

NCP4306 Synchronous Rectification Evaluation Board User's Manual



ON Semiconductor®

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 $R_{DS(on)}$ synchronous MOSFETs is used. NCP4306 can be used in application working in DCM and CCM without any additional circuits thanks to very low propagation delays and strong driver output.

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
- Small Size

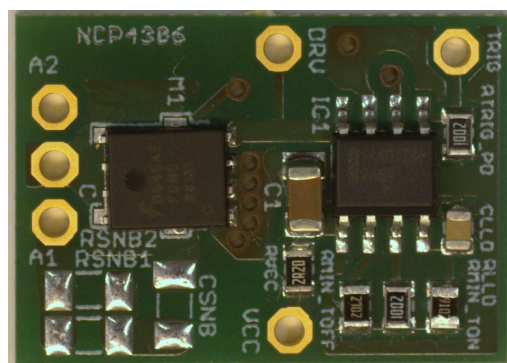


Figure 1. Evaluation Board Photo

Table 1.

SMPS Type	Supply Voltage	Reverse Voltage	Effective Resistance
Flyback, QR	4 – 35 V	100 V	3.3 mΩ

CONNECTION DIAGRAM

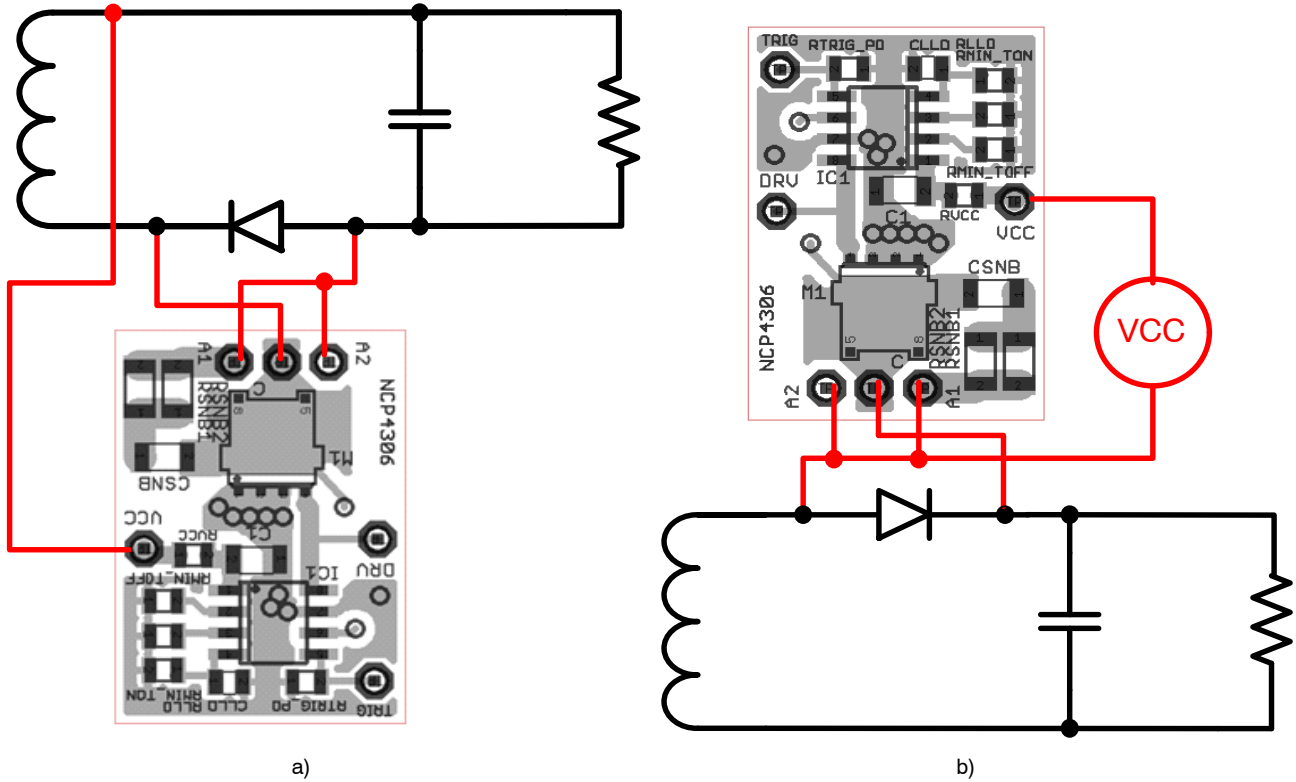


Figure 2. Possible Connections into Circuit

The evaluation board can be connected in circuit where the rectification diode is in the positive (Figure 2b) or negative (Figure 2a) branch. Connection to negative branch is simpler, VCC can be taken from SMPS VOUT if VOUT is in range of NCP4306 supply requirements. If connection

to a positive branch is used, it is necessary to use an external power supply, auxiliary winding with rectification or regulator supplied from transformer forward voltage (Figure 3) to provide power to the evaluation board. VCC should be referenced to A1 or A2 points.

