a very low  $R_{\text{DS(on)}}$  MOSFETs are used.

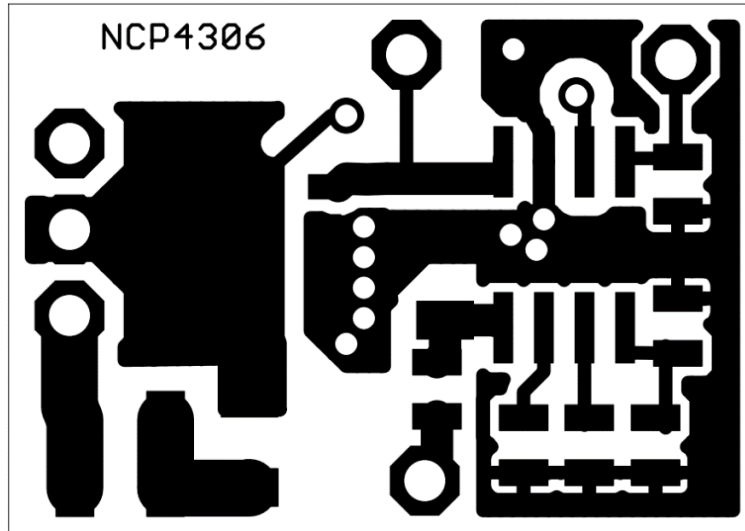


Figure 4. Top Layer

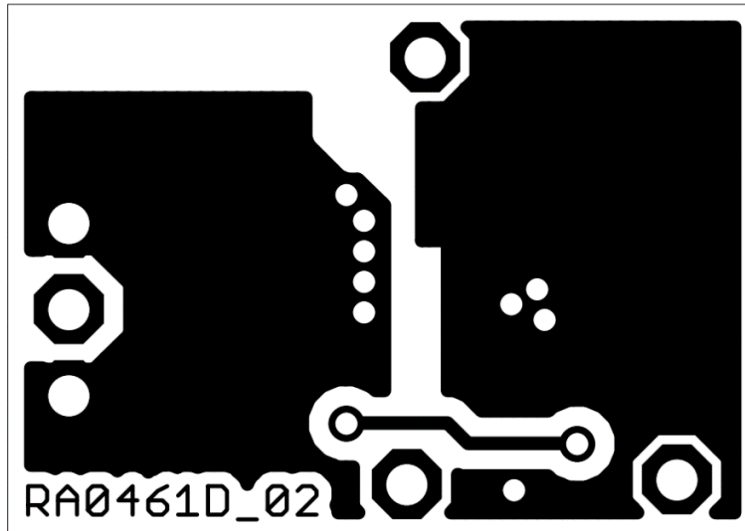


Figure 5. Bottom Layer

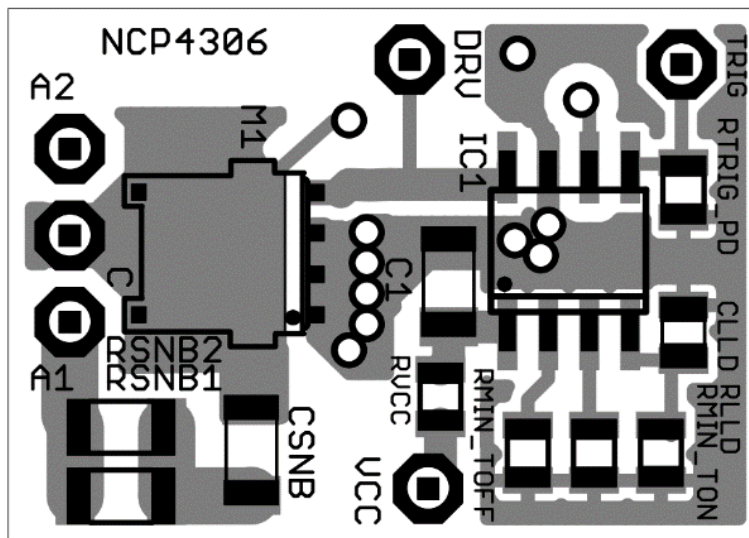


Figure 6. Top Side Components

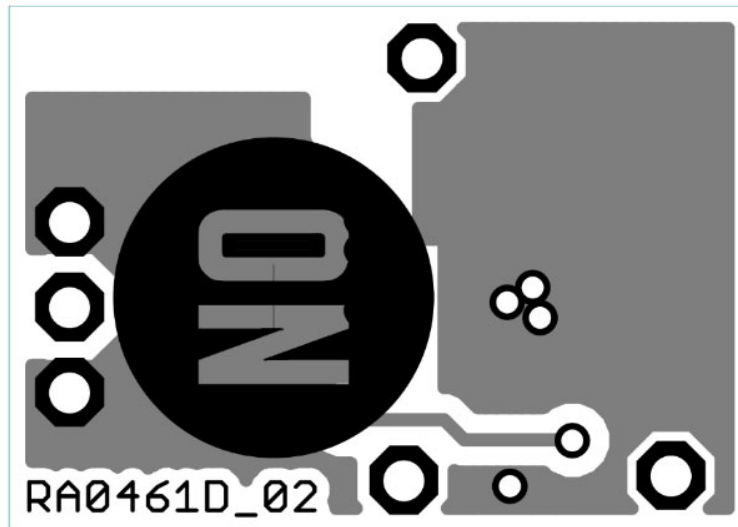


Figure 7. Bottom Side Components

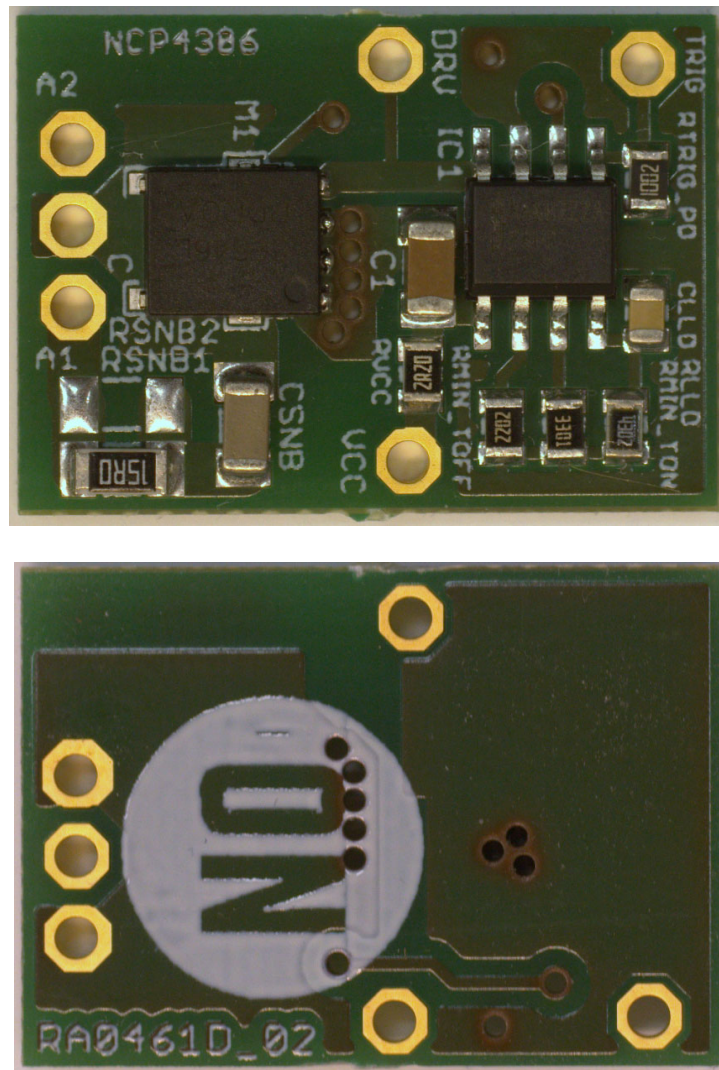


Figure 8. Evaluation Board Photos

# EVBUM2521/D

## BILL OF MATERIAL

**Table 2. BILL OF MATERIAL FOR THE NCP4306 PUT-IN BOARD SO8FL 60 V**

Designator	Qty	Description	Value	Tolerance	Footprint	Manufacturer	Manufacturer Part Number	Substitution Allowed
C1	1	Ceramic Capacitor	2.2 $\mu$ F / 50 V	10%	1206	KEMET	C1206C225K5RACTU	Yes
CLLD	1	Ceramic Capacitor	1 nF	20%	0805	KEMET	C0805C102M5RACTU	Yes
CSNB	1	Ceramic Capacitor	2.7 nF	10%	1206	TDK Corporation	C1206C273K5RACTU	Yes
IC1	1	Secondary Side Synchronous Rectification Controller	NCP4306AAHZZA	–	SOIC–08	ON Semiconductor	NCP4306AAHZZAD R2G	No
M1	1	N–Channel Power MOSFET	FDB110N15A	–	SO–8FL	ON Semiconductor	NTMFS5C646NLT1	Yes
RVCC	1	Resistor SMD	2.2 $\Omega$	1%	0805	YAGEO	RC0805FR–072R2L	Yes
RLLD	1	Resistor SMD	43 k $\Omega$	1%	0805	YAGEO	RC0805FR–0743KL	Yes
R <sub>MIN_TOFF</sub>	1	Resistor SMD	22 k $\Omega$	1%	0805	YAGEO	RC0805FR–0722KL	Yes
R <sub>MIN_TON</sub>	1	Resistor SMD	3.3 k $\Omega$	1%	0805	YAGEO	RC0805FR–073K3L	Yes
R <sub>TRIG_PD</sub>	1	Resistor SMD	10 k $\Omega$	1%	0805	YAGEO	RC0805FR–0710KL	Yes
RSNB1	1	Resistor SMD	15 $\Omega$	1%	1206	YAGEO	RC1206FR–0715RL	Yes
RSNB2	1	Resistor SMD	NU	–	1206	–	–	Yes

NOTE: All components are Pb–Free.

**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).

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at [www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)



# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[onsemi:](#)

[NCP4306LLC60GEVB](#)