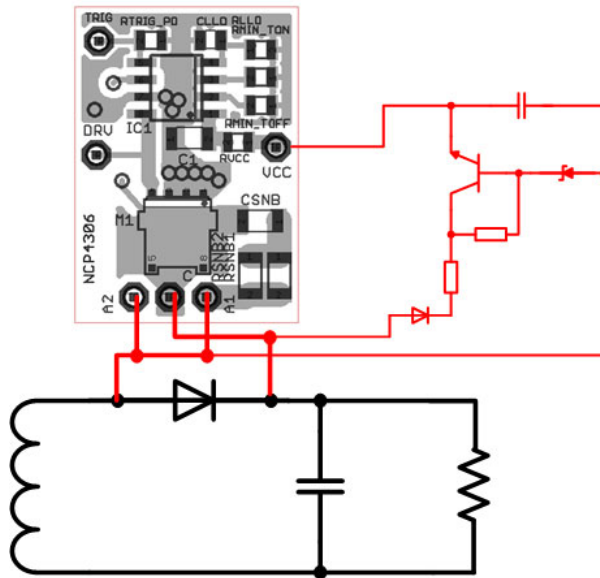


Figure 3. External Voltage Regulator for SR Supply

EVALUATION BOARD SCHEMATIC

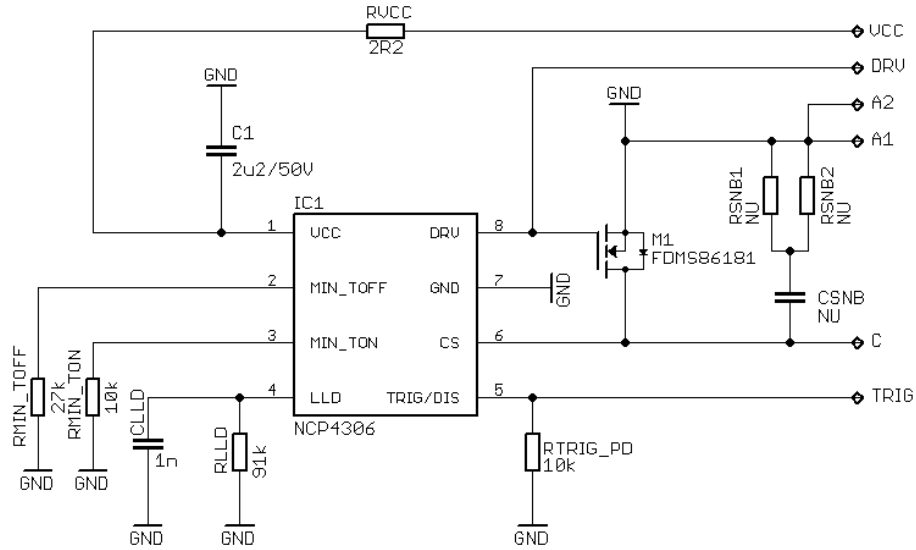


Figure 4. Schematic of the NCP4306

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. 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 100 V V_{DS} capable, $R_{DS(on)}$ of 3.3 m Ω typ@10 V with soft recovery body diode that allows to omit snubber circuit without ringing and overshoots at SR transistor drain.

CIRCUIT LAYOUT

The PCB consists of a 2 layer FR4 board with 35 μm 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.

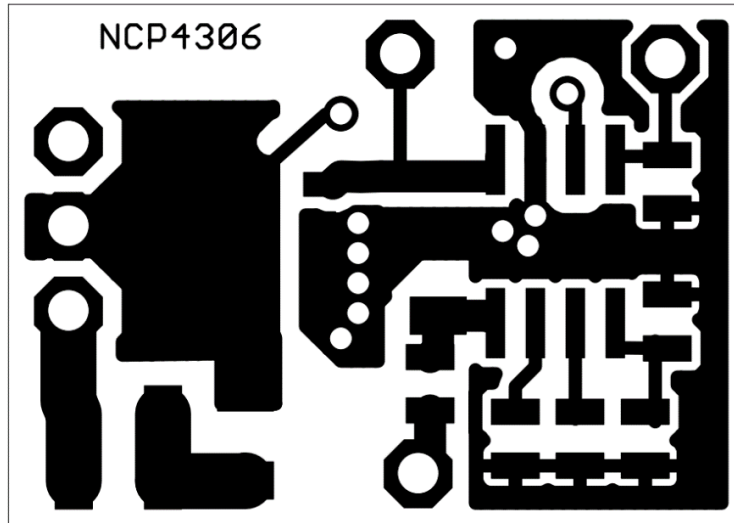


Figure 5. Top Layer

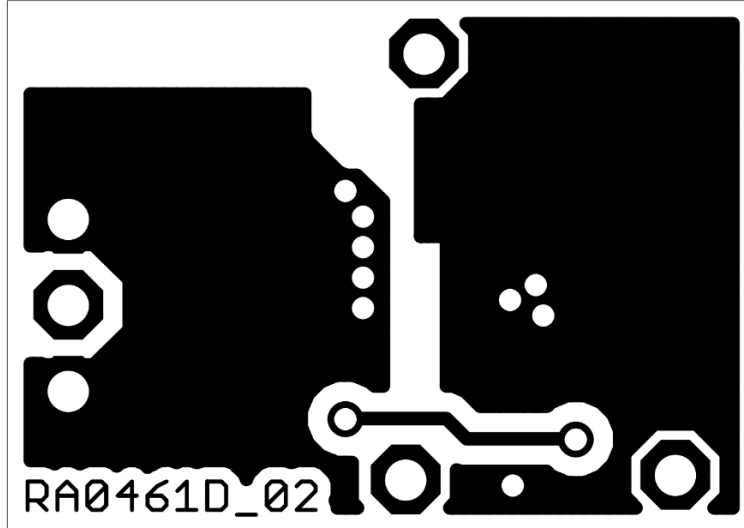


Figure 6. Bottom Layer

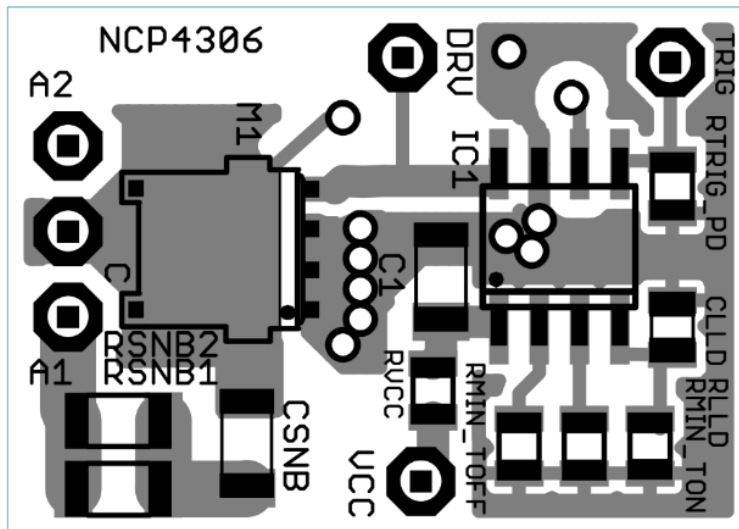


Figure 7. Top Side Components

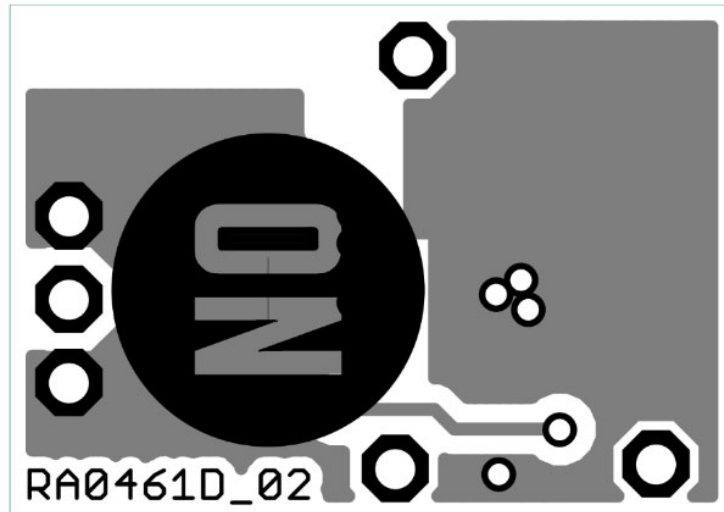


Figure 8. Bottom Side Components

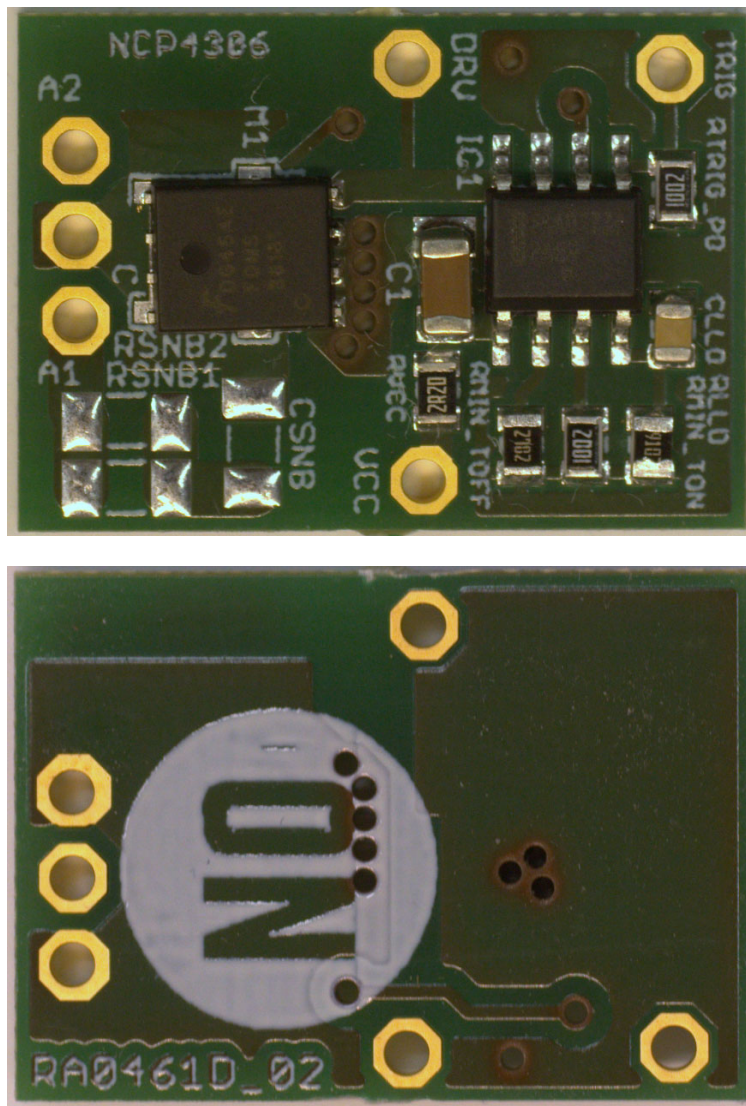


Figure 9. Evaluation Board Photos

BILL OF MATERIAL

Table 2. BILL OF MATERIAL FOR THE NCP4306 PUT-IN BOARD SO8FL 100 V

Designator	Qty	Description	Value	Tolerance	Footprint	Manufacturer	Manufacturer Part Number	Substitution Allowed
C1	1	Ceramic Capacitor	2.2 μ F / 50 V	10%	1206	KEMET	C1206C225K5RACTU	Yes
CLLD	1	Ceramic Capacitor	1 nF	20%	0805	KEMET	C0805C102M5RACTU	Yes
CSNB	1	Ceramic Capacitor	NU	–	1206	–	–	Yes
IC1	1	Secondary Side Synchronous Rectification Controller	NCP4306AADZZA	–	SOIC-08	ON Semiconductor	NCP4306AADZZAD R2G	No
M1	1	N-Channel Power MOSFET	FDMS86181	–	Power 56	ON Semiconductor	FDMS86181	Yes
RVCC	1	Resistor SMD	2.2 Ω	1%	0805	YAGEO	RC0805FR-072R2L	Yes
RLLD	1	Resistor SMD	43 k Ω	1%	0805	YAGEO	RC0805FR-0743KL	Yes
R _{MIN_TOFF}	1	Resistor SMD	22 k Ω	1%	0805	YAGEO	RC0805FR-0722KL	Yes
R _{MIN_TON} , R _{TRIG_PD}	2	Resistor SMD	10 k Ω	1%	0805	YAGEO	RC0805FR-0710KL	Yes
RSNB1, RSNB2	2	Resistor SMD	NU	–	1206	–	–	Yes

NOTE: All components are Pb-Free.

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor 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 as such not available for sale to consumers. The board is only intended for research, development, demonstration and evaluation purposes and should as such 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 delivered "AS IS" and without warranty of any kind including, but not limited to, that the board is production-worthy, that the functions contained in the board will meet your requirements, or that the operation of the board will be uninterrupted or error free. ON Semiconductor expressly disclaims all warranties, express, implied or otherwise, including without limitation, warranties of fitness for a particular purpose and non-infringement of intellectual property rights.

ON Semiconductor 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 ON Semiconductor shall not constitute any representation or warranty by ON Semiconductor, and no additional obligations or liabilities shall arise from ON Semiconductor having provided such information or services.

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. Should you purchase or use the board for any such unintended or unauthorized application, you shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of 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 ON Semiconductor 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.

ON Semiconductor does not convey any license under its patent rights nor the rights of others.

LIMITATIONS OF LIABILITY: ON Semiconductor 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 ON Semiconductor is advised of the possibility of such damages. In no event shall ON Semiconductor'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.

For more information and documentation, please visit www.onsemi.com.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Email Requests to: orderlit@onsemi.com

ON Semiconductor Website: 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